

RESEARCH

Open Access



How is intergenerational emotional cohesion linked to depression among older internal migrants in China: the mediating roles of loneliness and perceived stress

Ruyue Deng¹, Shiyuan Yan¹, Lin Zhang¹, Yanjie Hou¹, Hao Wang², Wenjing Zhang¹ and Jun Yao^{1,2,3*}

Abstract

Background Late-life internal migration is frequently associated with a higher risk of depression in older parents. This research delves into the impact of intergenerational emotional cohesion (IEC) on depression in older internal migrants and the underlying mechanisms within the contemporary Chinese context.

Methods Obtained from a cross-sectional survey in Nanjing, China, the research involved 654 older internal migrants (66.97% female; mean age = 66.05 years; SD = 4.67). Variables were assessed using the Intergenerational Solidarity Inventory, 3-item R-UCLA Loneliness Scale, Perceived Stress Scale, and 9-item Patient Health Questionnaire (PHQ-9). For mediation exploration, a serial mediation model was utilized, and the Bootstrap method was employed to test the significance of these mediation effects.

Results IEC demonstrates a negative correlation with depression. Through IEC, three significant mediation pathways were identified that directly affect depression: (1) loneliness ($\beta = -0.06$; Ratio = 17.14%), (2) perceived stress ($\beta = -0.09$; Ratio = 25.71%), and (3) loneliness and perceived stress ($\beta = -0.03$; Ratio = 8.57%).

Conclusions IEC can impact the depression of older internal migrants by mitigating negative psychological emotions during the migration process. This finding provides valuable theoretical insights for the prevention of mental health problems among this demographic.

Keywords Older internal migrants, Intergenerational relationships, Emotional cohesion, Depression, Loneliness, Perceived stress

*Correspondence:

Jun Yao

yaojun@njmu.edu.cn

¹School of Health Policy and Management, Nanjing Medical University, Nanjing, China

²School of Nursing, Nanjing Medical University, Nanjing, China

³Institute of Healthy Jiangsu Development, Nanjing Medical University, Nanjing, China



© The Author(s) 2024. **Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>. The Creative Commons Public Domain Dedication waiver (<http://creativecommons.org/publicdomain/zero/1.0/>) applies to the data made available in this article, unless otherwise stated in a credit line to the data.

Background

Propelled by the dual forces of urbanization and the aging demographic in China, internal migration in late life has emerged as a noteworthy phenomenon and tendency [1]. Driven by the motivation of family reunification and the responsibility of caring for grandchildren [2–4], an increasing number of older parents have relocated from their hometowns to urban centres where their adult children live and work [1, 2]. According to the seventh Chinese census, the number of internal older migrants aged 60 or above reached 33.27 million in 2020, marking a 2.14-fold increase from the figures in 2010 [2, 5]. Late-life migration, whether it's international or internal, and the migration-related processes have consistently been linked to a heightened risk of depression among older people. This pattern is observed in both Western and Eastern samples [6–9]. Existing Chinese literature indicates that older internal migrants face a greater risk of depression compared to their local counterparts [10, 11]. For instance, a study on older internal migrants in China revealed that approximately 34.90% experienced mild or severe depression [12]. Therefore, it is imperative to investigate the factors determining depression in older internal migrants within the Chinese context.

In China, enduring Confucian traditions underscore collectivist familism and filial piety [13]. Consequently, Chinese older parents tend to place a high value on intergenerational relationships and family cohesion [14]. According to the Social Convoy Model, social relations provide support to individuals at different stages of life, enabling them to cope with stress and promoting their physical and mental well-being [15]. Typically, the convoy structure is depicted as concentric circles, symbolizing different levels of closeness and social support [16]. For older parents, close adult children, who often provide the highest levels of support and affection, are positioned in the innermost circle [17]. Researchers have discovered that intergenerational relationships with adult children, particularly in terms of emotional closeness, play a pivotal role in mitigating depressive symptoms among Chinese older parents [14, 18, 19]. However, China's profound social changes and experiences of internal migration in late life have reshaped family structures, weakened family authority, and intensified intergenerational conflicts [20, 21], posing challenges to the intergenerational relationships of older Chinese internal migrants. Hence, this study sought to explore the impact of intergenerational relationships on depression among older internal migrants and the underlying mechanisms in the contemporary Chinese context.

Older internal migrants in the Chinese context

Based on the cultural virtues of filial piety and familial care, this group of older migrants manifests distinctive

migration patterns, motivations, challenges, and needs [1, 4]. Firstly, unlike older migrants in developed nations and regions who frequently move to more favourable climates or cost-effective areas for an improved retirement lifestyle [22], the migration pattern of Chinese older parents is notably influenced by the migration behaviour of their adult children [2]. Family reunion and participation in grandparenting have become the primary motivations for the migration of older parents [1, 3, 4]. Moreover, the Hukou System (Household Registration System, HRS), a distinct urban-rural segregation in China, presents an adaptation barrier. Under this constraint, hukou, along with the associated social and welfare rights (i.e., social security, community eldercare services, and public health services), does not transfer with older migrants within the country [23–25]. Hence, this distinctive Chinese context makes it increasingly important to comprehend the mechanisms and conditions under which intergenerational relationships impact the depression of older internal migrants.

Intergenerational emotional cohesion and depression

Intergenerational Emotional Cohesion (IEC) stands as a core dimension of intergenerational relationships, encompassing positive emotional connections between older parents and adult children [26]. In this study, we lean upon the intergenerational solidarity framework to conceptualize IEC [27]. It includes sentiments of affection, emotional closeness, and emotional support, constituting the pivotal dimension of the framework [28]. Confirmed by prior research in China, intergenerational relationships exert a positive influence in mitigating depressive symptoms among older adults [14, 18, 19, 29, 30]. Notably, among all dimensions of intergenerational relationships, IEC plays the most significant role [14, 19, 29]. Similar results have been identified in studies involving older internal migrants in China, particularly in relation to mental health and well-being indicators, including depressive symptoms [6, 11, 31] and subjective well-being [32]. However, there has been limited research delving into the psychological pathway that mediate the link between IEC and the incidence of depression among older internal migrants in the Chinese context. Based on this, we proposed the hypothesis that.

H1 IEC is significantly correlated with depression among older internal migrants.

Potential mediating effect of loneliness

Loneliness is a distressing emotion, typically arising when one's social needs are inadequately met in terms of both quantity and quality of relationships, particularly in terms quality of interpersonal relationships [33]. It stands as a risk factor for mental health, escalating

vulnerability to mental disorders, such as depression [34]. Massive evidence indicates that loneliness serves as a precursor to depressive symptoms among older adults [35–37]. Current research indicates that older internal migrants face an increased risk of loneliness due to changes in their living environment, disruptions to previous social networks, and challenges in social integration [38–40]. Intergenerational relationships have proven to be highly effective in substantially alleviating loneliness among older internal migrants in China [41]. Empirical studies found that intergenerational relationships play a role in diminishing loneliness and subsequent psychological problems among Chinese older parents [19]. Furthermore, the substantial mediating role of loneliness between IEC and depression in older adults has been confirmed in samples settings in China [19, 29, 42]. Consequently, we hypothesize that.

H2 Loneliness mediates the relationship between IEC and depression among older internal migrants.

Potential mediating effect of perceived stress

Perceived stress is an individual's psychological response to life unpredictability and uncontrollability [43]. One immediate negative consequence of stress is the reduction of mental well-being [44], and it is considered to play a crucial role in the etiology of depression [45]. Research has documented that older adults with a high level of perceived stress are at an increased risk of experiencing depression [46, 47]. With the combination of extrafamilial stressors (i.e., unequal household registration policy, inaccessible basic public health services) [48] and intrafamilial stressors (i.e., acculturation, intergenerational conflicts, role strain from grandparenting) [49, 50], Chinese older internal migrants are facing a high level of stress [51]. Intergenerational relationships and support, being a crucial source of social relations and support, have been recognized as a core factor influencing perceived stress among older adults [52–54]. Moreover, limited studies has substantiated the mediating role of stress between intergenerational relationships and depression [50, 55]. According to the Social Convoy Model, social relations influence the degree of stress an individual experiences, assisting them in coping with stress and enhancing their mental well-being [15, 16]. Thus, we hypothesize that.

H3 Perceived stress mediates the relationship between IEC and depression among older internal migrants.

Potential serial mediating role of loneliness and perceived stress

We are intrigued to investigate the potential relationship between loneliness and perceived stress when both factors are considered as mediators. Loneliness was

regarded as a stressor due to its linked perception of social rejection and exclusion [56]. Researchers have validated a positive correlation between loneliness and perceived stress [57]. The connection between loneliness and poor mental health outcomes may be mediated by heightened stress levels reported by lonely individuals. This is because they are less likely to employ adaptive coping mechanisms when confronted with stress compared to non-lonely individuals [58]. Moreover, empirical investigations on in samples settings in China have illustrated that perceived stress serves as a mediator in the association between loneliness and depression among older adults [46, 59]. Integrating Berkman's theoretical framework, which suggests that social relations influence mental health through psychosocial mechanisms [60], and the Social Convoy Model [15], we developed a hypothesis that.

H4 Loneliness and perceived stress play a serial mediating role in the relationship between IEC and depression among older internal migrants.

The present study

This study scrutinizes the pivotal psychological mechanism through which IEC correlates with depression in a sample of older internal migrants within the Chinese context. Drawing on Berkman's theoretical framework [60] and Social Convoy Model [15], we posit that IEC can impact the depression of older internal migrants by mitigating negative psychological emotions during the migration process. We formulated mediation models with depression as the dependent variable, IEC as the independent variable, and loneliness and perceived stress as mediating factors. The serial mediation mechanism of loneliness and perceived stress in the relationship between IEC and depression was explored. The detailed research framework is illustrated in Fig. 1 and Fig. 2.

Methods

Participants

Data for this study were derived from the research project titled 'A Study on the Mechanism of Intergenerational Relationships on the Mental Health of Older Internal Migrants.' This cross-sectional investigation transpired in Nanjing, China, spanning from September 2020 to December 2020. Nanjing, as one of China's supercities experiencing swift economic advancement, exerts significant appeal and absorptive capacity for the migrating population. By 2021, the internal migrant cohort in Nanjing had surged to 2.65 million, denoting an increase of 38.65% since 2010. Consequently, delving into a research inquiry with Nanjing as a focal point provides a high level of representativeness.

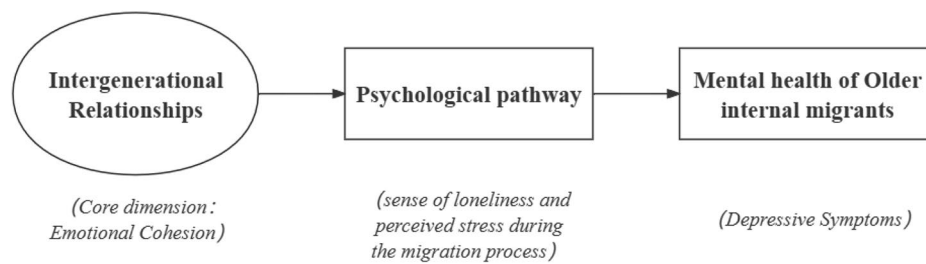


Fig. 1 Conceptual framework of psychological pathway linking Intergenerational emotional cohesion to mental health of older internal migrants

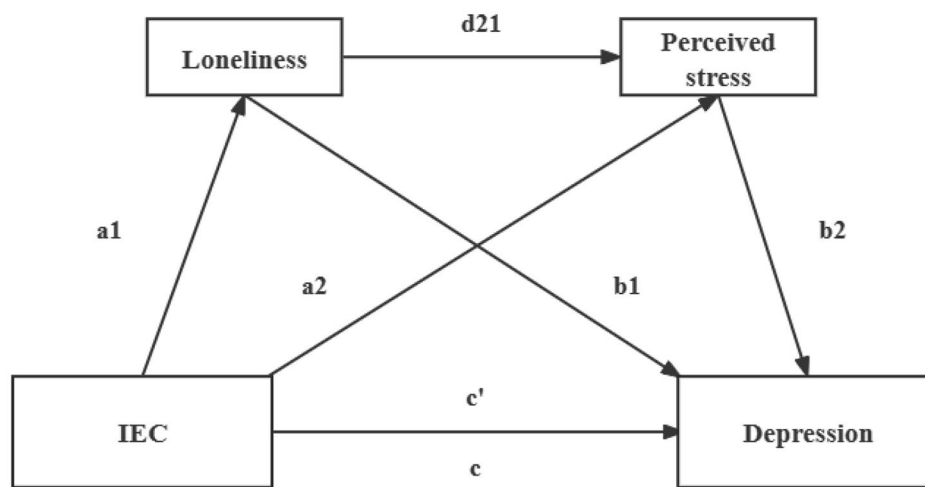


Fig. 2 A serial mediation model of the association between IEC and depression through loneliness and perceived stress

The participants were first randomly selected from three communities in the seven districts of Nanjing (Qinhuai, Qixia, Gulou, Xuanwu, Jianye, Yuhuatai, and Jiangning District). Eligibility criteria for inclusion were as follows: (a) age of ≥ 60 years; (b) residency in Nanjing for ≤ 10 years (to capture late-life migration); (c) retention of Hukou in their former residences; and (d) having at least one adult child. Finally, a total of 654 participants were included. All participants engaged in face-to-face interviews employing a structured questionnaire. Each participant was informed of the study details and showed consent to participate in the study. All interviewers, comprised of postgraduate students, possessed prior experience in medical research and underwent standardized training before embarking on the project.

Measures

Intergenerational emotional cohesion

IEC was measured according to the dimensions in the intergenerational solidarity measurement model [27]. Specific measurements were captured by the intergenerational solidarity inventory [61], using the following three questions: (a) ‘Do you think you are emotionally close to your children?’ (no=1, close=2, and very close=3), (b) ‘Do

you think you get along well with your children?’ (no=1, well=2, and very well=3), and (c) ‘When talking about your thoughts or difficulties, do you think your children will be willing to listen?’ (no=1, sometimes=2, usually=3). Scores ranges from 3 to 9, with a higher score indicating a better emotional cohesion. Cronbach’s alpha for the present sample was 0.73.

Loneliness

The 3-item R-UCLA Loneliness Scale [62] was used to measure the loneliness of older internal migrants. It consists of 3 items rated on a 3-point scale (1=‘hardly ever or never’ to 3=‘almost always’), the total score ranges from 3 to 9. A higher score indicates a stronger loneliness. The Chinese version [63] of the scale has proven highly reliable among older adults. Cronbach’s alpha for the present sample was 0.87.

Perceived stress

Perceived Stress Scale (PSS) [64] was used to measure the perceived stress of older internal migrants over the month earlier. PSS consists of 14 items and two subscales: the sense of uncontrollable and nervous. Each item is scored from 0=‘never’ to 4=‘always’ on the scale, and the

total score ranges from 0 to 56. The Chinese version [65] of the scale has shown a high reliability. A higher score indicates a stronger perceived stress. Cronbach's alpha for the present sample was 0.81.

Depression

The 9-item Patient Health Questionnaire (PHQ-9) [66] was used to measure the depressive symptoms of older internal migrants over the two weeks before. Nine items were rated on a four-point scale (0='never' to 3='almost every day'). The total score ranges from 0 to 27, with a higher value indicating a more severe depression. The Chinese version [67] has been widely used to measure the depressive symptoms among the older adults, with a high reliability. Cronbach's alpha for the present sample was 0.81. In addition to examining PHQ-9 total scores, we formulated a binary variable with scores ≥ 10 indicating clinically significant depressive symptoms, aligning with published cut-off scores for the PHQ-9 [68].

Sociodemographic variables

Sociodemographic variables included age, gender (1='male', 2='female'), education level (1='primary school or lower', 2='junior or senior high school', 3='college or higher'), Hukou (1='agricultural', 2='non-agricultural'), marital status (1='currently married', 2='widowed', 3='divorced'), living with marital partners (1='living with marital partners', 2='living separately from marital partners'), annual income (1=0-¥5000, 2=¥5001-¥10,000, 3=¥10,001-¥40,000, 4>>¥40,000). Subjective health was assessed with the widely used question: 'How is your present health?'. The answer was given a score ranging from 1='very bad' to 5='very good'. Living arrangement (1='living with adult children', 2='living separately from adult children'), cause of migration (1='grandparenting', 2='enjoying life', 3='working', 4='other'), and duration of migration (years).

Data analysis

Firstly, we conducted a descriptive analysis to describe the demographic characteristics of the participants. The Chi-square test was employed to explore the relationship between depression and categorical variables, such as gender, education level, Hukou, and others. The independent two-sample t-test was used to scrutinize differences in age, subjective health, and the duration of migration between the depressed and non-depressed groups. Subsequently, intercorrelations among the four key variables (IEC, loneliness, perceived stress, and depression) were examined. Finally, the serial mediation model was performed by using Hayes' PROCESS macro 3.4 [69]. Paths between mediators were examined by the serial multiple mediator model (PROCESS Model 6). The score of each key variable was standardized (z scores) before analysis. This methodology utilized an ordinary least-square regression model and the bootstrap method to estimate the indirect effect and its 95% confidence intervals (CIs) through random resampling techniques. This approach provides better control over type I errors. The Bootstrap method was employed to assess the significance of these mediation effects using 5000 bootstrap samples [70]. The mediating effect was significant if the bootstrap 95% CIs did not include zero [71]. Furthermore, age, gender, education level, hukou, marital status, living with marital partners, annual income, subjective health, living arrangement, cause of migration, as well as duration of migration were introduced into the model as covariates. The statistical analysis was conducted using the IBM SPSS 25.0 software, and the significance level was set at 0.05 (two-tailed).

Table 1 Demographic characteristics and measurements of participants ($n = 654$)

Variables	Category	Mean (SD) /N (%)
Age		66.05 (4.67)
Gender	Male	216 (33.03%)
	Female	438 (66.97%)
Education level	Primary school or lower	354 (54.13%)
	Junior or senior high school	262 (40.06%)
	College or higher	38 (5.81%)
Hukou	Agricultural	453 (69.27%)
	Non-agricultural	201 (30.73%)
Marital status	Currently married	553 (84.56%)
	Widowed	90 (13.76%)
	Divorced	11 (1.68%)
Living with marital partners	Living with marital partners	335 (51.22%)
	Living separately from marital partners	319 (48.78%)
Annual income	0-¥5000	249 (38.07%)
	¥5001-¥10,000	126 (19.27%)
	¥10,001-¥40,000	199 (30.43%)
	>¥40,000	80 (12.23%)
Subjective health		3.07 (0.94)
Living arrangement	Living with adult children	549 (83.94%)
	Living separately from adult children	105 (16.06%)
Cause of migration	Grandparenting	506 (77.37%)
	Enjoying life	86 (13.15%)
	Working	19 (2.91%)
	Other	43 (6.57%)
Duration of migration		3.96 (1.46)

Table 2 Association of depression with participants demographic characteristics ($N=654$)

Variables	Category	PHQ-9 (< 10)	PHQ-9 (≥ 10)	<i>p</i> -value
Age		66.15 (4.59)	65.35 (5.21)	0.066 [†]
Gender	Male	197 (91.20%)	19 (8.80%)	0.097 [†]
	Female	380 (86.76%)	58 (13.24%)	
Education level	Primary school or lower	308 (87.01%)	46 (12.99%)	0.508
	Junior or senior high school	234 (89.31%)	28 (10.69%)	
	College or higher	35 (92.11%)	3 (7.89%)	
Hukou	Agricultural	393 (86.75%)	60 (13.25%)	0.080 [†]
	Non-agricultural	184 (91.54%)	17 (8.46%)	
Marital status	Currently married	495 (89.51%)	58 (10.49%)	0.033*
	Widowed	72 (80.00%)	18 (20.00%)	
	Divorced	10 (90.91%)	1 (9.09%)	
Living with marital partners	Living with marital partners	300 (89.55%)	35 (10.45%)	0.281
	Living separately from marital partners	277 (86.83%)	42 (13.17%)	
Annual income	0-¥5000	219 (87.95%)	30 (12.05%)	0.415
	¥5001-¥10,000	107 (84.92%)	19 (15.08%)	
	¥10,001-¥40,000	177 (88.94%)	22 (11.06%)	
	>¥40,000	74 (92.50%)	6 (7.50%)	
Subjective health		3.05 (0.94)	3.18 (0.91)	0.630
Living arrangement	Living with adult children	482 (87.80%)	67 (12.20%)	0.435
	Living separately from adult children	95 (90.48%)	10 (9.52%)	
Cause of migration	Grandparenting	457 (90.32%)	49 (9.68%)	0.020*
	Enjoying life	71 (82.56%)	15 (17.44%)	
	Working	15 (78.95%)	4 (21.05%)	
	Other	34 (79.07%)	9 (20.93%)	
Duration of migration		3.99 (1.45)	3.70 (1.54)	0.111

Note: Values are given as 'Mean (SD)' or 'N (%)', [†] $p < 0.10$, * $p < 0.05$

Table 3 Spearman correlation analysis among the key variables ($N=654$)

Variables	Mean	SD	Range	1	2	3	4
1 IEC	7.75	1.34	3-9	1			
2 Loneliness	4.02	1.43	3-9	-0.26**	1		
3 Perceived Stress	20.87	7.66	15-70	-0.30**	0.40**	1	
4 Depression	5.01	3.99	0-27	-0.36**	0.45**	0.54**	1

Note: IEC: intergenerational emotional cohesion. * $p < 0.05$, ** $p < 0.01$ (two-tailed)

Results

Sample profile and correlation analysis

Table 1 presents the demographic characteristics of all 654 participants. In this study, the mean age of older internal migrants was 66.05 years ($SD=4.67$, range=60-86). The mean score for subjective health was 3.07 ($SD=0.94$, range=1-5). The average duration of migration in Nanjing was 3.96 years ($SD=1.46$, range=0.10-5.50). Over two-thirds of the participants were female (67.00%). More than half of them had an education level of primary school or lower (54.13%), and 69.27% had an agricultural Hukou. Four-fifths of the participants were married (84.56%), and half of them lived with their marital partners (51.22%). Over half of the participants reported an annual income lower than ¥10,000 (57.34%), and the majority were living with their adult children (83.94%). Additionally, 77.37% migrated to take care of their grandchildren.

Table 2 illustrates the association of depression with participants' demographic characteristics. The majority of participants had a PHQ-9 score less than 10 (88.23%). When categorical groups were compared within the PHQ-9 depression group (<10 versus ≥ 10), there was a statistically significant difference between gender (p -value=0.097), Hukou (p -value=0.080), marital status (p -value=0.033), and cause of migration (p -value=0.020) concerning the presence of depressive symptoms. Additionally, a statistically significant difference in age distribution across the depression groups was observed (p -value=0.060).

Table 3 shows the Spearman correlation coefficients for all variables. IEC was IEC exhibited a significant negative correlation with loneliness ($r=-0.26$, $p < 0.01$), perceived stress ($r=-0.30$, $p < 0.01$), and depression ($r=-0.36$, $p < 0.01$). Loneliness exhibited a positive correlation with perceived stress ($r=0.40$, $p < 0.01$) and depression ($r=0.45$,

Table 4 Serial mediation analysis among the key variables (N=654)

Result variable	Predictor variable	R	R ²	F	B	t	95%CI
Loneliness	IEC	0.30	0.09	5.75	-0.27***	-7.20	(-0.35, -0.20)
perceived stress	IEC	0.49	0.24	17.11	-0.23***	-6.48	(-0.30, -0.16)
	Loneliness	-	-	-	0.33***	9.09	(0.26, 0.40)
Depression	IEC	0.60	0.36	27.81	-0.17***	-4.84	(-0.23, -0.10)
	Loneliness	-	-	-	0.23***	6.57	(0.16, 0.30)
	Perceived stress	-	-	-	0.37***	10.04	(0.29, 0.44)

Note: IEC: intergenerational emotional cohesion, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Age, gender, Hukou, marital status, living arrangement, education level, and annual income were analyzed as control variables

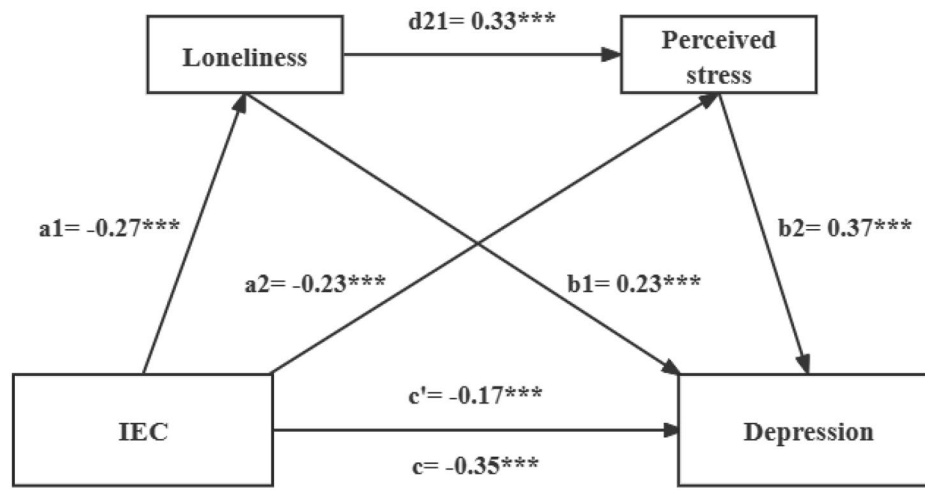


Fig. 3 A serial mediation model of the association between IEC and depression through loneliness and perceived stress. Standardized path coefficients are shown. Note: IEC: intergenerational emotional cohesion, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5 The indirect effects of IEC on depression with loneliness and perceived stress as mediators (N=654)

Model pathways	B	Boots SE	Mediating effect	95%CI	
				Lower	Upper
Total effects	-0.35 ^a	0.04	100%	-0.42	-0.27
Direct effects	-0.17 ^a	0.03	48.57%	-0.23	-0.10
Indirect effects	-0.18 ^a	0.03	51.43%	-0.23	-0.13
path1: IEC → Loneliness → Depression	-0.06 ^a	0.02	17.14%	-0.10	-0.04
path2: IEC → Perceived stress → Depression	-0.09 ^a	0.02	25.71%	-0.12	-0.05
path3: IEC → Loneliness → Perceived stress → Depression	-0.03 ^a	0.01	8.57%	-0.05	-0.02

Note: IEC: intergenerational emotional cohesion. ^a The bootstrap 95% CIs not contain zero

$p < 0.01$). Furthermore, perceived stress showed positive correlation with depression ($r = 0.54, p < 0.01$).

Serial mediation model results

In the serial mediation analysis, IEC was entered as an independent variable and depression as a dependent variable. Loneliness and perceived stress were proposed as mediators. As shown in Table 4; Fig. 3, IEC significantly

and negatively predicted depression ($c' = -0.17, p < 0.001$), thus confirming H1. As the regression equation included loneliness and perceived stress, IEC exhibited a significant negative effect on loneliness ($a_1 = -0.27, p < 0.001$) and perceived stress ($a_2 = -0.23, p < 0.001$). Loneliness had a significant positive effect on perceived stress ($d_{21} = 0.33, p < 0.001$) and depression ($b_1 = 0.23, p < 0.001$). Moreover, perceived stress was a significant positive predictor of depression ($b_2 = 0.37, p < 0.001$). These results indicated that the serial mediating effect of ‘loneliness → perceived stress’ was significant among the influences of IEC on depression, thus confirming H2, H3 and H4.

Bootstrap of mediators

The mediation effects of loneliness and perceived stress are presented in Table 5. Loneliness and perceived stress mediated the relationship between IEC and depression, with a mediating effect value of -0.18 that accounted for 51.43% of the total effect. Specifically, the indirect effect contained three mediation pathways: (1) path 1: IEC → loneliness → depression ($\beta = -0.06, 95\% CI = -0.10, -0.04$), (2) path 2: IEC → perceived stress → depression ($\beta = -0.09, 95\% CI = -0.12, -0.05$), (3) path 3: IEC → loneliness → perceived stress → depression ($\beta = -0.03, 95\% CI = -0.05,$

-0.02). The three indirect effects accounted for 17.14%, 25.71%, and 8.57% of the total effect, respectively. Each of them reached a significant level, because the 95% CI of the above indirect effects did not contain zero. These results further supported H2, H3 and H4.

Discussion

This study explores the substantial impact of IEC on depression among older internal migrants in mainland China and examines the potential mediating effects of loneliness and perceived stress. As anticipated, the results revealed that IEC played a role in decreasing depression both directly and indirectly through the serial mediating effects of loneliness and perceived stress. The key findings of this study are detailed below.

First, correlational and regression analyses conducted in the study revealed that IEC significantly and negatively predicted depression. This implies that IEC is associated with a reduced likelihood of depression among Chinese older internal migrants, supporting hypothesis H1. This finding aligns with previous empirical studies suggesting that emotional cohesion can mitigate depressive symptoms and enhance mental well-being among older migrants [72, 73]. This phenomenon can be explained by the Social Convoy Model [15] and the socioemotional selectivity theory [74]. Older internal migrants, facing the challenges of aging and social integration, tend to seek affective closeness from their closest family members, enhancing positive emotional experiences and minimizing mental health risks [17]. Therefore, IEC emerges as a crucial factor in preventing and alleviating depression among older internal migrants.

Second, the investigation unveiled that loneliness mediates the association between IEC and depression, with an impact of 18.44%, substantiating hypothesis H2. IEC can predispose older parents to experience less depression by alleviating feelings of loneliness during the migration process. This finding aligns with antecedent research, signifying that familial intimacy functions as a safeguard against depression by mitigating feelings of loneliness [19]. Consistent with attachment theory [75], the reliance of older internal migrants on their adult children assumes a pivotal role. On one hand, the provision of emotional support by adult children effectively alleviates loneliness [76, 77]. On the other hand, social integration is bolstered through the social support extended by adult children, fostering an enhanced sense of belonging and diminished loneliness among older internal migrants [39]. Consequently, subsequent mental health challenges such as psychological stress and depression are more aptly alleviated [78].

Third, we observed that perceived stress was a robust mediator between IEC and depression, with an effect of 24.58%. Therefore, H3 was supported. Although

perceived stress has been linked to intergenerational relationships and depression [34], few studies have explored its mediating role. In this study, our data shed light into the mediating role of perceived stress in IEC-depression association among immigrant parents. For Chinese older adults, migration is usually accompanied by a range of intrafamilial stressors, such as acculturation, family conflicts, role strain from grandparenting [49, 50], each of which may cause psychological distress. Aligned with the Social Convoy Model [15, 16], IEC, serving as the core social relations among older internal migrants, proves advantageous in mitigating various stressors and enhancing their capacity to cope with stressful events, thereby promoting their mental well-being. This could elucidate the comparatively higher mediating effect of perceived stress.

Additionally, in the current study, loneliness and perceived stress played a serial mediating role in the association between IEC and depression, with an effect of 9.47%. Therefore, hypothesis H4 found support. IEC can influence the depression of older internal migrants by alleviating loneliness and perceived stress during the migration process. According to the added-stress hypothesis [79], loneliness, as a stressor associated with perceptions of social rejection and exclusion, heightens individuals' vulnerability to life stress events and weakens their resilience against them. Additionally, perceived stress and loneliness have been identified as contributory factors to depression among older adults [80]. Consistent with Berkman's theoretical framework [60] and the Social Convoy Model [15], the pathway through which intergenerational relationships influence mental health via psychological mechanisms can be deduced as 'IEC → loneliness → perceived stress → depression.' This finding contributes novel insights to the literature on mental health among older internal migrants.

Several limitations of this study need to be acknowledged. Firstly, it relies on cross-sectional data, limiting the ability to establish causality between the core variables. Besides, reverse causality might impact the study's robustness. Future research with a longitudinal design is recommended to explore causal relationships. Secondly, due to limitations in the survey design, we lacked an objective assessment of the physical health status of older internal migrants, such as the prevalence of chronic diseases and the activity of daily living (ADL). Future research should consider including these variables to control for the effects of physical health status on depression in older adults. Lastly, intergenerational relationships among older internal migrants may differ from those of left-behind older parents and non-migrant individuals. A comparative analysis of these three groups could provide deeper insights into intergenerational

relationships and their effects on the mental health of older internal migrants.

Conclusions

Despite its limitations, this study delves into the impact of intergenerational relationships on depression among older internal migrants, exploring the psychological mechanisms within familistic cultures and migration contexts. Based on the Berkman's theoretical framework and the Social Convoy Model, the findings suggest that IEC is linked to depression, both directly and indirectly. More precisely, it can influence depression by alleviating loneliness and perceived stress among older internal migrants. In summary, these results contribute to existing studies on intergenerational relationships and depression among older internal migrants, offering theoretical guidance for preventing mental health problems.

Acknowledgements

We thank all investigators and community managers who participated in this work, as well as all older internal migrants who volunteered to participate in this study.

Author contributions

Ruyue Deng: Conceptualization, Investigation, Data curation, Formal analysis, Writing-original draft. Shiyuan Yan: Writing-original draft. Lin Zhang: Supervision, Writing-review&editing. Yanjie Hou: Supervision, Writing-review&editing. Hao Wang: Investigation, Data curation, Formal analysis, Wenjing Zhang: Investigation, Data curation, Formal analysis. Jun Yao: Conceptualization, Supervision, Writing-review&editing, Project administration, Funding acquisition.

Funding

This study is supported by the Social Science Foundation Project of People's Republic of China (18BRK026) and Postgraduate Research & Practice Innovation Program of Jiangsu Province (KYCX22_1768).

Data availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study was approved by the institutional review board of Nanjing Medical University. Nanjing Medical University Ethics Review (2020) No. 571. All methods used in the study were conducted according to the criteria set by the Ethics Committee of Nanjing Medical University, while each subject reviewed and signed an informed consent prior to participation in the study.

Consent for publication

Not Applicable.

Competing interests

The authors declare no competing interests.

Received: 5 July 2023 / Accepted: 7 February 2024

Published online: 23 February 2024

References

1. Dou X, Liu Y. Elderly Migration in China: types, patterns, and determinants. *J Appl Gerontol*. 2017;36(6):751–71.
2. Meng X, Jiang X, Song J, Wan H, Chen Y, Han Z, et al. The floating elderly population in Beijing: characteristics and determinants. *Popul Res*. 2004;28(6):53–9.
3. Liu Y, Huang C, Wu R, Pan Z, Gu H. The spatial patterns and determinants of internal migration of older adults in China from 1995 to 2015. *J Geog Sci*. 2022;32(12):2541–59.
4. Z DPW. The mental health and influencing factors among migrant older adults: based on the survey in Nanjing. *Popul Soc*. 2017;33(4):13.
5. Chengrong D, Yuding Q, Fan H, Donghong, aX. From 6.57 million to 376 million: remarks on Migration Transition in China. *Popul Res*. 2022;46(6):41–58.
6. Wang JJ, Lai DW. Mental health of older migrants migrating along with adult children in China: a systematic review. *Ageing Soc*. 2022;42(4):786–811.
7. Marin IB, Fernández D, Ayuso-Mateos JL, Leonardi M, Tobiasz-Adamczyk B, Koskinen S, et al. Healthy aging and late-life depression in Europe: does migration matter? *Front Med (Lausanne)*. 2022;9:866524.
8. Bradley DE, Van Willigen M. Migration and psychological well-being among older adults: a growth curve analysis based on panel data from the Health and Retirement Study, 1996–2006. *J Aging Health*. 2010;22(7):882–913.
9. Guo M, Stensland M, Li M, Dong X, Tiwari A. Is Migration at older Age Associated with Poorer Psychological Well-Being? Evidence from Chinese older immigrants in the United States. *Gerontologist*. 2019;59(5):865–76.
10. Li Q, Zhou X, Ma S, Jiang M, Li L. The effect of migration on social capital and depression among older adults in China. *Soc Psychiatry Psychiatr Epidemiol*. 2017;52:1513–22.
11. Zeng W, Wu Z, Schimmele CM, Li S. Mass relocation and depression among seniors in China. *Res Aging*. 2015;37(7):695–718.
12. HU, J-j. NI Y-y, LI Q-j. Depression among elderly migrants in urban Hangzhou: a cross-sectional study. *Chin J Public Health*. 2016;32(9):1144–8.
13. Yan Y. Chinese families upside down: intergenerational dynamics and neo-familism in the early 21st century. Brill; 2021.
14. Sun Q, Wang Y, Lu N, Lyu S. Intergenerational support and depressive symptoms among older adults in rural China: the moderating roles of age, living alone, and chronic diseases. *BMC Geriatr*. 2022;22(1):83.
15. Antonucci TC, Ajrouch KJ, Birditt KS. The convoy model: explaining social relations from a multidisciplinary perspective. *Gerontologist*. 2014;54(1):82–92.
16. Antonucci TC, editor. Editor social relations: an examination of social networks, social support, and sense of control. *Handbook of the psychology of aging*. Academic; 2001. pp. 427–53.
17. Fuller HR, Ajrouch KJ, Antonucci TC. The convoy model and later-life family relationships. *J Family Theory Rev*. 2020;12(2):126–46.
18. Li C, Jiang S, Zhang X. Intergenerational relationship, family social support, and depression among Chinese elderly: a structural equation modeling analysis. *J Affect Disord*. 2019;248:73–80.
19. Fu YY, Ji XW. Intergenerational relationships and depressive symptoms among older adults in urban China: the roles of loneliness and insomnia symptoms. *Health Soc Care Commun*. 2020;28(4):1310–22.
20. Li Y, Meng J, Xiong C, Zhu Z, Wu S, Wang S, editors. Family Migration Decisions of Floating Population and Its Influencing Factors—A Case of Wuhan Metropolitan Area, China. *Proceedings of the 25th International Symposium on Advancement of Construction Management and Real Estate*; 2021: Springer.
21. Lu X, Lan Q. Integration and exclusion: an analysis of the intergenerational ambivalence of Urban Elderly migrants. *Popul Soc*. 2021;2021(2019–2):15–23.
22. Litwak E, Longino CF Jr. Migration patterns among the elderly: a developmental perspective. *Gerontologist*. 1987;27(3):266–72.
23. Chan KW. The Chinese hukou system at 50. *Eurasian Geogr Econ*. 2009;50(2):197–221.
24. Cheng Z, Nielsen I, Smyth R. Access to social insurance in urban China: a comparative study of rural–urban and urban–urban migrants in Beijing. *Habitat Int*. 2014;41:243–52.
25. Mou J, Griffiths SM, Fong HF, Dawes MG. Defining migration and its health impact in China. *Public Health*. 2015;129(10):1326–34.
26. Bengtson VL. Generation and family effects in value socialization. *Am Sociol Rev*. 1975;35:58–71.
27. Bengtson VL, Roberts RE. Intergenerational solidarity in aging families: an example of formal theory construction. *J Marriage Fam*. 1991;856–70.
28. Silverstein M, Bengtson VL. Intergenerational solidarity and the structure of adult child–parent relationships in American families. *Am J Sociol*. 1997;103(2):429–60.
29. Zhou J-J, Bai X. Influence of intergenerational relationships on depressive symptoms in ageing Chinese adults in Hong Kong: mediating effects of sense of loneliness. *BMC Geriatr*. 2022;22(1):587.

30. Zheng R, Yu M, Huang L, Wang F, Gao B, Fu D, et al. Effect of intergenerational exchange patterns and intergenerational relationship quality on depressive symptoms in the elderly: an empirical study on CHARLS data. *Front Public Health*. 2022;10:1009781.
31. Tang D, Xie L. Whose migration matters? The role of migration in social networks and mental health among rural older adults in China. *Ageing Soc*. 2023;43(6):1389–408.
32. Peng H, Mao X, Lai D. East or West, home is the best: Effect of intergenerational and social support on the subjective well-being of older adults: a comparison between migrants and local residents in Shenzhen, China. *Ageing Int*. 2015;40:376–92.
33. Andersson L. Loneliness research and interventions: a review of the literature. *Ageing Ment Health*. 1998;2(4):264–74.
34. Hawkey LC, Cacioppo JT. Loneliness matters: a theoretical and empirical review of consequences and mechanisms. 2010(1532–4796 (Electronic)).
35. Luo Y, Hawkey LC, Waite LJ, Cacioppo JT. Loneliness, health, and mortality in old age: a national longitudinal study. *Soc Sci Med*. 2012;74(6):907–14.
36. Barg FK, Huss-Ashmore R, Wittink MN, Murray GF, Bogner HR, Gallo JJ. A mixed-methods approach to understanding loneliness and depression in older adults. *Journals Gerontol Ser B: Psychol Sci Social Sci*. 2006;61(6):329–339.
37. Aylaz R, Aktürk Ü, Erçi B, Öztürk H, Aslan H. Relationship between depression and loneliness in elderly and examination of influential factors. *Arch Gerontol Geriatr*. 2012;55(3):548–54.
38. Tao W, Wang Y, Zhang Y, Yan Q, Zhang B, Wei J et al. The effects of self-acceptance and loneliness on the social adaptability of the migrant elderly. *Chin Nurs Manage*. 2018.
39. L YN. The dilemma and countermeasures of the social integration of 'the old drifters' from the perspective of the community. *Social Secur Stud*. 2016;4:34–43.
40. XY W. The offsite endowment of the older drifting group in the process of urbanisation. *Popul Soc*. 2017;33:50–8.
41. Zong D, Lu Z, Shi X, Shan Y, Li S, Kong F. Mediating effect of family support on the relationship between acculturation and loneliness among the migrant elderly following children in Jinan, China. *Front Public Health*. 2022;10:934237.
42. Zhang X, Silverstein M. Intergenerational emotional cohesion and psychological well-being of older adults in rural China: a moderated mediation model of loneliness and friendship ties. *Journals Gerontology: Ser B*. 2022;77(3):525–35.
43. Vancampfort D, Koyanagi A, Ward PB, Veronese N, Carvalho AF, Solmi M, et al. Perceived stress and its relationship with Chronic Medical conditions and Multimorbidity among 229,293 Community-Dwelling adults in 44 low- and Middle-Income Countries. *Am J Epidemiol*. 2017;186:97Y989.
44. Tennant C. Life events, stress and depression: a review of recent findings. *Aust N Z J Psychiatry*. 2002;36(2):173–82.
45. Tsai AC, Chi Sh Fau - Wang J-Y, Wang JY. Association of perceived stress with depressive symptoms in older Taiwanese: results of a population-based study. 2015(1447–0594 (Electronic)).
46. Huang L, Du W, Liu Y, Guo L, Zhang J, Qin M, et al. Loneliness, stress, and depressive symptoms among the Chinese rural empty nest elderly: a moderated mediation analysis. *Issues Ment Health Nurs*. 2019;40(1):73–8.
47. Tsai AC, Chi S-H, Wang J-Y. The association of perceived stress with depressive symptoms in older Taiwanese—result of a longitudinal national cohort study. *Prev Med*. 2013;57(5):646–51.
48. Hou HL, Chun-Hua LI. Identity, Region and City Size: Inequality of Basic Public Health Services for the Elderly Floating Population. *Population and Development*. 2019.
49. Chen Y, Sun W. The Health consequences of Grandparenting and History among Chinese: evidence from Harmonized CHARLS Data. *Popul J*. 2019;41(5):12.
50. Yu B, Chen X, Elliott AL, Wang Y, Li F, Gong J. Social capital, migration stress, depression and sexual risk behaviors among rural-to-urban migrants in China: a moderated mediation modeling analysis. *Anxiety, Stress, & Coping*. 2019;32(4):362–75.
51. Bairen D, Wang Y, Stress. Resources, and the Well-being of drifting older adults. *Jiangsu Social Sci*. 2020;6:33–43.
52. Han S. Social capital and perceived stress: the role of social context. *J Affect Disord*. 2019;250:186–92.
53. Feizi A, Aliyari R, Roohafza H. Association of perceived stress with stressful life events, lifestyle and sociodemographic factors: a large-scale community-based study using logistic quantile regression. *Comput Math Methods Med*. 2012;2012:151865.
54. Lawrence RH, Bennett JM, Markides KS. Perceived intergenerational solidarity and psychological distress among older Mexican Americans. *J Gerontol*. 1992;47(2):55–65.
55. Russell DW, Cutrona CE. Social support, stress, and depressive symptoms among the elderly: test of a process model. *Psychol Aging*. 1991;6(2):190.
56. Hawkey LC, Cacioppo JT. Loneliness and pathways to disease. *Brain Behav Immun*. 2003;17(1):98–105.
57. Zhang J, Wu Z-Y, Fang G, Li J, Han B-X, Chen Z-Y. Development of the Chinese age norms of CES-D in urban area. *Chin Mental Health J*. 2010;24(2):139–43.
58. Hawkey LC, Bosch JA, Engeland CG, Marucha PT, Cacioppo JT. Loneliness, dysphoria, stress and immunity: A role for cytokines. 2007.
59. Li S, Ye X, Wang L, Li Y, Yang H, Liu X. The effect of perceived stress and social support between loneliness and mental health among the solitary elderly. *Chongqing Med*. 2018;47:4044–7.
60. Berkman LF, Glass T, Brissette I, Seeman TE. From social integration to health: Durkheim in the new millennium. *Soc Sci Med*. 2000;51(6):843–57.
61. Clair JM. Measurement of intergenerational relations. *Gerontologist*. 1988;28(5):718.
62. Hughes ME, Waite LJ, Hawkey LC, Cacioppo JT. A short scale for measuring loneliness in large surveys: results from two Population-Based studies. *Res Aging*. 2004;26(6):655–72.
63. Liu T, Lu S, Leung DKY, Sze LCY, Kwok WW, Tang JYM, et al. Adapting the UCLA 3-item loneliness scale for community-based depressive symptoms screening interview among older Chinese: a cross-sectional study. *BMJ Open*. 2020;10(12):e041921.
64. Cohen S, Kamarck T, Mermelstein R. Stress A Global Measure of Perceived. 1983.
65. Yang TZ, Huang HT. [An epidemiological study on stress among urban residents in social transition period]. *Chin J Epidemiol*. 2003;24(9):760.
66. Areán PA, Ayalon L. Assessment and treatment of depressed older adults in primary care. *Clin Psychol Sci Pract*. 2005;12(3):321–35.
67. Zi-Wei L, Yu Y, Mi H, Hui-Ming L, Liang Z, Shui-Yuan X, et al. PHQ-9 and PHQ-2 for Screening Depression in Chinese Rural Elderly. *PLoS ONE*. 2016;11(3):e0151042.
68. Kroenke K, Spitzer RL, Williams JB, Löwe B. The Patient Health Questionnaire somatic, anxiety, and depressive Symptom scales: a systematic review. *Gen Hosp Psychiatry*. 2010;32(4):345–59.
69. Hayes AF. Introduction to Mediation, Moderation, and conditional process analysis: a regression-based Approach: introduction to Mediation, Moderation, and conditional process analysis. *A Regression-Based Approach*; 2013.
70. Preacher KJ, Hayes AF. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behav Res Methods*. 2008.
71. Mallinckrodt B, Abraham WT, Wei M, Russell DW. Advances in testing the statistical significance of Mediation effects. *J Couns Psychol*. 2006;53(3):372–8.
72. Kim BJ, Chen L, Lee Y, Xu L. Quality of life of elderly Chinese immigrants: focusing on living arrangements and social capital. *Educ Gerontol*. 2019;45(6):377–89.
73. Lu N, Xu L, Lou VW, Chi I. Intergenerational relationships and the trajectory of depressive symptoms among older Chinese adults in rural migrant families. *Ageing Ment Health*. 2018;22(3):389–96.
74. Carstensen LL, Isaacowitz DM, Charles ST. Taking time seriously: a theory of socioemotional selectivity. *Am Psychol*. 1999;54(3):165.
75. Bowlby J. Attachment and loss: retrospect and prospect. *Am J Orthopsychiatry*. 1982;52(4):664.
76. Golden J, Conroy RM, Bruce I, Denihan A, Greene E, Kirby M, et al. Loneliness, social support networks, mood and wellbeing in community-dwelling elderly. *Int J Geriatric Psychiatry: J Psychiatry late life Allied Sci*. 2009;24(7):694–700.
77. Zhou G, Wang Y, Yu X. Direct and indirect effects of family functioning on loneliness of elderly Chinese individuals. *Curr Psychol*. 2018;37:295–301.
78. Yanguas J, Pinazo-Henandis S, Tarazona-Santabalbina FJ. The complexity of loneliness. *Acta Bio Medica: Atenei Parmensis*. 2018;89(2):302.

79. Cacioppo JT, Hawkley LC, Berntson GG. The anatomy of loneliness. *Curr Dir Psychol Sci.* 2003;12(3):71–4.
80. Saini S, Mandeep. A study of perceived stress and loneliness in older people with Depression. *Int J Indian Psychol.* 2020;4.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.