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# The impact and mechanism of neighbourhood social capital on mental health: a cross-sectional survey based on the floating elderly population in China

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## Abstract

**Background** Under the definition of positive mental health, the present study focused on the emerging group of floating elderly to explore the impact and mediating mechanisms of bonding and bridging neighbourhood social capital on their mental health.

**Methods** The data were sourced from community surveys in three major cities in Guangdong Province, China, with a total of 659 respondents aged 55 and above. Structural equation modelling was used to verify the hypotheses proposed in this study.

**Results** The latent variables of bonding and bridging neighbourhood social capital were established. After controlling for the main demographic and social characteristic variables, bonding neighbourhood social capital had a significant positive impact on the happiness of floating elderly ( $\beta=0.484, p<0.05$ ). Bridging neighbourhood social capital was beneficial for alleviating the tendency towards mental illness ( $\beta=-0.545, p<0.05$ ). Physical exercise and psychological integration were mediating mechanisms that connected bonding neighbourhood social capital and happiness ( $RIT=0.313, p<0.05$ ;  $RIT=0.674, p<0.001$ ). Social adaptation was found to have a mediating effect on the relationship between bridging neighbourhood social capital and mental illness ( $RIT=0.088, p<0.05$ ).

**Conclusions** By incorporating the geographical concept of neighbours into the discussion, the findings support the utility of social capital theory in the context of the floating elderly population and Chinese cities. By classifying neighbourhood social capital, the impact of bonding and bridging social capital on different dimensions of mental health is revealed, further expanding the mechanism of the mental health effect of social capital. Cultivating neighbourhood social capital and transforming individual interaction needs into practical actions should be included in the construction of mental health promotion policies

**Keywords** Bonding neighbourhood social capital, Bridging neighbourhood social capital, Happiness, Mental illness, The floating elderly population

## Background

In recent years, China's aging population has become increasingly prominent. As of 2020, the number of elderly people in China has reached 264 million, accounting for 18.70% of the total population, which is 5.44% higher than the number in 2010 [1]. Under

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the dual influence of China's continuous urbanization and traditional inter-generational support, the floating elderly population, has gradually become a new heated topic in academic research [2–4]. According to the report on the development of floating population in China 2018, the number of floating elderly increased from 5.03 million in 2000 to 13.04 million in 2015, with an average annual growth rate of 6.6% [5], that will continue to grow in the future [6].

Floating elderly refer to the population entering the stage of aging who have left the district or county with registered residence for at least 6 months, and are not registered in their current residence [7]. They maintain a set of unique living habits with regard to lifestyle, social communication and psychological identity that are influenced by the place of outflow [8]. Compared with other elderly groups, the floating elderly population faces the multiple pressures of physiological decline, urban integration difficulties and role change adaptation after moving to new cities, resulting in higher mental health risks [9, 10]. Some studies have shown that the prevalence of anxiety disorder was 27.5% among the elderly migrants in China [11]; the proportion of depressive symptoms reached 36.0%, significantly higher than non-migrant elderly groups [12].

To date, the mental health issues of the floating elderly population have been paid attention to increasingly, but the number of studies is relatively scarce. There are still two aspects that need further research. On the one hand, most studies are based on the negative psychological analysis position or generalized overall evaluation and rarely involve positive issues such as happiness and joy [3, 13]. Keyes, one of the representatives of positive psychology, argued that mental health not only refers to the absence of mental illness, but also a state of psychological prosperity, including subjective well-being, psychological well-being, and social well-being [14]. A comprehensive concept of mental health will help the floating elderly population achieve the best psychological functioning. On the other hand, social capital is regarded as one of the key factors that can alleviate loneliness and promote happiness among the floating elderly population [15, 16]. However, the classification of social capital and its regional dependence have not received attention in these studies. The community is the basic unit of urban governance in China, where floating elderly start a new life and achieve urban integration. Neighbourhood social capital based on the new geographical space may improve the mental health of the floating elderly population. This is an important issue that has been ignored by previous research.

### The health effects of neighbourhood social capital

The positive impact of social capital on health extends from intimate family relationships and friend networks to aspects such as participating in community organizations and social activities [17]. In Putnam's theory, social capital is conceptualized within the geographical area of the community, which opens up a new path for distinguishing social capital from social support research at the macro level. Subsequent research has explored communities with regard to issues related to social problems and personal life opportunities, focusing on the impact of neighbourhood social capital on health [18]. The results showed that frequent interaction with neighbours effectively reduces the occurrence of depression [19]. When people feel that community members are trustworthy, they are more willing to cooperate and gain a sense of order and belonging [20]. Compared to other community characteristics, harmonious neighbourhood relationships are the most important indicator for evaluating the quality of life of people in vulnerable communities [21].

With the rise of globalization and individualism as well as the increasing diversity of lifestyles, traditional community connections have undergone changes [22]. Nevertheless, this study believes that the community, as the main spatial place for people's daily lives, still has a lasting and profound impact on people's quality of life in China, including health. On the one hand, China's health policies, such as Health China 2030 and a plan for the development of the country's elderly care services system during the 14th Five-Year Plan period (2021–2025), highlight the significant impact of communities on individual health. The construction of neighbourhood social capital has been included in the policy toolbox for health promotion.

On the other hand, in the Chinese acquaintance society that advocates mutual assistance and neighborly friendship, the neighbourhood effect has a more intimate impact on the health of the elderly [23]. The sense of neighbourhood security is highly correlated with the cognitive function of older adults [24]. Participating community-organized physical activities reduce frailty risk of the elderly [25]. This impacts have been verified in the floating elderly population by some latest studies. Social interaction within the community is an important channel for improving their mental health [4]. Building neighbourhood social networks actively decreases the potential mental health risks of older Chinese immigrants [2]. This means that modernity has weakened neighbourhood relations, but they are still the basic components of people's social networks. The community, which is bound by common interests and identity formation, provides a sense of comfort and security for its members [20].

### The impact of bonding and bridging social capital on health

The impact of bonding social capital and bridging social capital on health is a focus of recent research [26, 27]. Bonding and bridging are one classification standard for social capital. The former refers to the connection within members who share similar demographic characteristics with regard to social class, race and other social attributes, while the latter is defined as the connection between individuals who have different backgrounds and possess distinct cultural, social, and economic resources [28].

Bonding social capital helps individuals form a dense social network and enhance group reciprocity and community solidarity, which in turn improves mental health [26, 29]. Immigration research has found that bonding social capital can help immigrants overcome the adaptability problems caused by social and cultural barriers, relieve psychological pressure, and improve their psychological well-being [30]. However, the reciprocal exchanges among homogeneous groups are limited by the total amount of available resources contained in the network. When a disaster strikes a community that lacks resources, strong social ties force community members to share limited resources, which undoubtedly has a negative psychological impact [31]. At the same time, bonding social capital places excessive emphasis on group boundaries and crowds out outsiders, which in turn has an obvious negative effect on the psychological status of members. In Japanese traditional collectivist communities, strong social ties set an internal standardization that hinders the establishment of trust with outsiders and exerts strong psychological pressure on those who build heterogeneous networks [32]. Bonding social capital may also become a source of stress, and the resulting conflict, jealousy and disappointment can harm mental health. In communities with limited resources, community members are forced to rely on informal social networks to obtain resources, and members are both eager for social networks and afraid [33].

Bridging social capital emphasizes network heterogeneity, which can help individuals obtain information and resources and achieve stronger political influence in a wider range through diverse and loose networks. The concept of a "weak relationship" proposed by Granovett describes his observation that most people find jobs not through the closest social network but through the recommendation of people who are different from them. In addition to directly providing resource opportunities, heterogeneous networks can provide credit guarantees that improve opportunities for elderly individuals to obtain public health services [34], because trustworthy recommenders make people more willing to trust and utilize information resources. At the community level,

communities with more bridging social capital are more likely to participate in social policy decisions. Communities with diverse social networks are consistently more successful in reducing budgets for community services and are more likely to provide better educational opportunities and housing environments, thus improving people's health [35]. However, in rural areas with limited resources and poor social heterogeneity, it is difficult for people to obtain resources through bridging social networks to improve health [36].

Due to the fact that the impact of social capital depends on the context, the operation of bonding social capital and bridging social capital cannot be separated from the specific social situation, such as neighbourhoods. Social capital is not only the core element for building safe, beautiful and harmonious neighbourhoods, but also the "lubricant" for promoting community progress [37]. This implies the scope of benefits of bonding social capital and bridging social capital is broader in a neighbourhood setting. Furthermore, limited range of activities and withdrawal from the labor market have led to a strong dependence on neighbourhood social capital among the elderly [38]. For the floating elderly population, the disruption of original social network caused by spatial migration strengthens their sensitivity to environment and resources within the new neighbourhoods. So this study placed two types of social capital mentioned above in the neighbourhood life scene and investigated the main effects and their mechanisms on the mental health of floating elderly.

### Research hypotheses

Cohen, an American psychologist, proposed two models (the stress-buffering model and main effect model) to explain the relationship between social capital and mental health [39]. The stress-buffering model suggests that when individuals encounter events that may produce stress, social capital can adjust individuals' reactions by providing material or emotional resources and thus protecting mental health. According to the main effect model, social capital can directly produce positive psychological feelings for individuals, such as a sense of purpose, belonging, security and identity, which are beneficial to the neuroendocrine regulation of stress and self-protection and thus benefits mental health. Based on these two models and the different functions of social capital, this study suggests two types of neighbourhood social capital, bonding and bridging social capital, play different important roles in the mental health of floating elderly. In stressful situations, bridging neighbourhood social capital which is loose and heterogeneous, provides social support including diverse opportunities and resources to alleviate negative emotions such as fear,

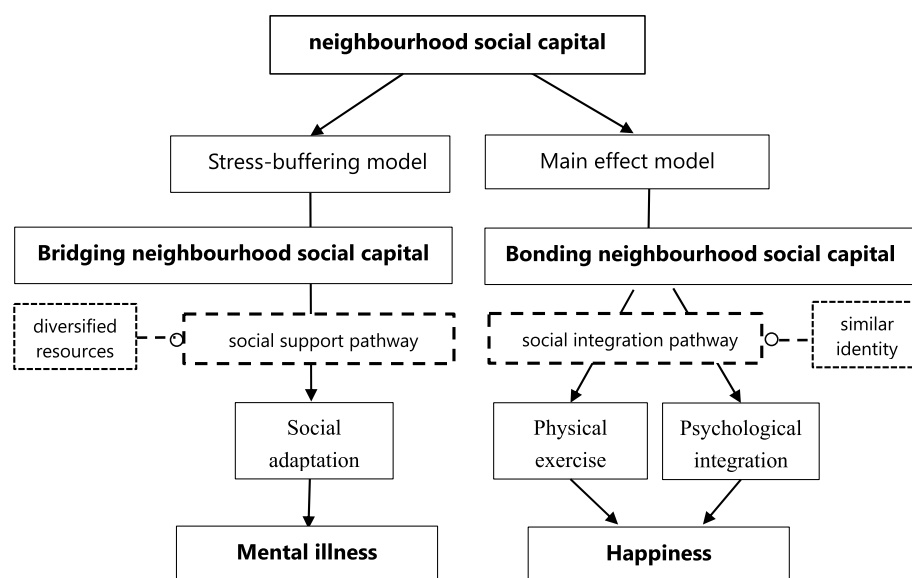
anxiety, and stress among the floating elderly, thereby reducing the tendency towards mental illness. In non-stressful situations, bonding neighbourhood social capital represents a path of social integration, which is prone to generate trust and norms in social networks due to common and familiar identities of the floating elderly. When embedded in the networks, they are more likely to experience positive emotions such as identification, belonging and happiness, shaping optimistic and positive healthy mindset. The theoretical framework of this study is shown in Figure 1.

The negative emotions on floating elderly mainly comes from life events such as changes in the living environment, marginalized family status, migration, retirement and social identity transformation [8], which lead to the rise of psychopathic symptoms. Within the community, the close connection between the floating elderly population and other people has become one of the most important means to obtain more community resources for them [40]. According to the theoretical model proposed in this study, loose heterogeneous connections in the community provide more opportunities for floating elderly to access external resources, which alleviate their life pressure. More noteworthy is that bridging neighbourhood social capital renew values and lifestyles that floating elderly have rarely encountered before, such as being more tolerant of different ideas and raising grandchildren in more scientific ways. These experiences generate internal resources which are conducive to psychological adaptation, helping them complete their role change and improve mental health [41, 42].

As a kind of positive psychological feeling, happiness is divided into three main dimensions: emotional happiness, psychological happiness and social happiness. Existing research on elderly people shows that bonding social capital has a significantly positive role in the happiness of elderly individuals [43], while the influence of bridging social capital is negligible [27]. This statistical result is closely related to the age-related motivation change. Socioemotional selectivity theory argues that individuals give priority to different life goals based on their expectation of the length of their future life. Young people with a longer future are generally committed to maximizing future benefits by building new social networks, while elderly people with limited future time give priority to emotional satisfaction and prefer to establish relationships with trusted individuals, thus maintaining happiness [44, 45].

Sharing the same ageing characteristics and migration experiences also makes it easier for them to establish relationships with other floating elderly people in the community. So Bonding neighbourhood social capital provides them with a sense of belonging and emotional satisfaction. In comparison, bridging neighbourhood social capital helps the floating elderly population acquire new resources in many heterogeneous social networks, which has considerable economic and information value [46]. Therefore, this study proposes the following:

**Hypothesis 1:** Bridging neighbourhood social capital has a significant negative impact on the mental illness tendency of floating elderly.



**Fig 1** Theoretical framework of this study

Hypothesis 2: Bonding neighbourhood social capital has a significant positive impact on the happiness of floating elderly.

The mediation mechanisms of the two types of social capital on the mental health of the floating elderly population are also different. The floating elderly population often have to face adaptability problems and psychological pressure caused by regional and cultural barriers, especially in the initial stage of moving to a new community. Bridging neighbourhood social capital can effectively help them adapt to the new environment through diversified social support networks. In the process of communicating with local people, floating elderly gradually understand and accept behaviors and customs that they were not familiar with before, and take positive actions to cope with the challenges brought by environmental changes. This positive resocialization is beneficial in reducing their mental illness tendency triggered by negative emotions [8].

Bonding neighbourhood social capital is an important cornerstone for the emotional acquisition of the floating elderly. When interacting with neighbours with similar attributes, they are more likely to experience positive emotions such as being respected, understood, and supported [47]. Because homogeneous networks are highly effective in spreading ideas related to value judgments, rather than certain factual statements. The common attribute of aging and immigration is to create a familiar interactive environment for them, which can easily form a sense of identity and belonging to the new community, and enhance their psychological integration in the immigrant community [48]. Physical exercise is a common hobby and topic among elderly individuals. It usually occurs in public places and is susceptible to the influence of the surrounding environment, with a higher correlation with social capital in the neighbourhood [40]. Proximity provides important interaction and feedback for interpersonal communication, strengthening internal members' compliance with health norms [49]. The members from homogeneous neighbourhood networks exchange health information, implement healthy behaviors and supervise each other, which is conducive to form a positive attitude and a sense of pleasure [50, 51]. In summary, this study proposes the following:

Hypothesis 3: Bridging neighbourhood social capital reduces the tendency towards mental illness among floating elderly people by enhancing their adaptation to the city.

Hypothesis 4: Bonding neighbourhood social capital enhances the happiness of floating elderly people by promoting psychological integration.

Hypothesis 5: Bonding neighbourhood social capital improves the happiness of floating elderly people by promoting physical exercise.

## Methods

### Sampling

The data were sourced from a questionnaire survey conducted from May to August 2022 in three major cities where floating elderly resided in Guangdong Province. The quota sampling method was used to recruit respondents. The sampling procedure was as follows. First, based on two important criteria, the proportion of elderly people and the floating population at the city level, the three most concentrated areas of the floating elderly population in Guangdong Province (i.e., Guangzhou, Shenzhen and Foshan) were selected as the survey cities. Second, the survey randomly chose 2 streets in each city and then 2 communities in each street. The Human Resources and Social Security Department of Guangdong Province contacted the leaders of the selected communities, that provided convenience for the admission of this investigation. Finally, 55 respondents from each community received questionnaire surveys from well-trained interviewers. To be recruited to participate in the survey, respondents needed to (a) be aged 55 or above; (b) be non-local residents and live in local communities for more than 6 months in the past year; and (c) have normal cognitive and listening abilities. The age and gender ratio of the recruited respondents were consistent with the representative sample of people aged 55 or above whose household registration was outside the local area from the seventh National Population Census. The response rate of each selected community was above 98%.

### Measurement

#### *Dependent variable*

This study adopted the definition of positive mental health, regarding it as a positive state without mental illness to comprehensively improve emotional well-being, psychological well-being and social well-being [52]. The dependent variable was divided into two aspects: mental illness and happiness. According to Keyes and Simoes' approach [14], mental illness was measured by depression whose main symptoms were mood depression and decreased interest, anxiety disorder, and panic attack. The corresponding items to the above variables were as follows: In the past two weeks, "I feel depressed or helpless", "I have no interest in doing anything", "I feel nervous, anxious or irritable", "I feel frightened or scared". The answers included: 1=completely not; 2=no more than 2 days; 3=lasting for 3–4 days; 4=lasting for 5–9 days; 5=lasting for 10–14 days. According to the criteria of the fifth revision of the Diagnostic and Statistical Manual of



Mental Disorders, each item was coded a score from 1 to 5, representing the severity of the tendency towards mental illness. The results of Cronbach's alpha (0.763) and KMO (0.761) showed that the four items were internally consistent.

The positive emotion scale, Ryff's psychological well-being scale and Keyes' social well-being scale were used to measure happiness [14]. Emotional well-being is considered as an individual's subjective evaluation of his or her quality of life from the perspective of emotion and cognition [53], measured by items below, "being able to maintain a good mental state", "feeling happy", "feeling peaceful/calm", "feeling full of vitality" and "feeling satisfied with life". Psychological well-being refers to effective function and self-realization [54], including the items "I like my personality", "I can easily build trust with others", "life is a process of continuous learning and change", "life is full", "my goals are clear", "I am good at managing my daily life", and "I am not easily influenced by others". Social well-being is defined as an individual's perception of the quality of his or her relationship with others, neighbours and communities [55]. The measured items contained "People care about the difficulties encountered by others", "Society is constantly improving my situation", "I have contributed to my community", "I know what is happening in the world" and "I am close to other people in the community". The answer options for the above questions were from 1 to 5; the higher the score, the higher the level of happiness. Statistical results of three scales displayed that KMO were 0.837, 0.793, and 0.703, respectively, and Cronbach's alpha were 0.836, 0.714, and 0.701, respectively, indicating measures of happiness had high applicability in this study. Descriptive statistics and Correlation Analysis were shown in Table 1.

### Independent variable

Due to the multiple definitions and operational methods of the concept, a systematic measurement of neighbourhood social capital is lacking. Although neighbourhood social capital is a collective construct, individual-level measurements have been widely used in previous research [24, 56]. Therefore, this study adopted an individual-level approach to measure neighbourhood

social capital. Similarly, there is no unified standard for measuring bonding and bridging social capital. The relevant measurement basis for this study was as follows. First, because the homogeneity and heterogeneity of networks have been seen as the results of interacting with individuals with similar or different characteristics [26], bonding and bridging social capital should be regarded as independent concepts rather than two ends of a conceptual continuum. Second, some proxy variables have usually been applied to the measurement of the above concepts. For example, prerequisites for building heterogeneous networks, such as extroverted relationships, extensive interpersonal contact, and seeing oneself as part of a group, are often used as important indicators to measure bridging social capital [57]. In recent years, scholars have increasingly paid attention to the attribute characteristics of two types of social capital, similar or different communication objects, advocating for the design of more accurate and targeted measurements for specific groups [31]. Based on this, this study mainly adopted questions that directly reflected the nature of the communication object, supplemented by a logical approach of proxy variables, to measure bonding neighbourhood social capital and bridging neighbourhood social capital.

Specifically, bonding social capital was measured by three indicators: the trust of fellow villagers, the trust of non-locals, and the willingness to communicate with similar people in the neighbourhood (1=minimum trust/willingness to communicate; 2=medium-low trust/willingness to communicate; 3=medium trust/willingness to communicate; 4=medium-high trust/willingness to communicate, 5=the highest degree of trust/willingness to communicate). Bridging social capital was also measured by three questions: the trust of local people, the ability to get along with most people and participation in different kinds of community activities. The answer options for the first two questions were assigned scores of 1–5 (1=minimum trust/ability; 2=medium-low trust/ability; 3=medium trust/ability; 4=medium-high trust/ability, 5=the highest degree of trust/ability). The answer options for the last question ranged from 1–5, where 1 indicated no participation at all and 5 indicated full participation.

**Table 1** Descriptive statistics and correlation analysis

	Mean	SD	1	2	3	4
1.Emotional well-being	21.587	3.229	—			
2.Psychological well-being	25.125	3.500	0.780 <sup>a</sup>	—		
3.Social well-being	20.285	3.107	0.778 <sup>a</sup>	0.707 <sup>a</sup>	—	
4.Mental illness	6.089	2.835	−0.365 <sup>a</sup>	−0.329 <sup>a</sup>	−0.242 <sup>b</sup>	—

Note. <sup>a</sup>indicates significance at the 0.1% level (two-tailed); <sup>b</sup>indicates significance at the 1% level (two-tailed)

### Mediating variable and control variables

The mediating variables in this study were physical exercise, psychological integration and social adaptation. Due to social attributes of physical exercise, the location significantly affects the formation of social capital [58]. Measurement of physical exercise included three indicators: the frequency of exercise per week (1=0 times; 2=1–2 times; 3=3–4 times; 4= 5–6 times; 5= 7 times or more) the frequency of using community sports facilities, and the frequency of using public spaces such as parks and squares. The latter two answer options were assigned values of 1–5 (1=never; 2=rarely; 3=sometimes; 4=often; 5=always). Psychological integration, as the higher stage of integration, refers to individuals' identification, acceptance and willingness to reside at the migration destination from a cognitive perspective [3]. Four indicators were used for measurement according this definition: long-term residence willingness, willingness to integrate into the local area, local people's willingness to accept me as a community member, and self-identification with a community member. The answer options were on a scale of 1–5 (1=minimum integration; 2=medium-low integration; 3=medium integration; 4=medium-high integration; 5=the highest degree of integration). Social adaptation is an important requirement for urban life, involving individuals' adjustment of behaviors, attitudes, and lifestyles to adapt to the new environment [59], including three indicators: adaptability of diet, customs and language (1=minimum adaptability; 2=medium-low adaptability; 3=medium adaptability; 4=medium-high adaptability, 5=the highest degree of adaptability).

Gender, age, marital status, education, household registration, physical health status and income were incorporated into the statistical analysis as control variables. Gender, marital status, and household registration were all recorded as binary variables (0=male, 1=female; 0=single, 1=non-single; 0=agricultural registered permanent residence, 1=nonagricultural registered permanent residence). Education and health status were recorded as ordered variables (1=primary school and below, 2=junior school, 3=senior high school, 4=university or above; 1=unhealthy, 2=generally healthy, 3=healthy). Age and income were recorded as continuous variables.

### Data analysis

Structural equation modelling (SEM) was used to test the research hypotheses in this study. SEM was conducted in two steps: establishing a measurement model and a structural model. Some popular indexes were adopted to evaluate the goodness of fit of the measurement model, including the chi-square test, root mean square error of approximation (RMSEA), comparative fit index (CFI), Tucker–Lewis index (TLI) and standardized root

mean square residual (SRMR). The criteria for an ideal model were as follows: nonsignificant chi-square values, RMSEA values below 0.05, CFI and TLI values above 0.90, and SRMR values below 0.08 [60]. On this basis, this study established a structural model to examine the direct impact of bonding and bridging neighbourhood social capital on mental health. Because positive mental health, including mental illness and happiness, reflects distinct continua rather than the extreme ends of a single spectrum [42]. This correlation has been confirmed by subsequent studies on various countries and populations, widely used in the measurement of current mental health [14, 61]. This study referred to previous research and established a correlation between mental illness and happiness in the SEM.

A structural equation model was used to analyse the mediating effect. To extract the information contained in the sample observations as much as possible, this paper adopted the maximum likelihood method of preserving missing values to estimate parameters, and the variable information matrix was used to calculate the standard error after incorporating the main control variables. To overcome the limitations of the BK test [62] and the need for the Sobel test to satisfy the hypothesis of a normal distribution, the improved BK test [63] and the Monte Carlo method [64] were used to retest the mediating effect.

## Results

### The demographic and social characteristics of the respondents

The results of Table 2 show that the respondents were mainly young and married mobile elderly people. The proportion of women in the sample was slightly higher than that of men. 92.12% of respondents had an education degree below the university level. The ratio of household registration in urban and rural areas was 4:6. The main types of migration in the sample were cross-provincial migration and cross-city migration within the province, which accounted for 48.86% and 37.63%, respectively. A total of 63.13% of respondents reported that their income was between 200 USD and 700 USD per month. In terms of reasons for migration, approximately half of the respondents chose to migrate to take care of their families, while the proportion of job-related migration was 40.50%.

Regarding indicators of mental health, 7.23% of respondents (those who chose the option of lasting for more than 5 days) reported being troubled by negative emotions such as helplessness, anxiety, and fear. 94.67% and 92.56% of respondents believed that their emotional well-being and psychological well-being were at a high level (total scores for choosing the option of 4 or 5), while

**Table 2** Sample characteristics (N=659)

Variable	Frequency	Percentage(%)
Gender		
Men	272	41.27
Women	387	58.73
Age		
55–60	200	30.35
61–64	229	34.75
65–69	125	18.97
70 or above	105	15.93
Household registration		
Urban area	240	36.42
Rural area	419	63.58
Education		
Primary school or below	233	35.36
Junior high school	215	32.63
High school	159	24.13
University or above	52	7.88
Income (USD per month)		
Less than 20	106	16.08
200–400	215	32.63
401–700	201	30.50
Over 700	137	20.79
Reasons for migration		
Working	267	40.50
Taking care of the family	332	50.40
Retirement or other reasons	60	9.10
Type of migration		
Cross provincial migration	322	48.86
Cross-city migration within the province	248	37.63
Migration within the city	89	13.51
Marital status		
Married	592	89.80
Other marital status	67	10.20

the proportion of respondents who reported a high level of social well-being (total scores for choosing the option of 4 or 5) was 89.38%.

In terms of bonding neighbourhood social capital, 72.08% of respondents trusted people from the same hometown in their community (choosing the trust or strongly trust option), while the trusting floating population in the community accounted for 68.21% (choosing the trust or strongly trust option). A total of 84.97% of respondents were willing to make friends with people who were similar to themselves in age, personality, and other aspects. In terms of bridging neighbourhood social capital, 60.65% of the respondents trusted local people in the community (choosing the trust or strongly trust option), and 76.63% of respondents could confidently get along with the majority of people (choosing the agree or strongly agree option). The proportion of those who participated in community activities was 88.92%.

#### Measurement model: mental health and neighbourhood social capital

Table 3 indicates the measurement model of mental health,  $\chi^2(11)=27.582$ ,  $p=0.114$ , RMSEA=0.049, CFI=0.988, TLI= 0.977, SRMR=0.027. These indexes demonstrated a high degree of fit between the data and the measurement model. The standardized estimates of the factor loadings ranged from 0.558 to 0.816 for mental illness and 0.535 to 0.892 for happiness.

The fit statistics of the neighbourhood social capital measurement model were  $\chi^2(8)=14.033$ ,  $p=0.108$ , RMSEA=0.034, CFI=0.991, TLI= 0.983, SRMR=0.020, which met the standards for an ideal model. The standardized estimates of the factor loadings in Table 4 ranged from 0.446 to 0.665 for bonding neighbourhood social capital and 0.438 to 0.684 for bridging neighbourhood social capital.

**Table 3** Measurement model of mental health

	Estimate	SD	Standardized Estimate	Standardized SD
Mental illness				
Decreased interest	1.000	0.000	0.563 <sup>a</sup>	0.033
Mood depression	1.327 <sup>a</sup>	0.108	0.816 <sup>a</sup>	0.026
Anxiety	1.364 <sup>a</sup>	0.114	0.728 <sup>a</sup>	0.027
Panic	0.743 <sup>a</sup>	0.073	0.558 <sup>a</sup>	0.035
Happiness				
Emotional well-being	1.000	0.000	0.892 <sup>a</sup>	0.048
Psychological well-being	0.819 <sup>a</sup>	0.095	0.636 <sup>a</sup>	0.041
Social well-being	0.593 <sup>a</sup>	0.073	0.535 <sup>a</sup>	0.041

Note. <sup>a</sup>Indicates significance at the 0.1% level (two-tailed)



**Table 4** Measurement model of neighbourhood social capital

	Estimate	SD	Standardized Estimate	Standardized SD
Bonding neighbourhood social capital				
	1.000	0.000	0.653 <sup>a</sup>	0.031
	1.119 <sup>a</sup>	0.089	0.665 <sup>a</sup>	0.030
	0.619 <sup>a</sup>	0.065	0.446 <sup>a</sup>	0.037
Bridging neighbourhood social capital				
	1.000	0.000	0.684 <sup>a</sup>	0.033
	0.785 <sup>a</sup>	0.081	0.500 <sup>a</sup>	0.037
	0.589 <sup>a</sup>	0.069	0.438 <sup>a</sup>	0.040

Note. <sup>a</sup>indicates significance at the 0.1% level (two-tailed)

### The direct impact of neighbourhood social capital on mental health

SEM was used for estimation to examine the impact of bonding and bridging neighbourhood social capital on mental health. Some main variables of demographic and social characteristics, such as age, gender, household registration, income, education, marital status and health, were included in the model. As shown in Figure 2, the model fit met the standard,  $\chi^2(118)=290.494$ ,  $p=0.125$ , RMSEA=0.047, CFI=0.931, TLI= 0.903, SRMR=0.039. The standardized estimates of the factor loadings ranged from 0.454 to 0.658 for bonding neighbourhood social capital and 0.440 to 0.611 for bridging neighbourhood social capital. The standardized estimates of the factor loadings ranged from 0.519 to 0.793 for mental illness and 0.585 to 0.816 for happiness.

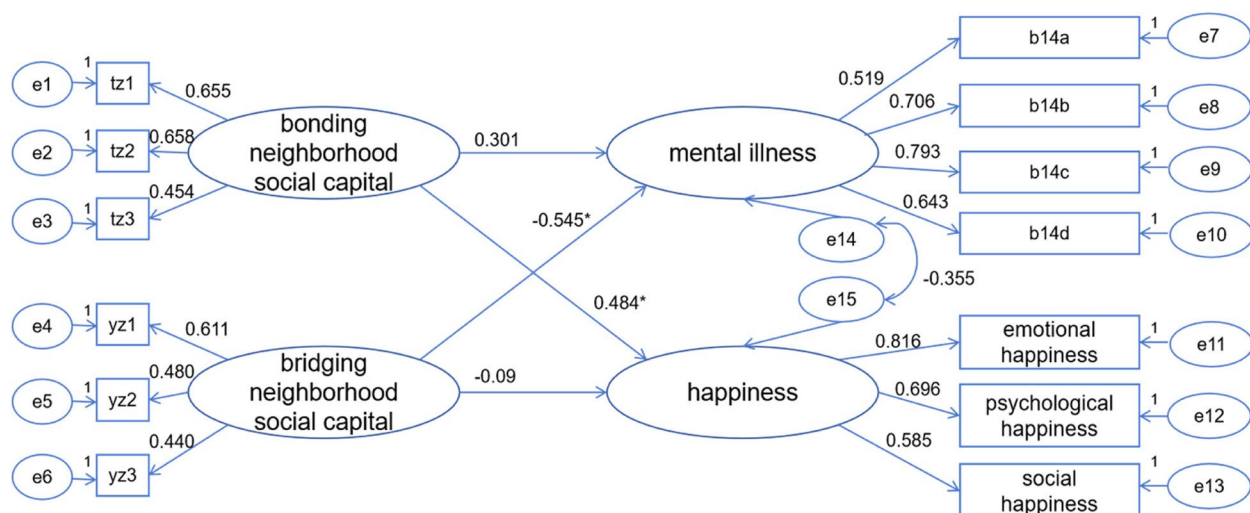
After controlling for the main variables of demographic and social characteristics, bridging neighbourhood social

capital had a significant negative impact on mental illness ( $\beta=-0.545$ ,  $p<0.05$ ). This result indicated that constructing bridging neighbourhood social capital was beneficial for reducing the tendency towards mental illness. When control variables were accounted for in the model, bonding neighbourhood social capital had a significant positive correlation with happiness ( $\beta=0.484$ ,  $p<0.05$ ) but had no significant effect on mental illness. Bridging neighbourhood social capital also had no significant influence on happiness. Hypothesis 1 and Hypothesis 2 were supported by the data.

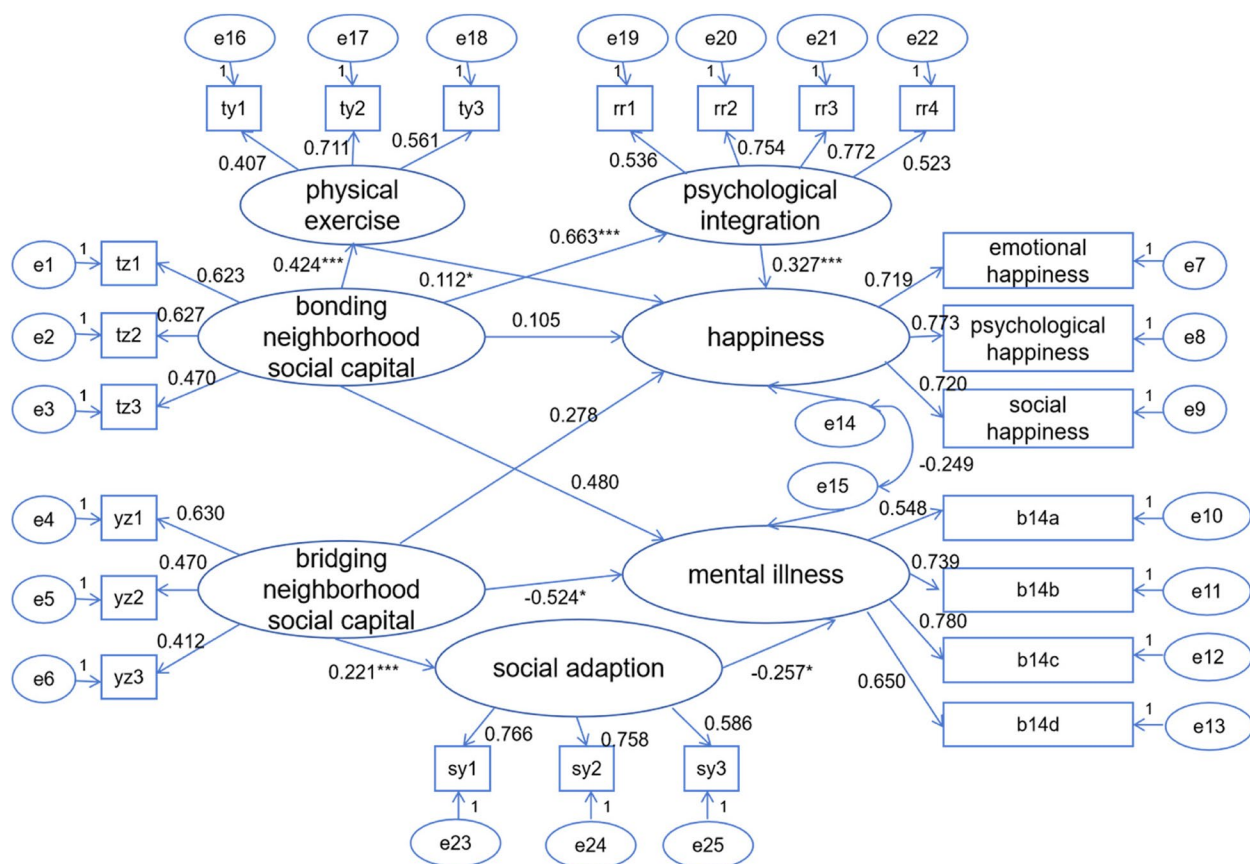
### The mediating impact of neighbourhood social capital on mental health

This study further explored the mechanism of bonding and bridging neighbourhood social capital on mental health. Physical exercise, psychological integration and social adaptation were included in the structural equation model as mediating variables. The results of Figure 3 show that the model adequately fit the data:  $\chi^2(325)=663.428$ ,  $p=0.113$ , RMSEA=0.041, CFI=0.921, TLI= 0.905, SRMR=0.046.

When the main variables of demographic and social characteristics were included in the model, bonding neighbourhood social capital was significantly positively correlated with physical exercise ( $\beta=0.424$ ,  $p<0.001$ ) and psychological integration ( $\beta=0.663$ ,  $p<0.001$ ), while physical exercise ( $\beta=0.112$ ,  $p<0.05$ ) and psychological integration ( $\beta=0.327$ ,  $p<0.001$ ) had a significant positive relationship with happiness. The results showed that bonding neighbourhood social capital improved happiness by promoting physical exercise



**Fig 2** The impact of neighbourhood social capital on mental health. Note. Standardized coefficients reported. \*, \*\*, and \*\*\* indicate significance at the 5, 1 and 0.1% levels (two-tailed). Gender, age, marital status, education, household registration, physical health status and income were incorporated into the statistical analysis as control variables



**Fig 3** The mediating impact of neighbourhood social capital on mental health. Note. Standardized coefficients reported. \*, \*\*, and \*\*\* indicate significance at the 5, 1 and 0.1% levels (two-tailed). Gender, age, marital status, education, household registration, physical health status and income were incorporated into the statistical analysis as control variables

and psychological integration. Bridging neighbourhood social capital had a significant positive impact on social adaptation ( $\beta = 0.221, p < 0.001$ ), while social adaptation showed a significant negative relationship with mental illness ( $\beta = -0.257, p < 0.05$ ). In other words, bridging neighbourhood social capital reduced the tendency towards mental illness by enhancing social adaptation.

Table 5 demonstrates the results of the mediation effect using the improved BK test and the Monte Carlo method. The Sobel statistical values for physical exercise and psychological integration were 1.977 and 4.852, respectively, and the Monte Carlo values were 1.947 and 4.828, respectively. The above results were verified at a significance level of 0.05. The coefficients of a and b were significant, while the coefficients of c' were not significant, indicating that physical exercise and psychological integration played completely mediating roles in the impact of bonding neighbourhood social capital on happiness. The Sobel statistical value for social adaptation was -1.934, and the Monte Carlo value was -1.882. They all passed the test with a significance level of 0.05. The coefficients of a, b

and c' were both significant, showing that social adaptation partially mediated the negative impact of bridging neighbourhood social capital on mental illness. Hypothesis 3, Hypothesis 4 and Hypothesis 5 were supported by the data.

## Discussion

Due to the disruption of social networks caused by changes in living space and the role shift caused by withdrawal from mainstream social culture, the floating elderly population in China is more prone to mental health problems than other elderly people [9, 10]. However, there is currently a lack of empirical research on the mental health of this new type of elderly population or a deep understanding of the mechanism to improve their mental health. This study focuses on neighbourhood social capital, which is divided into bonding and bridging social capital, and explores its impact on the mental health of the floating elderly population, including mental illness and happiness. Comprehensively examining the mechanism that connects neighbourhood social capital

**Table 5** Statistical results of mediating effects

Dependent variable	Happiness		Mental illness
Independent variable	Bonding neighbourhood social capital		Bridging neighbourhood social capital
Mediating variable	Physical exercise	Psychological integration	Social adaptation
a	0.424 <sup>c</sup>	0.663 <sup>c</sup>	0.221 <sup>c</sup>
b	0.112 <sup>a</sup>	0.327 <sup>c</sup>	−0.257 <sup>a</sup>
c'	0.105	0.105	−0.591 <sup>a</sup>
c	0.484 <sup>a</sup>	0.484 <sup>a</sup>	−0.545 <sup>a</sup>
m	0.048	0.217	−0.057
Sobel	1.977 <sup>a</sup>	4.852 <sup>c</sup>	−1.934 <sup>a</sup>
Monte Carlo	1.947 <sup>a</sup>	4.828 <sup>c</sup>	−1.882 <sup>a</sup>
RIT	0.313	0.674	0.088
RID	0.456	2.069	0.097

Note. a is the path coefficient between the independent variable and the mediating variable, b is the path coefficient between the mediating variable and the dependent variable, c is the path coefficient between the independent variable and the dependent variable (without the mediating variable), and c' is the path coefficient between the independent variable and the dependent variable after the mediating variable is added. Sobel statistical value =  $\frac{a \times b}{\sqrt{a^2 s_b^2 + b^2 s_a^2}}$ . The Monte Carlo value is a statistical value using the Sobel calculation method after several estimates. RIT represents the proportion of mediating effects in the total effect, while RID represents the ratio of mediating effects to direct effects. <sup>a</sup> and <sup>c</sup> indicate significance at the 5% and 0.1% levels (two-tailed)

and mental health can provide a new empirical basis for the application of social capital theory in the context of China and can contribute new policy ideas to promote the mental health of the floating elderly population.

It was found that the floating elderly population can rebuild their social networks in new communities, which effectively compensates for the interruption of social relationships caused by spatial migration. Both bonding and bridging social capital in the neighbourhood are at a high level. The construction of their neighbourhood bonding social capital is based on a common place of origin and similar aging attributes, which has not hindered the construction of their heterogeneous network. The floating elderly population actively participate in community activities and communicate with local elderly people in the neighbourhood, gradually accumulating rich bridging social capital. Diverse and extensive social interaction indicates new characteristics that are different from the tendency of immigrant groups who just like to interact with fellow villagers [65, 66].

In this study, the above two types of neighbourhood social capital have a positive impact on their mental health, which is inconsistent with the results from other countries [26, 27]. A research on the elderly in developed countries has shown that bonding social capital has a positive effect on the mental health, while the impact of bridging social capital is negligible [27]. In ethnically diverse neighbourhoods, trust, altruistic spirit, and cooperation among community residents are low [67]. A Japanese study found that bridging social capital even

increased the likelihood of depression. The elderly living in collective communities for a long time maintained a vigilant attitude when interacting with new strangers in the community [26].

There are two main reasons for the inconsistent results in our opinions. From a theoretical perspective, due to the lack of classification of mental health, diverse impacts of neighbourhood social capital on mental health have not been distinguished in previous studies. From a practical perspective, there are differences in the background of social capital operation and the attributes of the floating elderly population. China is a country with a tradition of collectivism. However, in the process of social transformation, population migration is frequent and the characteristics of family migration are prominent [6]. So Chinese people show great tolerance towards the migrant population, but also rely on social support formed by neighbourhood interaction. Based on the stress-buffering model and main effect model [39], this study suggests bridging neighbourhood social capital, although loose, is more inclusive, and its impact on mental health is mainly reflected in the ability to buffer adaptation pressure. Diversified neighbourhood networks connect the floating elderly population with new lifestyles by increasing opportunities for extensive access to different resources, enabling them to obtain symbolic psychological resources across roles and regions. This alleviates the dual adaptive pressures from ageing and migration, and decreases the tendency towards mental illness. In comparison, bonding neighbourhood social capital has the

characteristic of cohesion among neighbors, and its effect on mental health is mainly manifested to enhanced positive attitudes. For elderly people with a limited future, their main pursuit is emotional satisfaction rather than instrumental satisfaction [45]. Bonding neighbourhood social capital, which emphasizes homogeneous identity and intimate relationships, forms a high level of trust and understanding through frequent interactions in the neighbourhood, and promotes positive experiences and happiness of the floating elderly population.

Another contribution of this study is to further explore the mechanisms of two types of neighbourhood social capital on mental health. The results displays that social adaptation is a mediating variable that connects bridging neighbourhood social capital with mental illness in the floating elderly. Different community social networks provide more resource opportunities to encourage the floating elderly population to gradually understand, accept, and adapt to previously unfamiliar behavioural and cultural systems, complete the process of resocialization in the immigrant community as quickly as possible, and reduce the possibility that adaptation pressure will transform into mental illness [68]. In contrast, physical exercise and psychological integration are mediating variables that affect the relationship between bonding neighbourhood social capital and the happiness of floating elderly. The close and powerful support system formed by homogeneous networks enhances information flow and compliance with norms. The sense of identification, belonging, and health value orientation towards the immigrant community is strengthened through homogeneous interaction processes, which has a significant positive impact on the perception of happiness. Therefore, bonding neighbourhood social capital has a more effective impact on the deep-seated beliefs of floating elderly. The connection between bridging social capital and mental health is based on opportunities, while the impact of bonding social capital has psychological and behavioural properties.

The policy implications of this study are as follows. First, in line with daily needs, community public facilities such as fitness facilities and parks should be upgraded to create a convenient and comfortable neighbourhood space to promote daily communication among community members (including floating elderly). Second, normalized neighbourhood mutual assistance should be established, such as sharing leftover medications and leftovers, to help community members and solve small problems in daily life. This can enhance emotional exchange between neighbours and create a good atmosphere of mutual assistance and neighbourhood harmony. Third, sports and cultural activities can be used as a starting point for homogeneous networks such as hometown

associations to enhance interaction among floating elderly, focus on interests and hobbies, support the cultivation of autonomous organizations for elderly individuals, and break the trust barriers between the floating elderly population and local residents.

This study has several limitations. First, this study used only cross-sectional data rather than panel data, which are more conducive to obtaining causal inferences. Future studies should use panel data to overcome this problem. Second, the latent construct of neighbourhood social capital was examined in large cities where floating elderly gather in Guangdong Province, but it was not replicated and tested in other contexts (such as small and medium-sized cities and large cities in other provinces). Third, although micro variables have been widely used to measure neighbourhood social capital at the individual level, recent research has advocated aggregating these variables to establish a higher-level construct by calculating the mean for a community or using ecological measurement methods. Due to the sample size of the data, this measure could not be applied in this study.

## Conclusions

Throughout the global trend of aging development, floating populations have gradually become an important part of the elderly population in various countries around the world. In China, as the floating population undergoes generational rotation, the scale of the floating elderly population has become increasingly large, which has been forming a unique phenomenon. Mobility in the later stages of the life leads to adaptation difficulties and mental health problems of the floating elderly have been becoming increasingly prominent. This study has found that reshaping neighbourhood social capital which is composed of various elements such as networks, trust, and norms, formed in a community where they live together, can enhance the mental health of the floating elderly. By classifying neighbourhood social capital, the impact of bonding and bridging social capital on different dimensions of mental health for the floating elderly further, expands the mechanism for promoting mental health and provides policy implications for the implementation of active aging.

## Abbreviations

KMO	Kaiser-Meyer-Olkin measure of sampling adequacy
SD	Standard Deviation
SEM	Structural Equation Modelling
RMSE	Root Mean Square Error
CFI	Comparative Fit Index
TLI	Tucker Lewis Index
SRMR	Standardized Root Mean square Residual
BK test	Baron & Kenny test
USD	United States Dollar
RIT	The Ratio of the Indirect effect to the Total effect
RID	The Ratio of the Indirect effect to the Direct effect

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## Informed consent

Informed consent was obtained from all individual participants included in the study.

## Authors' contributions

Conceptualization, J.H.; methodology, J.H.; empirical analysis, J.H.; writing original draft preparation, J.H. and J.G.; writing-review and editing, J.H., J.G., M.Y. and S.Y. All authors have read and agreed to the published version of the manuscript.

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## Data availability

The data that support the findings of this study are restricted, which were used under license for the current study and thus are not publicly available.

## Declarations

### Ethics approval and consent to participate

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This study was approved by the ethics committee of the First Affiliated Hospital of Sun Yat-sen University (2024-019).

### Consent for publication

All respondents consented to the publication of their anonymized personal data.

### Competing interests

The authors declare no competing interests.

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