Adaptation and Validation of the Grandparental Involvement Inventory-Chinese version (GII-C) in Migrant Families

Abstract

Grandparental involvement is a multidimensional framework of the roles grandparents play in a child's life. However, culture-sensitive measurement of grandparental involvement, particularly in middle childhood, is underdeveloped. This study adapts and validates a self-report measure of grandparental involvement for children in Chinese migrant families. A total of 879 children completed the adapted 19-item Grandparental Involvement Inventory-Chinese version (GII-C), while their grandparents reported related information such as grandparent–grandchild relationship. Our item analysis and exploratory factor analysis suggested a shortened, 16-item scale with three factors: Company and Shared Activities, Mentorship and Instrumental Assistance, and Intimacy and Closeness. This factor structure showed a good fit in confirmatory factor analysis. The GII-C showed adequate reliability and convergent validity. Grandparental involvement showed positive correlations with grandparental acceptance of the child and grandparent–grandchild attachment, as well as a negative correlation with grandparental rejection. Subgroup and regression analyses further indicated the GII-C's known-group validity and predictive ability of child mental health outcomes. Grandparental involvement was positively associated with child resilience and psychological well-being while negatively associated with child depression, anxiety, stress, and loneliness. Our findings suggest the GII-C as a valid tool to measure Chinese grandparents' multifaceted roles beyond childcare. Future research should replicate the GII-C in multigenerational families across cultural contexts.

Keywords: grandparenting, validation, child, migration, China

Grandparents play a crucial role in multigenerational families by providing significant emotional and material support to their adult children and serving as a cost-effective and adaptable childcare option for their grandchildren (Fergusson et al., 2007). The extended human lifespan and growing dual-earner families have led to increasing grandparental involvement in grandchildren's lives (Abbott et al., 2013). Data from the U.S. Census Bureau showed a noticeable increase in the percentage of children living with their grandparents, from 6.5% in 1990 to 12% by 2015 (Pilkauskas & Dunifon, 2016). Research of European countries also showed that 44% of grandmothers and 42% of grandfathers provide regular or occasional childcare for their grandchildren (Zhang et al., 2020). In Southern Europe, where government-subsidized childcare is limited, grandparents often play a major role in childcare to ease the burden on working parents (Glaser et al., 2018). Grandparents in the U.K. reportedly spend over 8 hours a week on average caring for their grandchildren (Buchanan & Rotkirch, 2018).

Grandparental involvement is even more prevalent in non-Western cultures. For instance, Asian grandparents have the highest tendency of co-living with their adult children and providing care to the third generation (Ko & Hank, 2014). Over 50% of grandparents in Southeast Asia were estimated to be co-residing with and providing informal care for at least one grandchild (Knodel & Nguyen, 2015), and 70% of East Asian grandparents were living with at least one grandchild (Yasuda et al., 2011). In China, 60–70% of children are primarily cared for by their grandparents, and 30% are solely cared for by their grandparents (Zhong & Peng, 2020). Such high prevalence of grandparental involvement may be explained by the patrilineal kinship system that has historically influenced Asian societies. It is the cultural norm that married couples are expected to live with their aging parents (particularly the husband's parents), and grandparents are at the top of the extended family hierarchy structure (Hoang & Kirby, 2020).

Parental absence and parent–child separation is another major contributing factor to grandparental involvement in children's lives. In the context of parental absence due to migration, which is especially prevalent in Asian countries that are experiencing rapid urbanization today (Charles-Edwards et al., 2020), grandparents usually become the primary caregiver in families where parents migrated for work purpose (Graham & Jordan, 2011). In these families, grandparental involvement maximizes family interests (Cong & Silverstein, 2012) and buffers the adverse impact of parent–child separation on child developmental (Luo et al., 2020). For instance, a U.S. national study found that children in migrant families with co-residential grandparents showed fewer internalizing and externalizing problems than those without co-residential grandparents (Pilkauskas, 2014). Moreover, Chen and Jiang (2019) found that families led by grandparents (with both parents migrated) functioned as well as traditional nuclear families in terms of family processes and child behavioral outcomes.

Increasing research evidence suggests that grandparental involvement is linked to grandparent–grandchild attachment, grandparental acceptance, and grandparental rejection. Poehlmann (2003) suggested that when grandparents are actively involved in the caregiving process, children develop attachment bonds with them, similar to those formed with parents. Similarly, Parental Acceptance-Rejection Theory expanded beyond the parent–child dyad to include grandparental acceptance and rejection in intergenerational relationships (Rohner et al., 2005). More acceptance and less rejection from grandparents, particularly from grandmothers, was associated with grandchildren's better psychological adjustment (Parmar, 2022). According to this theory, grandparental acceptance involves both physical and verbal support for grandchildren, such as grandparents' involvement in children's activities (Rohner et al., 2005).

Studies across cultures have also highlighted the important role of grandparental involvement in child mental health. For example, Griggs and colleagues' (2009) study of families in the U.K. examined nine grandchild-reported questions covering various aspects of grandparental involvement, such as participation in school events, discussions about future plans, and financial support, and they found that grandparental involvement was associated with fewer child emotional symptoms. Similarly, Yang and Wild (2022) suggested that grandparental involvement was a protective factor for children in South Africa as it mitigates stress associated with family risk. Consistently, research on Chinese children living with grandparents during parental absence showed that grandparental involvement was a source of social support, reducing children's feelings of loneliness, a common mental health issue among this population (Wang et al., 2024a). Additionally, intergenerational interaction, such as grandparent–grandchild interaction, was a resilience factor for Israeli children facing family disruptions (Sorek, 2020).

Despite the important roles of grandparents in family processes, previous studies lack a systematic approach to measure grandparental involvement, particularly when grandparents serve as the child's primary caregivers (Wang et al., 2024b). Increasing studies suggest that grandparental involvement is a multidimensional construct that encompasses various support and shared activities beyond childcare (Duflos & Giraudeau, 2022; Sivak, 2018). For instance, a qualitative study found that in migrant families, grandparents may provide material support, time, reciprocal support, and sharing of cultural traditions (Wang et al., 2024a). Similarly, a systematic review of 206 studies highlighted three indicators of grandparental involvement: grandparental contact (e.g., co-residence, visit frequency), grandparental behaviors (e.g., feeding, transport), and grandparental support (e.g., school fees, home expenses) (Sadruddin et al., 2019).

In their pioneering work on U.S. grandparents, Elder Jr. and Conger (2000) qualitatively described grandparental involvement from the grandparents' perspectives. Building on this foundational work, Mueller et al. (2002) were the first to quantitatively measure grandparental involvement with 16 grandparent-reported items that included six dimensions: face-to-face contact (one item: meeting frequency), shared activities (five items: attending events, participating in community activities, working on projects, learning skills, and encouraging the child's talents), intimacy (three items: being an advisor, a friend, and talking together), helping (four items: providing wisdom, giving advice, discussing problems, and future planning), instrumental assistance (two items: financial help and assistance in finding a job), and authority and discipline (one item: exercising authority with the child). With these 16 items, Mueller and colleagues used a clustering method and identified different grandparental involvement patterns, which varied by sociodemographic factors (e.g., grandparent's age, grandchild's sex) and influenced grandparent–grandchild relationship quality and closeness.

Mueller and colleagues' (2002) six-dimension definition of grandparental involvement and their 16-item measure has been further developed and used in other cultural contexts, such as Griggs et al. (2009) in the U.K., Wild and Gaibie (2014) in South Africa, and Li et al. (2018) in Hong Kong. Table 1 exemplifies how grandparent involvement was measured in this literature. The format varied from structured scales to independent questions; the number of items ranged from three to 19; and the raters varied from grandparents, parents, to children. The time frames for data collection included current (at the time of the survey) and retrospective (e.g., when the grandchild was in primary school). In terms of living arrangements, some studies reported the average living distance between grandparents and grandchildren, whereas others provided the percentage of three-generational and skipped-generational family structures.

[Insert Table 1 here]

Although China has the largest population of children in migrant families living with their grandparents as caregivers (The Lancet Regional Health-Western Pacific, 2023), research has rarely explored Chinese grandparents' multidimensional involvement. Li and colleagues' (2018) study of a group of college students in Hong Kong was among the first to explore Chinese grandparents' multidimensional involvement. They used the translation and back-translation method and developed a 19-item scale from Mueller et al. (2002)'s work. They kept the six dimensions but added new items about participants' current relationship with grandparents, closeness with grandparents, level of grandparental care, and frequency of learning family traditions from grandparents. Two original items about grandparents' childhood and grandparents' encouragement of children's talent were removed. Li et al. (2018) found that their adapted scale showed adequate reliability (Cronbach's $\alpha = 0.94$) and that grandparental involvement was positively related to participants' cognitive well-being and friendship quality.

These preliminary findings suggest several directions for the further development of grandparental involvement measures. First, several existing scales employed a unidimensional structure, whereas the multifaceted nature of grandparental involvement warrants more nuanced measurement (Findler et al., 2013). Second, some studies retrospectively asked family members about grandchildren's childhood experiences (e.g., Bol & Kalmjin, 2016), which may lead to recall bias. Third, although most studies used multiple questions to measure grandparental involvement, their psychometric properties were not examined with factor analyses. Moreover, research predominantly focused on adolescents and adults, which limits our understanding of grandparental involvement from the perspectives of children in middle childhood, a

developmental stage when family relationship plays a crucial role in shaping children's well-being (Van Heerden & Wild, 2018). This line of research is especially lacking in Asian societies.

In this study, we assess the psychometric properties of the child-reported scale of grandparental involvement, named Grandparental Involvement Inventory-Chinese version (GII-C), including its internal consistency, convergent validity, known-group validity, and predictive ability of child mental health outcomes. Our hypotheses are: (1) The GII-C has adequate internal consistency; (2) Higher GII-C scores are positively associated with grandparent–grandchild attachment and grandparental acceptance and are negatively associated with grandparental rejection; (3) GII-C scores significantly differ by demographic characteristics, such as child sex; parental migrant status; family income; and grandparental sex, lineage, physical health, and educational level; (4) Higher GII-C scores predict less depression, anxiety, and loneliness, as well as greater resilience and psychological well-being among grandchildren.

Method

Participants

Our sample was a group of rural Chinese children, most of whom are primarily cared for by their grandparents due to parental migration to work in cities, a childcare arrangement that is common in urbanizing countries such as China (Silverstein & Xu, 2022). Participants were recruited from 30 elementary schools in a major labor-sending county of southwest China. In total, 891 students and their grandparents were invited, among whom 886 children and 887 grandparents completed the survey. Excluding seven children who completed less than 80% of the GII-C items (following Schlomer et al. 2010's recommendation that over 20% of missing data can introduce bias in analyses), our analytic sample was 879 grandchild–grandparent dyads. This sample size met the minimum requirement of 3–20 participants per item in factor analysis (DeVellis &

Thorpe, 2022; Mundfrom et al., 2005). This study was approved by the Human Research Ethics Committee of the University of Hong Kong (Reference No. EA2001035). Written informed consent was obtained from all participants and their guardians before the study.

The child sample comprised 463 girls (52.67%) and 416 boys (47.32%), mean age 10.71 years (range 9–14, *SD* = 0.43). The grandparents' average age was 63.31 years (range 40–89, *SD* = 8.07), 75.31% were grandmothers, and 76.56% were paternal grandparents. Regarding family structure, 63.37% of children have both-parent migrated, 24.12% had one migrated parent (the child lives with the other parent and grandparents), and 12.51% were living with both parents.

Procedure

Prior to the data collection, the research team provided a half-day training for 30 local schoolteachers that explained research ethics, survey content, and interview techniques for administering surveys among children and older adults. During the interviews, the schoolteachers followed a standard questionnaire and assisted the grandparents to fill out the questionnaire by reading each item to them and recorded participants' answers into standardized response categories. The research team was in constant communication with the teachers and answered any questions during data collection to ensure survey quality control. In the survey, children were invited to self-report the levels of grandparental involvement in their lives, their attachment with grandparents, their mental health status, and demographic information. To triangulate the child-reported outcomes with grandparent-reported measures, the primary grandparental caregivers answered questions regarding their demographic information and their levels of acceptance and rejection toward their grandchildren.

Measures

Grandparental Involvement

We adapted the GII-C from a previous study of grandparental involvement among Hong Kong college students (Li et al., 2018). We contacted the authors for the full questionnaire and adapted the language to suit elementary-school reading level, such as using simpler grammar and wording. Additionally, we revised the item "How often does your grandparent serve as a resource in helping you find a job" to "How often does your grandparent serve as a resource in helping you with schoolwork." Two researchers with extensive experience working with rural Chinese children and migrant families completed the adaptation; any differences were resolved through discussion.

The adapted GII-C includes 19 items (α = 0.88 in this study) that measure six domains of grandparental involvement, including *contact* (i.e., frequency of meet), *activities* (e.g., frequency of going to a show, hanging out, or shopping together), *intimacy* (e.g., grandparent as a confidant), *mentorship* (e.g., advice from grandparents), *instrumental assistance* (e.g., financial help from grandparent), and *authority* (i.e., grandparent as a role of authority and discipline). Participants rated each item based on their interactions with their closest grandparent. The item on contact frequency was rated on a 9-point scale ranging from 1 (never) to 9 (daily), the items on intimacy were rated from 1 (not at all) to 4 (very much), and all other items were rated on a 3-point scale ranging from 1 (never) to 3 (often). The composite score was calculated by averaging the standardized scores of the 19 items. Higher scores indicate higher levels of grandparental involvement perceived by the child.

Grandparent–Grandchild Attachment

We used the Chinese version of Inventory of Parents and Peer Attachment-Revised (IPPA-R) to measure grandparent–grandchild attachment (Armsden & Greenberg, 1987), which includes 25 child-reported items (α = 0.89 in this study), such as "I like to get my grandparent's

point of view on things I'm concerned about." After reverse coding negatively worded items, higher scores indicate stronger grandparent-grandchild attachment. This scale has shown good reliability and validity among Chinese children in middle childhood (Zhang et al., 2011).

Grandparental Acceptance and Rejection

Grandparents self-rated their acceptance and rejection of the child using the 24-item Parental Acceptance-Rejection Questionnaire (PARQ), Chinese version (Rohner & Ali, 2020; α = 0.88 in this study), which includes four domains: warmth/affection, hostility/aggression, indifference/neglect, and undifferentiated rejection. We replaced the word "child" with "grandchild" in all items. Sample items included "I let my grandchild know I love them." After reverse coding items under the warmth/affection subscale, higher scores reflect greater grandparental rejection and less acceptance of their grandchildren. This Chinese version of the scale has shown good reliability among Chinese adolescents (Li, 2014).

Child Mental Health

We measured four child-reported mental health outcomes. First, emotional health was assessed through the Chinese version of the 21-item Depression Anxiety Stress Scales (DASS) (Lovibond & Lovibond, 1995); higher scores indicate poorer emotional health (α = 0.89 in this study). Second, loneliness was assessed through the 6-item Chinese version of UCLA Loneliness Scale (ULS; Hays & DiMatteo, 1987); higher scores indicate more loneliness (α = 0.89 in this study). Third, resilience was measured by the 17-item Child & Youth Resilience Measure-Revised (CYRM-R; Jefferies et al., 2019), Chinese version; higher scores indicate greater resilience (α = 0.92 in this study). These measures have shown good reliability and validity among Chinese children (Cao et al., 2013; Xiang et al., 2014; Xu et al., 2018). Lastly, children's psychological well-being was measured by one item: "How would you rate your psychological

health," rated on a scale from 0 to 10. We also collected demographic information from children (sex, age, and parental migration status) and grandparents (sex, lineage, age, self-rated physical health, family income, and educational level).

Data Analyses

All statistical analyses were performed using R Statistical Software (v4.2.2; R Core Team, 2022) with the{lavaan} package (Rosseel, 2012) and the {Psych} package (Revelle, 2024). The sample was first randomly divided into two independent subsamples using R-generated random numbers. Sample One (n = 439) was used for Exploratory Factor Analysis (EFA), and Sample Two (n = 440) was used for Confirmatory Factor Analysis (CFA). Before the formal analysis, we assessed if data were missing completely at random (MCAR) using Little's (1988) test. The result suggested that we could not reject the null hypothesis that the data were MCAR ($p > 0.05$). Therefore, we handled missing data through multiple imputation, as suggested by Pedersen et al. (2017).

We evaluated the Kaiser-Meyer-Olkin (KMO) measure and conducted the Bartlett's test of sphericity to ensure sampling adequacy for factor analysis (Shrestha, 2021). We then conducted an item analysis to examine each item's correlation with the total GII-C score and to identify potential items for removal. We then conducted EFA to explore GII-C's factor structure and to detect any deviations from the original GII-C framework. We applied Kaiser normalization and Oblique rotation with a factor loading cut-off of above 0.3 for assigning items to factors, as suggested by Maskey et al. (2018). We then conducted CFA to assess the construct validity of a newly proposed three-factor model. The model fit was evaluated by the Tucker-Lewis Index (TLI), Comparative Fit Index (CFI), Root Mean Square Error of Approximation

(RMSEA), and Square Root Mean Residual (SRMR). TLI and CFI values of 0.90 or above, and RMSEA and SRMR values below 0.08, indicate a satisfactory model fit (Byrne, 1994).

We assessed convergent validity through the correlation between GII-C and related measures (i.e., grandparent–grandchild attachment and grandparental acceptance/rejection) and assessed its internal consistency using Cronbach's α and McDonald's ω. Additionally, subgroup analyses by various demographic factors were conducted to assess the GII-C's distribution across diverse family backgrounds, an approach referred to as known-group validity (Davenport & de Morton, 2011). Furthermore, we estimated multiple regression models to examine whether the GII-C predicts child mental health outcomes. Coding syntax and de-identified data of this study will be made available upon request. This study was not preregistered.

Results

Sample Adequacy

We assessed our data's suitability for factor analysis through the KMO measure of sampling adequacy and Bartlett's test of sphericity. The KMO statistic yielded an overall measure of sampling adequacy of 0.92, indicating an excellent level of common variance among items and the data were well-suited for factor analysis. The Bartlett's test of sphericity yielded a Chi-square statistic of 2824.54 ($df = 171$, $p < .001$), further suggesting that the items were strongly interrelated and suitable for factor analysis.

Item Analysis

Most items showed significant, positive correlations with the total GII-C, r ranged from 0.46 to 0.71, $p < .001$. These correlations were moderate-to-strong, based on the criteria that r below 0.30, between 0.30 and 0.50, and above 0.50 indicate weak, moderate, and strong correlations, respectively (Cohen, 1992). Two items were removed due to their weak correlations

with the total score: frequency of face-to-face contact with grandparent ($r = 0.21$) and child-perceived grandparental authority ($r = 0.26$). This decision was based on the premise that items showing low correlations are less relevant and often suggest the need for potential removal from the preliminary scale (Boateng et al., 2018).

Sample One: Exploratory Factor Analysis

As shown in Table 2, our EFA suggested a three-factor model for a 16-item scale, as one item (Item 18: How often does your grandparent and you work on projects together) did not load on any factor, and the three-factor structure explained 44% of the variance. In the three-factor structure, five items loaded onto Factor 1, which includes three items from the original scale's Activities subscale, along with questions about "company." Consequently, this factor was labeled *Company and Shared Activities*. Eight items loaded onto Factor 2, aligning with the mentor and instrumental assistance subscales from the original scale, and this factor was named *Mentorship and Instrumental Assistance*. Lastly, as three items that loaded onto Factor 3 matched the original intimacy subscale, we named this factor *Intimacy and Closeness*. As a sensitivity analysis, we also conducted an EFA with all 19 items of the original scale. The results suggested that Item 2 (contact frequency) formed a single factor, while the other two factors were not consistent with the previous theoretical frameworks of grandparental involvement as discussed earlier (see Table S1 in the supplemental material for more details).

[Insert Table 2 here]

Sample Two: Confirmatory Factor Analysis

Our CFA of the three-factor structure showed a satisfactory goodness of fit, $\chi^2 = 187.58$, $df = 101$, $p < .001$; TLI = 0.96, CFI = 0.96, RMSEA = 0.04, SRMR = 0.04. The standardized

factor loadings for the 16 items ranged from 0.30 to 0.81, with all being significant for the 16 items, and the three factors correlated with each other.

Internal Consistency

Our adapted GII-C showed good internal consistency. The Cronbach's α and McDonald's ω for the total GII-C were 0.89 and 0.91, respectively. For the three subscales (Company and Shared Activities, Mentorship and Instrumental Assistance, and Intimacy and Closeness), α = 0.70, 0.83, and 0.85; ω = 0.74, 0.86, and 0.85, respectively. As shown in Table 3, the three subscales all showed significant, positive correlations with the GII-C total score (r = 0.73–0.93).

[Insert Table 3 here]

Convergent Validity

Convergent validity was assessed by the correlations between the GII-C and related measures (IPPA-R and PARQ). As shown in Table 4, the GII-C total score and subscales had strong and significant positive correlations with IPPA-R total score. In addition, the GII-C total score and subscales had small and significant negative correlations with PARQ total score, Hostility/Aggression, Indifference/Neglect, and Rejection, except for the nonsignificant relation between GII-C Company and Shared Activities and PARQ Rejection. The GII-C total and subscales also showed small and significant positive correlations with the PARQ Warmth/Affection subscale.

[Insert Table 4 here]

Known-Group Validity

Known-group validity was assessed by subgroup comparisons of GII-C total scores by child sex, grandparental sex, parental migrant status, grandparental lineage, family income, physical health, and educational level. As shown in Table 5, girls perceived greater grandparental

involvement than boys ($t = 2.50$, $p = .01$). Children with same-sex grandparents perceived greater grandparental involvement than children with different-sex grandparents ($t = 3.26$, $p = .001$). Paternal grandparents exhibited higher levels of involvement than maternal grandparents ($t = 2.17$, $p = .03$), and GII-C total scores varied by grandparents' health status ($F = 3.95$, $p = .02$) and grandparental educational level ($F = 4.96$, $p = .01$). On average, grandparents with better health status and those with primary school degrees or above had higher GII-C scores.

[Insert Table 5 here]

Predictive Ability of Child Mental Health

Our regression results indicated that the GII-C total score was significantly associated with child mental health outcomes, adjusting for child sex, age, parental migration status, family income, and grandparental characteristics (see supplementary Table S2). Higher levels of grandparental involvement predicted lower child anxiety, depression, stress, and loneliness, as well as greater child resilience and psychological well-being.

Discussion

By adapting the scale of grandparental involvement to a sample of Chinese children, this study validated a child-reported Grandparental Involvement Inventory-Chinese version (GII-C) that assesses grandparents' multifaceted roles in children's lives from children's perspective. The results demonstrate satisfactory reliability and validity of the GII-C, which encompasses three factors: Company and Shared Activities, Mentorship and Instrumental Assistance, and Intimacy and Closeness. The GII-C appears to be a suitable measure for assessing grandparental involvement in Chinese families.

We identified a three-factor structure that differed from the six-domain structure proposed by Mueller et al. (2002) and Li et al. (2018). The first factor, Company and Shared

Activities, encompasses grandparents' involvement in children's learning, school and community activities, alongside children's perception of grandparents as friends. Our finding echoes Viguer and colleagues' (2010) finding that the number of shared activities (e.g., walk, eat, watching movies) enhanced the relationship between grandparents and grandchildren and was beneficial to child socialization and development.

The second factor, Mentorship and Instrumental Assistance, includes how grandparents support and advise children in their current lives and future plans. Items assessing helping and instrumental support in the original scale were grouped under this factor in our version, which highlights that Chinese grandparents often act as a pivotal support and guide for their grandchildren (Tang et al., 2016). As suggested by Michałek-Kwiecień (2023), this mentorship can support grandchildren's development of value systems, enhance their sense of belonging to a family network, and provide grandchildren with unconditional acceptance.

The third factor, Intimacy and Closeness, is retained from the original scale and measures the child-rated relationship quality, closeness, and the care and love received from grandparents. This factor has been increasingly studied in the intergenerational solidarity literature, which suggests that the emotional closeness between the grandparents and grandchildren generations forms the foundation of a satisfying intergenerational bond in multigenerational families, thus improving both generations' well-being (Duflos et al., 2022).

In addition, two items from the original scale were removed due to their weak correlations with other items: an item about face-to-face contact (i.e., how often do you see your grandparent) and an item about authority (i.e., how often do you perceive your grandparent's authority or strictness). This may be due to the original scale lacks other items in the face-to-face contact and authority domains, weakening these items' correlation with the rest of the scale.

Although contact frequency and grandparent authority can be important to child well-being (Viguer et al., 2010), these two items may be conceptually different from the other items in the original scale. Future development of the Grandparental Involvement Inventory should include more items measuring contact frequency and grandparents' authority.

One item – "frequency of working on projects together, such as farm work" – was removed after the EFA due to its low factor loadings (below 0.3) on all factors. We speculate that these activities are not as common or significant in the context of contemporary grandparental involvement, especially for non-agricultural families. Additionally, the concept of "working on projects together" might be interpreted differently across participants, leading to inconsistencies in how this item was rated. This item therefore did not strongly correlate with the underlying factors, which focused more on emotional and supportive aspects of grandparental involvement rather than task-oriented activities.

The GII-C's items are conceptually consistent with previous grandparental involvement measures, but the GII-C improves the measurement of this construct with greater specificity. Previous measures assessed grandparental involvement in child-rearing with broad questions, such as "How much do you think the grandparents are involved in raising the children," which were often parent- or grandparent-reported. In contrast, the GII-C directly asks children about their grandparents' participation in specific aspects of their lives, such as assistance with schoolwork and involvement in shopping activities.

Because children have the deepest insights into their own experiences, surpassing those of external assessors (Downey, 2014), we focused on children's self-report and adjusted the original scale's language to ensure accessibility for children. This strategy distinguishes our work from prior research that primarily collected data from adolescents or adults. To our

knowledge, this is the first study that employs a child-centered approach to directly solicit children's perspectives about their grandparents. Developing a scale based on children's perspectives further acknowledges children's agency in their relationships (Gurdal & Sorbring, 2019). Our approach aligns with Somaiah and Yeoh's (2023) argument that children are not passive recipients of grandparental care; instead, they actively engage with and interpret their relationships with grandparents, which contributes to the dynamics of multigenerational families.

The GII-C total score and subscales also showed adequate convergent validity with relevant measures. Grandparental involvement was positively correlated with grandparental acceptance and grandparent–grandchild attachment, while being negatively correlated with grandparental rejection. These significant correlations suggest that the GII-C can effectively assess the relational aspect of grandparental involvement. This result aligns with the argument that grandparent–grandchild relationship is a key indicator of grandparental involvement (Dunifon & Bajracharya, 2012). Notably, whereas GII-C showed strong correlations with grandparent–grandchild attachment (IPPA-R), it showed weak correlations with grandparental acceptance/rejection (PARQ). A possible explanation is that the PARQ focuses on the emotional/affection dimension of the grandparent–grandchild relationship, which represents only a subset of the multifaceted interactions captured by the GII-C.

By examining GII-C total scores across children and grandparents' characteristics, our subgroup analyses indicate that girls perceived greater grandparental involvement than boys did. This observation aligns with the literature suggesting that compared with grandsons, granddaughters often have closer relationships with their grandparents (Creasey & Koblewski, 1991), particularly with maternal grandparents (Lussier et al., 2002). However, this result partly contradicts another study in rural China that found grandsons perceived greater investment (i.e.,

care and emotional closeness) from paternal grandparents than granddaughters did, an observation attributed to the cultural norm of son preference, which is especially prevalent in rural areas (Luo et al., 2024). Interestingly, we found that children perceived more involvement from their grandparents of the same sex. This result supports the "kin-keeper" hypothesis that children tend to have more interaction and closeness with grandparents of the same gender (Dubas, 2001), possibly due to their shared interests and similar experiences of gender roles.

Furthermore, our analysis highlighted that GII-C varied by grandparental characteristics, such as lineage, physical health status, and educational level. Children with paternal grandparents perceived more involvement than those with maternal grandparents. This finding contradicts most studies on grandparental lineage in other cultures, which found that maternal grandparents were typically more involved due to women's traditional roles in child-rearing and maintaining family connections (Chan & Elder, 2000). In contrast, our results reflect a different cultural context in China. The patriarchal tradition, especially in rural areas, often encourages married couples to live with the husband's family (Hoang & Kirby, 2020). This practice may foster closer relationships between children and their paternal grandparents, resulting in greater perceived involvement from paternal grandparents.

Additionally, grandparents with better physical health status and higher levels of education were more involved. This result is consistent with previous research that showed Chinese grandparents who were younger, healthier, and better educated were more likely to help with grandchild care, a complex task that requires grandparents' physical energy, knowledge, and communication skills (Sun & Zhang, 2013). Whereas grandparents with lower socioeconomic levels tend to be more involved in practical, hands-on activities, such as cooking and transportation, those with higher educational status assist more with academic tasks, such as

homework (Di Gessa et al., 2022). Previous research also suggested that compared with non-caregivers, Taiwanese grandparents caring for grandchildren reported better physical health (Ku et al., 2013). However, the effects of grandchild care on grandparents' health may not be universally beneficial or detrimental, but rather depends on the form and level of caregiving (Chen & Liu, 2012). Although our subgroup comparisons provide valuable insights, further research should meticulously examine the complex interplay between child and grandparental characteristics and how these factors co-influence grandparental involvement.

Our regression results highlight that GII-C predicted children's mental health outcomes. Greater grandparental involvement was associated with lower levels of child anxiety, depression, stress, and loneliness, as well as higher levels of child resilience and psychological well-being. These findings align with previous literature (e.g., Tanskanen & Danielsbacka, 2012; Wild & Gaibie, 2014), underscoring the protective role of grandparental involvement in children's mental well-being. We also observed that girls reported more loneliness than boys, a finding consistent with a meta-analysis indicating that Chinese girls with migrant parents had more mental health problems than boys (Zhao & Yu, 2016). Given that girls reported greater grandparental involvement than boys, grandparents may be a crucial protective factor for the mental health of girls, who are disadvantaged due to son preference culture and gender discrimination in rural China (Li et al., 2004).

This study has several limitations. First, our sample was recruited from 30 schools in one county. Given the homogenous local economic condition and family structure (87.49% of the participants had at least one migrant parent), the participants' experiences may not be generalizable to children from non-migrant families. Additionally, our choice of convergent validity measures was limited because most existing grandparenting measures focused solely on

a specific domain of grandparental involvement. For example, the PARQ only focused on affection (grandparental warmth) but not instrumental support (e.g., daily childcare). Future research should develop additional measures to disentangle grandparents' impact on the family system. Despite these limitations, we innovatively explored a multidimensional measure of grandparental involvement in a previously unexamined child population. The GII-C is a reliable and valid measure of grandparents' roles in child development among Chinese migrant families.

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Table 1

Existing Literature Measuring Grandparental Involvement

Study	Measurement of Grandparental Involvement	Participant Characteristics	Outcome Rater	Measurement Time Frame	Living Arrangement
Mueller et al., 2002	A 16-item, 6-domain scale including face-to-face contact, shared activities, intimacy, helping, instrumental assistance, and authority/discipline.	546 US adolescents (age unreported) and their grandparents	Grandparent (mean age 69)	Current (at the time of the survey)	Average living distance between grandparents and grandchildren is 132 miles
Barnett et al., 2010	A 3-item scale including grandparental involvement in childcare, grandparent-grandchild meeting frequency, and grandparents' help with child raising. Composite score equals the average of all items' standardized scores.	127 US families of children in early childhood	Mother	Retrospective (unspecified time)	Unreported
Griggs et al., 2009	Nine independent questions about grandparental involvement in childcare, hobbies/interest, school, problem-sharing, career-planning, advice, financial support, authority, and respect.	1569 UK children (age 11-16)	Child self-report	Current (at the time of the survey)	Two-thirds of the grandparents and grandchildren lived less than 10 miles away
Tanskanen & Danielsbacka, 2012	A 6-item scale of grandparental involvement in childcare, hobbies/ interest, school, problem-sharing, future planning, and instrumental assistance. Total score equals the sum of items.	1488 UK children (age 11-16)	Child self-report	Current (at the time of the survey)	Fewer than 2% of the grandparents and grandchildren live together; most live in the same town or less than 10 miles away
Wild & Gaibie, 2014	An 11-item scale developed from Griggs et al. (2009), including six domains based on Mueller et al. (2002). Items details were not provided.	204 South African adolescents (mean age 13.7)	Child self-report	Current (at the time of the survey)	94% of grandparents and grandchildren live in the same city, with 17% in the same household, and 1% lived in skipped-generation households

Bol & Kalmijn, 2016	A 5-item scale including how often grandparent looked after child, child stayed overnight at grandparent's house, face-to-face contact, how involved the grandparent was in child upbringing, and how strong the grandparent–grandchild tie was. Composite score equals the average of all items' standardized scores.	1540 Dutch parents (middle generation) of adult children (grandchildren, mean age 36.4)	Parent	Retrospective (when the grandchild was in primary school)	50% of the grandparents and grandchildren live within 30 minutes from each other
Li et al., 2018	19-item, 6-domain structure of grandparental involvement, developed from Mueller et al. (2002). Composite score equals the average of all items' standardized scores.	418 Chinese (Hong Kong) college students (mean age 19.8)	Adult grandchild self-report	Current (over the past 12 months)	Unreported

Table 2

Factor Structure and Items with Factor Loadings (Sample One)

Item	Brief Description	**Factor 1** Company and Shared Activities	**Factor 2** Mentorship and Instrumental Assistance	**Factor 3** Intimacy and Closeness
GII-C-9	Attend activities together	**0.62**	0.03	-0.04
GII-C-10	Grandparent as a teacher or friend	**0.46**	0.13	0.15
GII-C-11	Grandparent helps with schoolwork	**0.39**	0.24	-0.16
GII-C-14	Grandparent as company/close friend	**0.59**	-0.13	0.30
GII-C-15	Grandparent attends child's activities	**0.60**	0.03	-0.23
GII-C-4	Talk with grandparent	0.20	**0.49**	0.06
GII-C-5	Learn skills from grandparent	0.05	**0.55**	0.07
GII-C-6	Grandparent gives advice	-0.10	**0.70**	0.00
GII-C-7	Grandparent helps achieve goals	0.03	**0.70**	0.01
GII-C-8	Grandparent shares experiences/wisdom	0.03	**0.67**	-0.02
GII-C-12	Instrumental assistance from grandparent	0.04	**0.38**	0.13
GII-C-13	Discuss future planning with grandparent	0.12	**0.56**	-0.09
GII-C-16	Learn family traditions from grandparent	0.17	**0.44**	-0.01
GII-C-1	Relationship quality with grandparent	-0.05	0.02	**0.85**
GII-C-2	Closeness with grandparent	0.11	-0.09	**0.86**
GII-C-3	Care and love from grandparent	-0.19	0.39	**0.58**
Omitted	Work together (e.g., household chores)	0.22	0.26	0.13

Table 3

Correlation Analysis of the GII-C Total Scale and Subscales (Pearson's r)

	Mean (SD)	1	2	3
1. GII-C total	0.00 (0.61)	1		
2. Company and Shared Activities	0.00 (0.67)	0.85***	1	
3. Mentorship and Instrumental Assistance	0.00 (0.67)	0.93***	0.73***	1
4. Intimacy and Closeness	0.00 (0.88)	0.73***	0.47***	0.54***

Note. *** $p < 0.001$.

Table 4

Correlation Analysis Between GII-C, IPPA-R, and PARQ (Pearson's r)

	IPPA-R	PARQ Total	PARQ Warmth/Affection	PARQ Hostility/Aggression	PARQ Indifference/Neglect	PARQ Rejection
GII-C Total	0.72***	-0.26***	0.31***	-0.14***	-0.17***	-0.06†
GII-C Company	0.60***	-0.17***	0.24***	-0.07*	-0.10**	-0.01
GII-C Mentorship	0.69***	-0.24***	0.29***	-0.11***	-0.15***	-0.07*
GII-C Intimacy	0.53***	-0.27***	0.26***	-0.20***	-0.21***	-0.08*

Note. IPPA-R = Inventory of [Grand]Parents and Peer Attachment-Revised, PARQ = Parental Acceptance-Rejection Questionnaire.

† $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 5

Subgroup Differences in GII-C Total Scores by Child and Grandparent Characteristics

	n	**GII-C Mean (SD)**	***t*/*F***	***p***
Child sex				
Female	463	0.05 (0.60)	$t = 2.50$*	0.012
Male	416	-0.05 (0.62)		
Grandparent sex				
Female	662	0.01 (0.61)	$t = 0.26$	> 0.1
Male	217	-0.001 (0.62)		
Grandparent × grandchild sex				
Same sex	502	0.06 (0.60)	$t = 3.26$**	.001
Different sex	377	-0.08 (0.62)		
Grandparental lineage			$t = 2.17$*	.030
Paternal grandparents	672	0.03 (0.59)		
Maternal grandparents	206	-0.09 (0.68)		
Parental migration status				
Both non-migrant parents at home	110	-0.06 (0.64)	$F = 3.36$*	0.035
One migrant parent	212	-0.08 (0.64)		
Both parents migrated	557	0.04 (0.60)		
Family income (RMB/month)[a]				
Less than 1,000	216	-0.05 (0.61)	$F = 1.07$	> 0.1
1,000-3,000	317	0.02 (0.63)		
More than 3,000	346	0.01 (0.60)		
Grandparent's physical health				
Very poor or poor	209	-0.06 (0.63)	$F = 3.95$*	.020
Fair	394	0.02 (0.61)		
Good or very good	276	0.08 (0.59)		
Grandparental education level				
No education	204	-0.11 (0.61)	$F = 4.96$**	.007
Primary school	398	0.04 (0.61)		
Junior high school or above	120	0.03 (0.61)		

Note. [a]1 RMB is equivalent to 0.14 USD. $^{\dagger}p < 0.1$, * $p < 0.05$, ** $p < 0.01$.

Supplemental Material

Table S1

Item in original scale	Brief Description	Factor 1	Factor 2	Factor 3
#2	Meet frequency	-0.12	0.08	**0.61**
#14	Feel authority	**0.35**	-0.22	0.23
#6	Talk with grandparent	**0.66**	0.10	0.03
#7	Learn skills from grandparent	**0.58**	0.02	-0.02
#11	Attend activities together	**0.58**	-0.07	0.08
#12	Grandparent as a teacher or friend	**0.54**	0.19	-0.01
#13	Grandparent helps with schoolwork	**0.57**	-0.16	-0.04
#17	Grandparent as company/close friend	**0.42**	0.24	0.05
#18	Work together (e.g., household chores)	**0.50**	0.01	0.15
#20	Grandparent attends child's activities	**0.39**	-0.13	0.28
#8	Grandparent gives advice	**0.53**	-0.01	0.12
#9	Grandparent helps achieve goals	**0.66**	0.02	-0.10
#10	Grandparent shares experiences/wisdom	**0.65**	0.02	-0.07
#15	Instrumental assistance from grandparent	**0.39**	0.14	-0.11
#16	Discuss future planning with grandparent	**0.61**	-0.01	-0.02
#19	Learn family traditions from grandparent	**0.63**	-0.04	-0.09
#3	Relationship quality with grandparent	0.04	**0.79**	0.02
#4	Closeness with grandparent	0.03	**0.86**	0.10
#5	Care and love from grandparent	0.25	**0.58**	-0.09

Sensitivity EFA with All 19 Items (Sample One)

Table S2

Child Mental Health Outcomes Predicted by the GII-C Total Score

N = 645[a]	**Anxiety**	**Depression**	**Stress**	**Resilience**	**Loneliness**	**Psychological Wellbeing**
	B (SE)	**B (SE)**	**B (SE)**	**B (SE)**	**B (SE)**	**B (SE)**
Predictors						
GII-C total score	-1.12 (0.32)***	-2.62 (0.32)***	-3.06 (0.45)***	14.73 (0.63)***	-1.83 (0.19)***	1.25 (0.11)***
Child sex (ref: male)	-0.17 (0.39)	0.37 (0.39)	0.19 (0.55)	0.08 (0.77)	0.65 (0.23)**	-0.13 (0.14)
Child age	-1.01 (0.02)*	-0.44 (0.45)	-0.87 (0.63)	1.82 (0.89)*	-0.18 (0.27)	-0.15 (0.16)
Parental migration status (ref: both parents at home)						
One parent migrated	-0.51 (0.67)	0.40 (0.68)	0.30 (0.95)	-0.94 (1.33)	0.51 (0.40)	-0.16 (0.24)
Both parents migrated	0.53 (0.61)	1.25 (0.61)*	1.49 (0.86) †	-4.33 (1.20)***	0.90 (0.36)*	-0.56 (0.21)**
Family income (ref: less than 1,000 RMB)						
1,000-3,000	0.37 (0.51)	0.01 (0.51)	-0.14 (0.72)	-0.34 (1.01)	-0.12 (0.31)	0.16 (0.18)
More than 10,000	0.69 (0.50)	0.49 (0.51)	0.22 (0.71)	1.15 (0.99)	0.36 (0.30)	0.15 (0.18)
Grandparent sex (ref: male)	0.58 (0.47)	0.20 (0.47)	1.47 (0.66)**	1.70 (0.93) †	0.18 (0.28)	-0.01 (0.17)
Grandparent age	0.02 (0.03)	0.02 (0.03)	0.03 (0.04)	0.11 (0.05)*	0.01 (0.02)	0.00 (0.01)
Grandparent lineage (ref: paternal)	-0.19 (0.47)*	1.16 (0.47)*	0.60 (0.66)	-0.11 (0.92)	0.29 (0.28)	-0.26 (0.17)
Grandparental health (ref: very poor or poor)						
Fair	-0.35 (0.49)	0.11 (0.49)	0.20 (0.69)	0.22 (0.96)	0.03 (0.29)	0.03 (0.17)
Good or very good	-0.64 (0.53)*	-1.08 (0.04)*	-0.62 (0.75)	2.48 (1.05)*	-0.50 (0.32)	0.56 (0.19)**
Grandparental education (ref: no education)						
Primary school	-0.19 (0.48)	0.04 (0.48)	0.62 (0.35)	-0.23 (0.94)	0.38 (0.29)	-0.03 (0.17)
Junior high school or above	-0.28 (0.58)	-0.23 (0.58)	1.13 (0.81)	0.71 (1.14)	0.46 (0.35)	-0.30 (0.20)
R-squared	0.03	0.10	0.07	0.41	0.12	0.16
Adjusted R-squared	0.02	0.09	0.05	0.40	0.11	0.15

Note. SE = standard error. ref = reference group. † $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.