



Exploring social network typologies and their impact on health and mental well-being in older adults: Evidence from JAGES

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ABSTRACT

Background: The types of social networks, their prevalence, and their relationship to health outcomes in older age have been different across countries and cultures. Most of the literature has focused on USA or in European countries and little is known about the social network typologies among older adults from Japan. This study aimed to identify these patterns of social network typologies and examine the differences in sociodemographic and related to health variables.

Methods: 23894 participants from the JAGES project (2019), aged 65 or older ($M = 74.74$, $DT = 6.39$) from Japan. Statistical analyses included Latent Profile Analysis (LPA) followed by ANOVAs, Chi square and multinomial logistic regressions tests to compare the profiles.

Results: Four profiles were identified: family (66.9%), spouse (16.6%), diverse (14.5%), and neighbor/others (1.9%). The profiles differ statistically ($p < 0.001$) in all sociodemographic characteristics and in the means of depression, loneliness, self-perceived health, and happiness. Compared with the “family” network, younger men, with fewer chronic illnesses but higher levels of depression and loneliness were more likely to be in the “spouse” profile, older women with lower socioeconomic status, but less lonely and happier in the “diverse” profile and adults who still working, have lower socioeconomic status and are less happy into the “neighbors/others” group.

Discussion: We discuss the differences between the profiles found, the potential differences with previous studies and the specific cultural Japanese nuances that may explain the characteristics of the network types founded.

1. Introduction

Social networks are conceptualized as the group of close social relationships one has, serving as sources of advice, help, support, and companionship (Antonucci et al., 2010; Ye and Zhang, 2019). These networks gain particular importance in older age, when the need for support increases (Litwin et al., 2020). In the field of gerontology, the Convoy Model (Antonucci, 2001) stands out as a prominent theory for understanding social networks. According to this model, individuals are surrounded by a “convoy” of supportive others who accompany them through various stages and challenges of life. This convoy can include family members, friends, and other significant individuals and these relationships vary in their closeness, quality, function, and structure (Antonucci et al., 2014). In addition, the Socioemotional Selectivity Theory suggests that throughout our lives, we select social networks to maximize social and emotional gains and minimize social and emotional risks (Carstensen, 1992). Both Antonucci’s (2001) Social Convoy Theory

and Carstensen’s (1992) Social-Emotional Selectivity Theory agree that with age the size of the more peripheral social network decreases, but relationships with family and closest friends are maintained or even increased. Consequently, older adults often maintain a core group of significant others who play a pivotal role in influencing their health and well-being.

To better understand the social networks of the older adults and to capture their multidimensional nature, Wenger (1991) was one of the first authors to employ social network typologies to describe individual and subgroup profiles. Wenger found five social network typologies in older adults from the UK considering several aspects such as proximity, interaction, and proportion of relatives, friends, and neighbors within the network. Since this pioneer study, research has proved that social networks of older adults are linked with several physical and mental health variables as depression (Choi and Jeon, 2021; Harasemiw et al., 2019; Ye and Zhang, 2019), loneliness (Shin and Park, 2023), self-perceived health (Park et al., 2015), chronic diseases (Torres et al.,

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2023), quality of life and life satisfaction (Litwin and Stoeckel, 2014; Shankar et al., 2015). In general, the studies focused on older people have identified four robust network types: “family”, “friends”, “diverse”, and “restricted” (Cheng et al., 2009; Choi and Jeon, 2021; Fiori et al., 2006; Litwin, 2001; Litwin and Stoeckel, 2014; Ye and Zhang, 2019).

Following the convoy model of social relations (Antonucci et al., 2010, 2014), these studies include criterion variables related to structural (e.g., composition) and interactional (e.g., frequency of contact) aspects of the relationship and support the idea that family and diverse networks have the better outcomes, while the restricted networks have the worst. In addition, several investigations have included neighbors and “other” contacts (as former colleagues, or formal helpers) in social network typologies and have found a network centered on “neighbors/others” (Litwin, 2001; Litwin and Stoeckel, 2014; Torres et al., 2023). This typology of “neighbors/others” has been characterized by being composed mainly of neighbors or other people with whom there is a high frequency of contact, but not a great emotional closeness.

Despite these general results, the social networks typologies present notable cross-cultural variations. Across countries and cultures, the social network types have showed differences. For example, the most prevalent type among US citizens was the “diverse” but for the Japanese and European older adults the most common network was the “family” network (Fiori et al., 2006, 2008; Torres et al., 2023). Furthermore, there seems to be differences between the effects by network type on health and mental health from one country to another. For example, the primarily spouse-centered network has been shown to be a beneficial network for European older adults since it has been related to higher quality of life scores (Litwin and Stoeckel, 2014) and lower means of depression and loneliness (Torres et al., 2023). However, in the context of older Japanese and Korean adults, the spouse or husband centered network was associated with depressive symptomatology (Choi and Jeon, 2021; Fiori et al., 2008).

Regarding cultural differences in the family network, for Japanese (Fiori et al., 2008) and European (Litwin and Stoeckel, 2014; Torres et al., 2023) older adults, the family-centered network has been characterized by having emotional closeness and high frequency of contact with network members. This family-focused network showed good results for health and well-being for older adults from Europe (Litwin and Stoeckel, 2014; Torres et al., 2023) and alleviated the negative effect of loneliness on depressive symptoms for Korean older adults (Shin and Park, 2023). However, studies of older people social networks from China (Cheng et al., 2009; Ye and Zhang, 2019) found one type of family network, restricted and distant. In addition, for the older people from United States the family network was consider negative since present higher levels of depressive symptomatology.

These different results show the need to expand the investigation of social network typologies into more diverse cultures and countries. However, the research in this field is predominantly centered within Western nations, including United States and Europe. The leading Asian country in this research area is South Korea (Choi and Jeon, 2021; Park et al., 2015, 2018; Shin and Park, 2023) followed by China (Cheng et al., 2009; Ye and Zhang, 2019) and to our knowledge there are few research focused on the older people Japanese population. Japan is one of the fastest-aging societies worldwide (Muramatsu and Akiyama, 2011) so understanding social networks the older adults and their characteristics is essential. However, to our knowledge only the study of Fiori et al. (2008) has focused on this field of research including Japanese sample. Fiori et al. (2008) made a cross-cultural investigation to compare social network typologies in older adults from United States and Japan and found four common network types (family, friends, diverse, restricted) and a “married and distal” network type only for the Japanese sample. The study of Fiori et al. (2008) focused on depression and mortality and, surprisingly, showed no differences by network type in Japanese older adults. However, the study by Fiori et al. (2008) presents two main limitations: it only includes 491 people from the city of Yokohama and the sample was collected in 1993. This may make these results

unrepresentative of the current Japanese older population. Japan’s society, family values and traditions are changing (Rindfuss et al., 2004), so the social networks of the older people may not be the same as they were a few years ago. Thus, in our study we aimed to investigate the social networks of Japanese older adults with a larger, representative, and current sample.

Based on previous evidence, we could infer that social network types and the relationship between health and mental health and social networks differs according to cultural values and social circumstances. However, limited research has been done among older adults in Japan. Therefore, the aims of this study were: a) to identify the optimal number of social networks in a representative sample of older people from Japan, b) to examine the sociodemographic characteristics in the profiles, and c) to study the differences in mental and physical health in the different social network typologies.

2. Method

2.1. Participants

This study used data from the wave 2019 of the Japan Gerontological Evaluation Study (JAGES). The JAGES project aims to obtain scientific knowledge to inform older adults care policy and emphasizes the promotion of evidence-based gerontological research focused on adults over 65 years of age from a multidisciplinary point of view. It is a collaboration between academic institutions and municipalities throughout Japan. The respondents of the JAGES project are people aged 65 and older, across 25 Japanese prefectures and not certified with long term care need. JAGES is a longitudinal study that started in 2003 and currently has six regular waves of data or time-points collected in 2006, 2010, 2013, 2016 and 2019. The present study employ data from JAGES 2019, the most recently gathered data (collected between December 2019 and January 2020).

The sampling protocol in the JAGES depends on the policies of each municipality, the size of its population and the budget allocated. In large municipalities with more than 5000 residents over 65 years of age, multistage random sampling methodology based on the official residential registers was used to select respondents. In small municipalities a complete survey was conducted to all eligible residents. This study follows the principles of the Declaration of Helsinki and this data received ethical approval from the Ethics Committee of Chiba University, Japan (Approval number: 2493) and the National Center for Geriatrics and Gerontology, Japan (Approval number: 992–3). The participation of all respondents was voluntary, and they indicated their consent to participate in the study. For the 2019 wave of the JAGES study, there were 201,975 participants from 62 different cities or towns across Japan, aged between 65 and 95 ($M = 74.76$, $DT = 6.37$), of which (47.4%) were males and (52.6%) were females. Most of the participants were married (72.4%) and retired (63.6%). 43.4% of the participants had between 10 and 12 years of education. From this group, we selected for our study all participants who responded to the questions regarding their social networks. The sociodemographic characteristics of the 23,883 participants included in our study were similar to those of the overall sample. The final participants were aged between 65 and 95 ($M = 74.74$, $DT = 6.39$), a 47.6% were males and the 52.4% were females, 72.8% were married, 63.3% retired, and the 43.3% of the sample had between 10 and 12 years of education. In addition, the distribution of participants by city or town are presented in Table 1.

2.2. Measures

To determine the social network of the participants, we employed nine variables. First, we identified the person’s close social network with the question “Do you have someone who listens to your concerns and complaints?”, and we consider the next categories: spouse, children living together, children living apart or relatives, friends, and

Table 1
Number of participants from each city or town.

	N (%)		N (%)		N (%)
Nagara	172 (0.7%)	Shijonawate	64 (0.3%)	Tottori	455 (1.9%)
Hayakawa	30 (0.1%)	Tsukumi	378 (1.6%)	Taka	136 (0.6%)
Matsuura	386 (1.6%)	Kokonoe	131 (0.5%)	Mori	169 (0.7%)
Sanno	86 (0.4%)	Takeda	259 (1.1%)	Nanbu	124 (0.5%)
Tenri	198 (0.8%)	Matsumoto	625 (2.6%)	Usuki	199 (0.8%)
Nagoya	2155 (9.0%)	Chuo	493 (2.1%)	Ichikawa	671 (2.8%)
Higashikagura	154 (0.6%)	Chigusa	172 (0.7%)	Machida	423 (1.8%)
Higashikawa	152 (0.6%)	Oarai	69 (0.3%)	Hachinohe	377 (1.6%)
Biei	219 (0.9%)	Mifune	348 (1.5%)	Saitama	401 (1.7%)
Yoichi	337 (1.4%)	Toyonaka	344 (1.4%)	Katsurao	36 (0.2%)
Tomamae	65 (0.3%)	Iida	531 (2.2%)	Rokunohe	207 (0.9%)
Kuriyama	275 (1.2%)	Iwanuma	775 (3.2%)	Kashiwa	384 (1.6%)
Towada	409 (1.7%)	Goto	153 (0.6%)	Fukuoka	1321 (5.5%)
Kosaka	144 (0.6%)	Taketoyo	459 (1.9%)	Tokamachi	788 (3.3%)
Oyama	141 (0.6%)	Handa	614 (2.6%)	Yokohama	1660 (6.9%)
Hekinan	599 (2.5%)	Tokoname	535 (2.6%)	Mutsusawa	188 (0.8%)
Ichihara	349 (1.5%)	Tokai	440 (2.2%)	Ikoma	187 (0.8%)
Kaga	211 (0.9%)	Obu	357 (1.5%)	Niigata	449 (1.9%)
Moriguchi	141 (0.6%)	Chita	437 (1.8%)	Hachioji	681 (2.9%)
Kadoma	107 (0.4%)	Higashiura	222 (0.9%)	Yao	1291 (5.4%)

neighbors/others, in which participants choose (1 = yes, 0 = no). Then, following previous studies (Litwin and Stoeckel, 2014; Torres et al., 2023) we applied a transformation to these variables. We divide each category type by the total diversity of people in the network and multiply by 100 to convert into percentage. As a result, the scores express the percentages of the relative importance of that type of contact in the network. For example, if a participant had a “yes” in the spouse and friends options their total network diversity would be a 2 and their new scores would be 50% in the “Spouse” category and 50% in “Friends”. In addition, we considered four questions about the frequency of interaction “How often do you meet with your family and relatives?”, “How often do you see your friends?”, “How often do you keep in contact with your family and relatives via letter, phone, email, etc?” and “How often do you keep in contact with your friends and acquaintances via letter, phone, email, etc?” answered on a Likert scale with six categories for the questions about friends (1 = rarely, 2 = several times a year 3 = once or twice a month, 4 = about once a week, 5 = 2–3 times a week, 6 = almost every day) and adding a seventh category for the questions about family (7 = I live with my family).

As sociodemographic variables we included age, gender, marital status (married or not), living alone (yes or not), occupational status (employed or retired/never employed). Also, we address questions about the years of education (1 = less than six, 2 = six to nine, 3 = teen to twelve, 4 = thirteen or more) and the financial situation (1 = very difficult to 5 = very comfortable).

Health status was assessed measuring the self-perceived health of the participants with the general question “How is your current health status? ranging from 1 (poor) to 4 (excellent) (Ware Jr and Gandek, 1998).

In addition, we measured chronic diseases included the sum of the following chronic diseases: hypertension, stroke, cardiovascular disease, diabetes mellitus, hyperlipidemia, respiratory disease, gastrointestinal disease, kidney or prostate disease, musculoskeletal disorders, cancer, blood, or immune system disease.

As indicators of mental and social health, we measured depressive symptomatology with the 15-item Geriatric Depression Scale (GDS) (Sheikh and Yesavage, 1986), that includes one item per depression symptom, examples of items are “Do you feel that your situation is hopeless?”, and “Do you feel pretty worthless the way you are now?”. The scale showed adequate internal consistency $\alpha = 0.81$, $\omega = 0.82$. Also, loneliness was assessed with a short version of the R-UCLA Loneliness Scale (Hughes et al., 2004; Russel et al., 1980) that contains three items regarding the frequency (1 = rarely, 2 = sometimes, 3 = always) of feelings of lack of companionship, exclusion, and isolation. The internal consistency of the scale was $\alpha = 0.80$, $\omega = 0.80$. Finally, we included one question about the feelings of happiness (0 = very unhappy and 10 = very happy).

2.3. Analytic strategies

First, a latent profile analysis LPA was conducted to determine the patterns of social relationships. We use nine criterion variables, the percentages of relative importance of the (1) spouse or husband, (2) children living together, (3) children outside the house or other family, (4) friends, (5) neighbors or others. And the frequency of (6) Meet with family, (7) Meet with friends, (8) Contact family and (9) Contact friends. The optimal number of latent profiles was determined comparing the best model fit, starting with two groups, and increasing one by one. The models were evaluated using several model-fit criteria: the Akaike Information Criterion (AIC), Bayesian Information Criteria (BIC), and the Entropy (an index of classification quality). In general, lower AIC and BIC values, and higher entropy values indicate better fit to the model (Muthén and Muthén, 2000; Tein et al., 2013; Wang and Wang, 2019). Additionally, we analyzed the Lo, Mendell and Rubin (LMR) and boot-strapped likelihood ratio (BLR) tests that compare two adjacent models. When LMR and BLR show statistical significance, they indicate an improvement when a profile is added to the model (Lo et al., 2001). Also, determine the optimal number of profiles is a subjective process that needs a theoretical rationale.

Once we determined the best model, we examined the clusters in their criterion variables. In addition, the profiles were compared in the sociodemographic characteristics and variables related to health and mental health. We employed a series of chi-square tests and V of Cramer effect sizes to compare categorical variables and ANOVAS and partial eta-squares effect sizes for the quantitative variables. When the ANOVAS test showed differences between groups, we conducted post-hoc tests to examine which means differed significantly. Finally, we tested a series of multinomial logistic regressions to examine the association between the sociodemographic characteristics, the health-related variables and the social networks profiles obtained. The analyses were performed using Mplus 8.7 (Muthén and Muthén, 1998–2017), SPSS version 28 and JAMOVI 2.3.16.

3. Results

3.1. Latent profile analysis

The optimal number of latent profiles was determined testing five models, results of model comparison fit statistics could be seen at Table 2. As a profile was incorporated the AIC and BIC indices decreased, Entropy increased, and the p-value of the LMR and BLMR were significant. This suggests a better fit as the number of profiles increased. Although the indices suggested that a five-profile model was a significant improvement, the solution provided two very closely related “neighboring/other” groups when analyzing the five-profile model. In

Table 2
Fit statistics, entropy, and statistical model comparisons.

Profiles	AIC	BIC	SSA-BIC	Entropy	p LMR	p BLR
1	1387980.736	1388126.201	1388068.998	NA	NA	NA
2	1370221.238	1370447.517	1370358.533	0.911	>0.001	>0.001
3	1344438.067	1344745.160	1344624.397	0.969	>0.001	>0.001
4	1325653.011	1326040.917	1325888.374	0.939	>0.001	>0.001
5	1291447.204	1291915.924	1291731.602	0.941	>0.001	>0.001

Note: AIC = Akaike Information Criterion; BIC=Bayesian Information Criterion; SSA-Bic = Sample-Size-Adjusted BIC; LMR = Lo–Mendel–Rubin test; BLRT = Bootstrapped Log-likelihood Ratio Test; NA = Not applicable.

addition, these two profiles represented a very low percentage of the sample indicating that they may be spurious (Marsh et al., 2009). For that reason, we decided to retain the four-profile model for use in the subsequent analysis, since it was the second best fit and the profiles had clear differentiated interpretable and meaningful patterns. These four typologies of social networks had substantial probabilities for the most likely latent type memberships: 0.952 for profile one, 0.988 for profile two, 0.917 for profile three, and 0.912 for profile four.

3.2. Profiles of social network types

The groups were labeled “diverse”, “family”, “spouse” and “neighbor/others” based on their distinct characteristics and in the terminology of previous research. The characteristics of the social network groups with respect to the criterion variables are presented in Table 3.

The most prevalent was the “family” network (66.9%), this group consists primarily of children, spouse and family members. This profile was also composed by friends and shows high means of frequency of meeting and contact with family and friends. The second largest profile is the “spouse” network (16.6%), mainly composed of the respondent’s wife or husband, with low frequency of meeting with family and friends, and low frequency of contact with friends. The “diverse” profile (14.5%) as its name indicates was characterized by having a very diverse network composition, presents high mean frequency of meeting and contact with family and friends. Finally, the “neighbor/others” profile (1.9%) is mostly comprised by neighbors or other people and shows low means of frequency of contact with family.

Table 3
Profiles of social network types.

Criterion	Family (n = 15978)	Spouse (n = 3978)	Diverse (n = 3476)	Neighbors/ Others (n = 462)	Total sample N = 23894
	% or M (SD)	% or M (SD)	% or M (SD)	% or M (SD)	% or M (SD)
Spouse/ Husband	22.06%	98.09%	15.55%	0.03%	32.81%
Children living together	11.11%	0.72%	5.37%	0.00%	8.32%
Children living outside/ Family	38.17%	0.66%	25.87%	0.05%	29.43%
Friends	28.53%	0.52%	19.34%	0.02%	22.00%
Neighbors/ Others	0.12%	0.00%	33.86%	99.90%	7.43%
Meet family	3.39 (1.48)	2.93 (1.51)	3.47 (1.45)	3.09 (1.65)	3.56 (1.56)
Meet friends	3.61 (1.51)	2.79 (1.54)	4.24 (1.44)	3.52 (1.69)	3.33 (1.49)
Contact family	3.72 (1.47)	2.97 (1.55)	3.90 (1.44)	2.87 (1.52)	3.32 (1.51)
Contact friends	3.43 (1.47)	2.54 (1.44)	3.74 (1.43)	3.12 (1.54)	3.61 (1.51)

3.3. Sociodemographic characteristics by network types

Regarding sociodemographic characteristics, in the “family” profile a 70.2% are married and 16.7% report living alone. The great majority of people in the “spouse” profile, 93.6% are married and only a 4.3% live alone. In the “diverse” group a 64.1% are married and a 22.7% live alone. Finally, the 43.8% of people from the “neighbors/others” group are married and the 38.3% live alone. The comparison of the other background characteristics by profiles can be consulted at Table 4. Profiles differ statistically (p < 0.001) in all sociodemographic characteristics. In terms of gender frequencies ($\chi^2(3) = 2585.113$; $V = 0.329$), women are more prevalent in the “diverse” typology and less in the “spouse” network. The differences in the proportions of retired people in each typology are not so notable ($\chi^2(3) = 41.367$; $V = 0.043$), but the “diverse” and “family” groups have the highest proportion of retired people.

The profiles also differ (p < 0.001) in terms of the mean age ($F(3, 27266) = 26.396$; $\eta^2 = 0.003$), the years of education ($F(3, 23301) = 33.244$; $\eta^2 = 0.004$) and the financial situation ($F(3, 23632) = 16.124$; $\eta^2 = 0.002$). In all these variables, the “neighbors/others” profile presents the most vulnerable socio-demographic results in terms of having less years of education ($M = 2.84$, $SD = 0.82$), and lower economic situation ($M = 2.66$, $SD = 0.82$). The groups “spouse” and “family” appear to be the most protected.

3.4. Physical mental and social health by network types

Table 5 provides information about the mean differences between the network’s typologies and all the variables. In general, the “diverse” group followed by the “family” group are the two that present the better

Table 4
Sociodemographic characteristics of each network type.

Characteristics	Family	Spouse	Diverse	Neighbors/ Others	Test statistic and effect size
	N (%)	N (%)	N (%)	N (%)	χ^2 (df), V Cramer
Women	9123 (57.1%)	685 (17.2%)	2457 (70.7%)	263 (56.9%)	2585.113 (3), 0.329
Retired or never employed	10436 (70.5%)	2496 (65.9%)	2272 (72.5%)	282 (69.8%)	41.367 (3), 0.043
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	F(df), η^2
Age	74.72 (6.27)	74.17 (6.18)	75.34 (6.27)	75.95 (6.86)	26.396 (3, 23890), 0.003
Years of education	3.06 (0.77)	3.11 (0.80)	2.97 (0.77)	2.84 (0.82)	33.244 (3, 23301), 0.004
Financial situation	2.88 (0.79)	2.83 (0.81)	2.84 (0.76)	2.66 (0.82)	16.124 (3, 23632), 0.002

Note: All the analysis are statistically significant p < 0.001.

Table 5
Physical, Mental and Social health of each network type.

	Family	Spouse	Diverse	Neighbors/Others	F(df), η ²	Post-hoc comparisons
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)		
Depression	2.94 (2.99)	3.46 (3.31)	2.70 (2.77)	4.11 (3.57)	53.463 (3, 20049), 0.008	1 < 2,4; 2 < 4; 3 < 1,2,4
Loneliness	3.86 (1.29)	4.18 (1.51)	3.68 (1.14)	4.11 (1.42)	97.489 (3, 23302), 0.012	1 < 2,4; 3 < 1,2,4
Self-perceived health	2.99 (0.57)	2.95 (0.60)	3.01 (0.58)	2.90 (0.66)	9.855 (3, 23311), 0.001	1 > 2,4; 3 > 2,4
*Chronic conditions	1.26 (1.09)	1.26 (1.12)	1.27 (1.09)	1.19 (1.12)	0.628 (3, 22675), 0.000	–
Happiness	7.24 (1.82)	6.93 (1.96)	7.46 (1.80)	6.55 (2.17)	68.850 (3, 22998), 0.009	1 > 2,4; 2 > 4; 3 > 1,2,4

Note: All the analysis are statistically significant $p < 0.001$ except for chronic conditions. Depression ranges from 0 to 15, loneliness ranges from 3 to 9, self-perceived health ranges from 1 to 4, chronic diseases range from 0 to 12 and happiness ranges from 0 to 10.

outcomes in all the variables and the “neighbor/others” group presents the worse. There are statistically significant differences ($p < 0.001$) between profiles in all the groups for depression ($F(3, 20049) = 53.463$; $\eta^2 = 0.008$), loneliness ($F(3, 23302) = 97.489$; $\eta^2 = 0.012$), self-perceived health ($F(3, 23311) = 9.855$; $\eta^2 = 0.001$), and happiness ($F(3, 22998) = 68.850$; $\eta^2 = 0.009$). The supplementary material includes graphs of the standard marginal measures means in the different profiles for each statistically significant variable (Fig. 1 for depression, Fig. 2 for loneliness, Fig. 3 for self-perceived health and Fig. 4 for happiness).

We also can observe the results of the post-hoc comparisons in Table 5, the “diverse” profile has better outcomes in depression, loneliness, and happiness than the other three profiles and better self-perceived health than the “spouse” and “neighbor/others” profiles. In addition, the “family” profile has higher happiness, and lower depression and loneliness than the “spouse,” and “neighbor/others” profiles. Detailed observations of the post hoc tests for the “neighbor/others” and “spouse” profiles reveal that their results do not differ in loneliness and self-perceived health, but the “neighbor/others” profile have higher means of depression and lower means of happiness than the “spouse” profile.

3.5. Multinomial logistic regression analysis

Table 6 presents the results of the multinomial regression models to examine the differences in sociodemographic characteristics and health related variables among social network patterns by showing which factors were associated with the higher likelihood of belonging to the “spouse”, the “diverse” or the “neighbors/others” group compared with to the reference category, the “family” group.

Regarding sociodemographic characteristics, those who are males (OR 7.11, 95% CI 6.36–7.94) and younger (OR 0.98, 95% CI 0.98–0.99) are more likely to be allocated to the “spouse” than in the “family” group. Females (OR 0.56, 95% CI 0.51–0.62), those who are older (OR 1.01, 95% CI 1.00–1.02), receive less years of education (OR 0.89, 95% CI 0.83–0.94) and have lower financial situation (OR 0.87, 95% CI 0.82–0.93) are more likely to pertain to the “diverse” group. In addition, those who are working (OR 1.38, 95% CI 1.05–1.80), have lower education (OR 0.82, 95% CI 0.70–0.96) and lower economic status (OR 0.85, 95% CI 0.72–1.00), are more likely to be assigned to the “neighbors/others” profile. People who have higher levels of depression (OR 1.03, 95% CI 1.01–1.05), loneliness (OR 1.15, 95% CI 1.11–1.19), and lower number of chronic conditions (OR 0.94, 95% CI 0.91–0.98) have higher likelihood of being in the “spouse” profile. However, those who reported lower feeling of loneliness (OR 0.89, 95% CI 0.85–0.94) and more happiness (OR 1.05, 95% CI 1.02–1.08) have higher likelihood to be assigned to the “diverse” social network. Finally, those with lower levels of happiness (OR 0.87, 95% CI 0.81–0.94) are more likely to be part of the “neighbors/others” profile than to the “family” group.

Table 6
Multinomial logistic regression analysis for profile memberships of social network.

Profile 2: Spouse (ref = Family)	Estimator	Odds Ratio	95%CI
Sex = Male (ref. Female)	1.96	7.11***	6.36–7.94
Occupational status = Employed (ref = Retired)	−0.03	0.97	0.88–1.07
Age	−0.02	0.98***	0.98–0.99
Years of education	0.02	1.02	0.96–1.08
Financial situation	−0.01	0.99	0.94–1.05
Depression	0.03	1.03**	1.01–1.05
Loneliness	0.14	1.15***	1.11–1.19
Self-perceived health	0.03	1.03	0.95–1.12
Chronic conditions	−0.06	0.94**	0.91–0.98
Happiness	0.01	1.01	0.98–1.04
Profile 3: Diverse (ref = Family)	Estimator	Odds Ratio	95%CI
Sex = Male (ref. Female)	−0.57	0.56***	0.51–0.62
Occupational status = Employed (ref = Retired)	0.03	1.03	0.93–1.15
Age	0.01	1.01**	1.00–1.02
Years of education	−0.12	0.89***	0.83–0.94
Financial situation	−0.13	0.87***	0.82–0.93
Depression	−0.01	0.99	0.97–1.01
Loneliness	−0.11	0.89***	0.85–0.94
Self-perceived health	0.07	1.07	0.98–1.17
Chronic conditions	0.02	1.02	0.98–1.06
Happiness	0.05	1.05**	1.02–1.08
Profile 4: Neighbors/Others (ref = Family)	Estimator	Odds Ratio	95%CI
Sex = Male (ref. Female)	0.18	1.20	0.94–1.52
Occupational status = Employed (ref = Retired)	0.32	1.38*	1.05–1.80
Age	0.02	1.02	1.00–1.04
Years of education	−0.20	0.82*	0.70–0.96
Financial situation	−0.16	0.85*	0.72–1.00
Depression	0.05	1.05	1.00–1.10
Loneliness	−0.02	0.98	0.89–1.08
Self-perceived health	−0.00	1.00	0.80–1.25
Chronic conditions	−0.07	0.93	0.83–1.05
Happiness	−0.14	0.87***	0.81–0.94

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

4. Discussion

4.1. Social network typologies of Japanese older adults

This study identified four typologies of social networks among older people from Japan composed mainly by family members, spouse, diverse people, or neighbors/others. Similar patterns have been found in previous studies (Cheng et al., 2009; Fiori et al., 2008; Shin and Park, 2023; Torres et al., 2023; Ye and Zhang, 2019). Specifically, the “diverse” and the “family” groups identified share characteristics consistent with those observed in previous research (Cheng et al., 2009; Shin and Park, 2023; Ye and Zhang, 2019), which also reported favorable health-related outcomes for these groups. In line with our findings, Torres et al. (2023) identified a “neighbors/others” profile associated

with elevated levels of depression and loneliness compared to the “family”, “diverse”, and “spouse” profiles.

However, the “spouse” profile found in our research is more like the “marital/distal” profile found in the research of [Fiori et al. \(2008\)](#) than to the “spouse” research with European sample ([Litwin and Stoeckel, 2014](#); [Torres et al., 2023](#)). In European research the spouse profile was related to good outcomes in health and quality of life. However, in our study this profile was more depressed, lonely, and unhappy than the “family” and “diverse” groups. These results cannot be explained by basic sociodemographic characteristics such as economic situation or age. The “spouse” group presents sociodemographic characteristics related to good health and happiness in old age such as lower proportion of people living alone, higher proportion of married people, lower mean age, and higher mean years of education. So, one possible explanation for the results in the “spouse” group, may be, that having a spouse or husband as the principal support of the social support network is not satisfactory for the Japanese older adults in this profile. Marked roles in marriage and separation in social activities have been the typical pattern of Japanese marriages for centuries ([Reischauer, 1981](#)). This may have led Japanese husbands and wives to have a more distant relationship and consequently, to be more depressed, lonely, and unhappy than people with other social network patterns.

Like in the Japanese subsample from the study of [Fiori et al. \(2008\)](#), the most prevalent group in our study has been the “family” group followed by the “spouse” network. This supports the idea that the older Japanese adults tends to focus their social network in the family ([Takahashi et al., 2002](#)). Furthermore, it’s worth noting that the family and diverse networks have children living together in their structure. Although co-residence with children is declining by the demographic and social changes that Japan has experienced over the past decades ([Rindfuss et al., 2004](#)), an 8.32% of our sample has children in their social network with whom they live. However, in contrast to the findings of [Fiori et al. \(2008\)](#), who identified a “friend-focused” profile among their Japanese sample, our study observed that friends were predominantly categorized within the “family” and “diverse” groups. We identified a separate profile mainly composed of “neighbors/others” that shares certain characteristics friend networks described by [Fiori et al. \(2008\)](#), such as a lower proportion of married individuals or individuals with lower education levels. So, these discrepancies may be due to the distinction made in our study between individuals considered friends and neighbors/others.

Regarding gender differences, this study found that men were much more present in the “spouse” profile while women were much more prevalent in the “diverse” profile. This may be because women live longer than men, being more common for women to be widowed than for men ([Okabayashi and Hougham, 2014](#)). Moreover, these differences may be explained by differences in traditional gender role socialization. Wives tend to connect with family members, siblings, parents of their kids’ friends, and people from the local community ([Ishii-Kuntz and Maryanski, 2003](#)) and maintain this diverse social network in older age. However, husbands may tend to socialize with coworkers, as this is crucial for the professional success and good working relationships in Japan ([Fiori et al., 2008](#)). Possibly, after retirement, these men experience a significant reduction in social interactions, remaining their wives as their main social network. The fact that our results with current data from 2019, found this “spouse” network composed mainly of men as did [Fiori et al. \(2008\)](#) with a sample of Japanese older people collected in 1993 shows the need to develop public initiatives focused on encouraging these men to expand their social connections.

Finally, based on the regression analysis, we can deduce that in comparison with the general population of Japan that belong to the “family” network, the “spouse” profile exhibits a higher proportion of men, younger and with fewer chronic illnesses. This group also reports higher levels of depression and loneliness. In contrast, the “diverse” profile is predominantly composed of women, older and with lower level of education and a more difficult economic situation. Despite these

difficulties, members of this “diverse” group tend to experience less loneliness and report higher levels of happiness. The “neighbors/others” group has a higher prevalence of people who are still working, have less education, worse economic situation and are less happy. So, the most vulnerable social networks for the old adults in Japan appear to be those composed of spouses and neighbors/others. These networks share a common characteristic: a limited presence of children and other relatives. Although these types of networks may not be widespread in Japanese society today, they are expected to become increasingly common in the future. Japan’s population is aging at the same time as its fertility rate is declining, so it will become increasingly common for older people to grow old without children ([Muramatsu and Akiyama, 2011](#)).

5. Policy implications

Japan is considered as a super-aging society and has a variety of services, programs and actions aimed at enhancing the social and community connections of the older adults. In 2000, Japan implemented a universal long-term care social insurance plan aimed at shifting care responsibilities from families to society. This policy ensured that all Japanese citizens over 65 years old had access to various home-based, community-based, and institutional services ([Muramatsu and Akiyama, 2011](#)). Furthermore, the Japanese government offers public assistance programs within its social welfare system, designed to support socioeconomically disadvantaged people ([Ministry of Health Labour and Welfare of Japan 2021](#) to the following; ["Ministry of Health Labour and Welfare of Japan, 2021](#)). Japanese older adults’ social networks play a crucial role in their ability to access these services by orienting older adults to available benefits, their application process, and assisting them in the application ([Kino et al., 2022](#)).

In addition, with Japan’s rapidly aging population, there have been suggestions to implement more sustainable systems to adapt to demographic changes. One proposed is the “Community-based Integrated Care System” (CbICS), designed to offer comprehensive support within local communities across the lifespan and maintain the dignity of the older people ([Song and Tang, 2019](#)). CbICS comprises four key components: self-help (Ji-jo) from individuals or their families, mutual aid (Go-jo) through informal networks involving local health volunteers, and social solidarity care (Kyo-jo) through organized social security ([Sudo et al., 2018](#)). Understanding older adults’ social networks can provide insights for the development of public health interventions and strategies based on this community integrated care system.

5.1. Limitations and paths for future research

It is important to note that the findings of our study are not without limitations. First, as this is a cross-sectional study, the potential reciprocal effect between health and social network typologies could not be studied. Some longitudinal research shows that social networks such as the diverse type produced the most beneficial health outcomes for Chinese older adults, but a decline in health indicators leads to a shift to less beneficial network types, such as family-centered or restricted networks ([Li and Zhang, 2015](#)). In addition, Korean older adults who were in restricted social network typologies or shifted to these groups were more likely to have poor self-rated health, higher levels of depressive symptoms, and lower levels of life satisfaction ([Kim et al., 2016](#)). Having established the typologies of social networks in Japanese older adults with this study, further studies could examine the longitudinal associations of health and social networks. Also, future studies could employ other techniques as latent profile transition analysis to explore the changes in latent profile membership across time ([Min et al., 2024](#)).

Second, the research has not yet reached a consensus about which criterion variables are the best to configure the social network profiles. So, some of the differences that we found between studies may be due to the different choices of variables. Nevertheless, in this study we have

tried to choose variables as similar as possible to previous literature to be able to compare the results with other studies. Third, although the 2019 data from the JAGES project included a total of 201975 participants, a large portion had missing values for all questions regarding frequency of contact and meeting with family and friends. Thus, the final sample included a much smaller number of participants. In addition, given that the data were self-reported, there is a possibility that they are affected by reporting bias and a nonresponse bias.

Finally, we have focused on variables associated with physical health, mental health, and well-being, but some variables relevant to successful aging remain to be studied, such as the participation in community groups and activities. Greater social networks that offer more social support has been associated with higher levels of participation in social activities such as sports, self-help groups, charity work and community events (Pollak and Von dem Knesebeck, 2004). Another study using data from JAGES 2010; Sekiguchi et al. (2021) explored the relationship between the types of social networks and the initiation of leisure activities. They focused on the relationship with friends, neighbors and colleagues and found five profiles: “Neighborhood”, “Restricted”, “Colleagues”, “Same-Interest”, and the “Diverse networks”. People in the Neighborhood and Same-Interest networks were significantly more likely to start a leisure activity. This finding supports the idea that some social network profiles promote high participation in social activities. Thus, future studies could investigate this question by also including family aspects in the social network typologies.

6. Conclusion

This study expands the previous research in the field and some of the strengths are the large sample size, and the use of a recent data from the JAGES study. Our results support the idea that is important to identify and understand social network profiles in the social and cultural context of each country. Also, characterized the social networks typologies could have practical implications as identifying vulnerable groups and which variables are the highest priority for intervention. Identifying the sociodemographic characteristics of the groups is also important when deciding on the actions to be applied to each group and their needs. For example, the neighbor/others group has a large proportion of people who live alone and are not married, and perhaps for them the most important thing would be to find that source of companionship. However, in the spouse group, the majority live with their partner and are married, so they may need another type of approach.

Ethical considerations

JAGES participants were informed that participation in the present study was voluntary and that completing and returning the self-administered questionnaire via mail indicated their consent to participate in the study. Ethics approval was obtained from the Ethics Committee at Nihon Fukushi University.

CRediT authorship contribution statement

Zaira Torres: Writing – original draft, Methodology, Investigation, Conceptualization. **Amparo Oliver:** Writing – review & editing, Supervision. **José M. Tomás:** Methodology, Formal analysis. **Naoki Kondo:** Supervision, Project administration.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

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