Patient Preference and Adherence

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ORIGINAL RESEARCH

Preferences of Integrated Care and the Influencing Factors Among Chinese Community-Dwelling Older Adults

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Objective: Population aging and epidemiological transition have prompted requests for integrating health and social care. The goal of meeting complex care needs necessitates the understanding of preferred patterns among older adults. The study aimed to elicit the preferred care patterns and the influencing factors of integrated health and social care among community-dwelling older adults in multiple regions of China.

Methods: From a national survey, 1184 community-dwelling older adults in three cities across China were included in the study. Individual characteristics and preferred care patterns were measured. Five preferred care patterns were classified, including Home-based health and social care, Community-based health and social care, Home-based health care but community-based social care, Community-based health care but home-based social care, and Institution-based health and social care. Multivariate logistic regression and random forest model were applied to obtain reliable results.

Results: Overall, approximately half of the participants (47.7%) in the survey preferred Home-based health and social care and more than a quarter of participants (25.6%) preferred Community-based health and social care, followed by Institution-based health and social care (14.4%). A relatively small fraction of participants reported preferences for Home-based health care but community-based social care (8.0%) and Community-based health care but home-based social care (4.2%). Gender, age, education, living arrangement, resident city, income per month, access to medication, and self-care capability were significantly associated with older adults' preferences ($p<0.05$ each). Education, living arrangement, age, resident city, and income per month were the most relevant predictors, followed by gender, number of chronic diseases, self-care capability, and access to medication.

Conclusion: To effectively meet care needs, efforts should focus on home- and community-based care. Since the preferred care patterns were characterized by obvious variability, policymakers and service providers should carefully consider the differences in making tailored strategies.

Keywords: health care, social care, home- and community-based settings, preferred care patterns

Introduction

With the issues of population aging and epidemiology transition, integrated long-term care has been established to meet the increasingly complicated demands of older adults in most developed countries.[1] For instance, the most typical model of community integrated care in the United States is the Program of All-Inclusive Care for the Elderly (PACE).[2] The Japanese integrated care model is characterized mainly by the long-term care insurance (LTCI) program and a sound legal system.[3] Embrace is an integrated care service designed for all community-dwelling older adults and utilizes the Chronic Care Model with risk profiles in the Netherlands.[4] A single conceptual clarity of integrated care is currently

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lacking, which might be approached from different perspectives and terminologies such as "comprehensive care" or "coordinated care".[5]

Aligned with the global trend, people aged 60 and older accounted for nearly 21.1% of the total Chinese population in 2022, up to 297 million people, while those aged 65 and older accounted for 15.4%, up to 217 million people.[6] Among the huge population, nearly 75% suffer from noncommunicable diseases.[7] Meanwhile, it is estimated that the number of Chinese older adults with disability reached 52.71 million in 2020.[8] These challenges made integrated long-term care a priority on the national policy agenda. China has issued a policy to promote integrated health and social care ("Yi-yang-jie-he") across care settings since 2013, as a synonymous innovation with integrated long-term care for older adults.[9] Health care includes the management and delivery of services ranging from health promotion, disease prevention, diagnosis, treatment, disease management, rehabilitation, nursing, and palliative care services for older adults, according to their demands throughout the whole life trajectory. Social care covers the rest assistive care services of caregiving and social supports such as adult day care, cultural activities, social participation, mental stimulation, emotional support, counseling, recreation, transportation, exercise, and assistance with walking, eating, or bathing. There are mainly three implementation settings now. The first mode focuses on the institutional settings. Social care facilities build their internal medical facilities for providing onsite medical practice, health institutions establish their post-acute care or long-term care facilities, or healthcare institutions coordinate with social care facilities to jointly provide care by signing contracts (healthcare institutions contribute medical-related services and social care facilities contribute post-acute care and long-term social care).[9] Generally, receiving institution-based care means leaving homes or communities and being admitted to a residential institution. The second mode focuses on the home-based settings. In this context, primary healthcare centers and community social care facilities may dispatch professionals (eg, family doctor teams or community social workers) to deliver home-visiting care to older adults.[10] Currently, home-based healthcare service in China is limited to providing relatively basic items, such as nursing or rehabilitative care. Accessing more advanced medical services is required to visit professional healthcare institutions (eg, primary healthcare centers or general hospitals). Home-based social care mainly refers to personal care, housework, meal preparation, or respite care. The third mode focuses on community-based settings, older adults could come to primary healthcare centers or community social care facilities to access such services in person.[11] The responsibilities of primary healthcare centers in China included health education and promotion, health records, disease prevention and treatment, chronic disease management, family doctor contract services, traditional Chinese medicine services, rehabilitation services, etc. Community social care facilities mainly refer to adult day care centers or community senior activity centers, offering social support services in a group setting during the daytime.

At the initial stage of policy practice, China gave more emphasis to institution-based integrated care since it might relieve the family caregiving burden, make full use of the healthcare institutions and social care facilities, and meet the diversity of care demands.[12] However, it gradually faces some challenges, for example, insufficient institutional coordination, higher service cost and price, lower occupancy rate, and poorer individual acceptance.[13,14] Home- and community-based care showed their natural advantages over institutional care in that the two modes allowed individuals to live independently in their homes or communities, maintain their social network, and enjoy a higher quality of life.[1,15,16] Under the traditional Chinese culture of "Aging at Home" and "Aging in Place", Chinese older adults still strongly prefer enjoying their old age in peace with familiar surroundings and relying heavily on care provided by informal caregivers (eg, family members, friends, or neighbors).[15] However, given the facts of minimizing household structure and rapid socioeconomic development in China nowadays, such conditions compel the authorities to re-orient their policy initiative. The "90-7-3 model" for older adults in China is therefore advocated at present, which means that 90% of all older adults live in their own homes and receive home care, 7% receive community care and the rest (3%) live and receive care in institution-based settings.[9,12]

Older adults are the main recipients of integrated long-term care; therefore services should be orientated around the needs of older adults.[17–19] However, the multifaceted characteristics of individuals may have varied attitudes toward the care patterns of delivery settings and care services. Understanding such preferences and the influencing factors is therefore crucial for responding to a diversity of older adults. Although several previous literatures have examined the willingness and preference of receiving integrated care among older adults in China, knowledge gaps still emerged in the

following two aspects. Firstly, most of the prior studies regarded the different integrated care patterns as a whole, such as older adults were simply asked if they would be willing to receive such services.[20,21] Although care patterns in the part of the literature have been classified, most of them were based on relatively rough classification, for instance, the preferences of integrated care were divided by "institution-based", "home-based", and "community-based" in several studies.[10,22] However, the existing literature primarily addressed the delivery setting issues of integrated care, while not taking the varied care types into consideration. Nowadays, healthcare services in China are managed primarily by the National Health Commission and local health departments, as well as delivered through general hospitals, specialized hospitals, or primary healthcare centers. Social care services in China are managed primarily by the Ministry of Civil Affairs and local departments of civil affairs, focusing on home care services and community support, etc. However, due to the heterogeneity of care needs in older adults, some of them may prefer obtaining healthcare services in primary care centers but get daily care at home, while some may prefer obtaining healthcare services in home settings but participate in social activities in community settings. Namely, older adults may fall through the cracks between two separate systems. Fostering better integration in delivering services and developing accurate and person-centered service strategies require clarifying the preferences of detailed care patterns. The information might help policymakers and service providers understand the actual needs and their respective focus, for being adequately responsive to the demand diversity. Meanwhile, concerning that home and community-based integrated long-term care is gradually developing into a national priority, such patterns are especially supposed to concentrate on home- and community settings. The second aspect is in terms of the analysis methods, existing studies mostly used the traditional multivariate logistic regression (MLR) to measure the related factors.[10,20,23–25] However, the MLR model is easily impacted by outliers, which may lead to leverage effects on the model and impair its predictive performance.[26,27] Random forest (RF), an emerging machine learning algorithm, has gained popularity in predicting behavior preferences and showed improved prediction accuracy compared to traditional linear algorithms.[28,29] To the best of our knowledge, however, there are rare researches that applied the machine learning approach with respect to preference of integrated care patterns in the aging population.

To unite care delivery practice and the demands of older adults better, care patterns in this study were therefore classified into five groups according to the integration of care delivery settings and specific service types in the context. Namely, "Home-based health and social care", "Community-based health and social care", "Home-based health care but community-based social care", "Community-based health care but home-based social care", and "Institution-based health and social care". The current study aimed to examine the preferences of the five patterns among older adults, analyze the predictor variables via the MLR model and RF algorithm, and finally compare the prediction performances of the two models. The research may contribute to the common understanding of care preference and the influencing factors in many countries with aging populations, where health and social care services are in a decentralized system. These findings of the study may shed fresh light on how to design and implement integrated long-term care systems efficiently to align with the variabilities of care needs and priorities of older adults.

Methods

Study Design

A cross-sectional survey entitled "The 2023 National Survey of Capability Improvement Action for Community-based Integrated Health and Social Care in China" was conducted in April and July of 2023. In the survey, a stratified multi-stage random sampling method was applied for a broader understanding of the current situation of integrated health and social care across the whole country. Seven cities in different provinces of China were selected as the primary sampling units. From each city, two communities in an urban district and two villages in a rural county or suburban area were selected as the secondary sampling units (districts and counties are at the same administrative level in China). Afterward, based on the assistance of local health administrations in the cities, the research team established appropriate communication channels with community workers for recruiting older adults and completing the final in-person investigation. For the current study, we purposively selected the following three cities to align with the objectives of the study, ie, Chengdu of Sichuan Province, Jiaozuo of Henan Province, and Wuxi of Jiangsu Province. There were two main reasons for the sites. Firstly, the three cities are in the western, central, and eastern

regions of China (Figure S1 in Supplementary Material). Generally, significant regional differences reflect disparities in social and economic conditions in China, with the eastern region being more developed, boasting stronger economies, better infrastructure, and more advanced healthcare systems compared to the central and western regions. Such selection with geographic diversity ensures that findings reflect a spectrum of regional variations, enhancing the generalizability of the findings. Secondly, the selection was based on the implementation and progress of integrated health and social care in different regions. These cities have great initiative and progress in integrated care since all of them have a higher degree of population aging.[8] Therefore, they began to implement integrated health and social care policies at an earlier stage in China. When compared with other survey sites, these cities provided a relatively robust data basis for analyzing preferences and influencing factors.

This study adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) instrument for observational studies (Table S1 in Supplementary Material).[30]

Study Participants and Data Collection

The eligible participants were those aged 60 or older with normal cognitive function at the time of the interview. Cognitive function was observed during the interview by trained research teammates, who evaluated participants' ability to understand and respond coherently to questions. Participants exhibiting signs of significant cognitive impairment or unstable psychological status, such as the inability to follow simple instructions or provide consistent answers, were excluded. If there was uncertainty, a brief clinical judgment or consultation with a family member was used to confirm cognitive status. Meanwhile, if the participants were unable to answer questions independently, a family member or community worker would provide assistance.

In order to guarantee the sufficiency of the sample size to substantiate the finding's validity, the minimum size was calculated using the following Cochran's formula.[31] Z is the critical value of the standard normal distribution, p is the estimated proportion, and d is the margin of error. In this study, we set α at 0.05, so the value of Z is 1.96, and the margin of error is 0.05. Through pre-surveys, we found that the proportions of those who tend to choose home-based care, community-based care, and institution-based care were approximately 0.6, 0.3, and 0.1, respectively. Using the formula (1), the calculated sample size was 394. Since this study adopted the stratified multi-stage random sampling method, we used formula (2) to calculate the final sample size. Assuming that the design effect (*deff*) was 3, then the final sample size should be at least 1182.

$$n_1 = \frac{Z^2_{\alpha/2} \sum_{i=1}^{k} p_i(1-p_i)}{k-1} \times \frac{1}{d^2} \tag{1}$$

$$n_2 = deff \times n_2 \tag{2}$$

In the three cities for the current study, 1280 individuals were interviewed. 96 of these were excluded due to incomplete data or incorrect responses. 1184 older adults were used for the final analysis (Figure S2 in Supplementary Material). Informed consent was obtained from all the participants. All participants in the three cities were covered by either the urban employee basic medical insurance (UEBMI) or the urban and rural resident basic medical insurance (URRBMI) for accessing health-related services. However, Chengdu and Wuxi have implemented the LTCI policy to cover the post-acute and long-term social care services for their citizens, while the older citizens in Jiaozuo have not enjoyed such a LTCI policy.

Ethical Considerations

Ethics approval was obtained from the Ethics Committee of Institute of Medical Information, Chinese Academy of Medical Sciences (ID: IMICAMS/07/24/HREC). Our research is in compliance with the Helsinki Declaration. All participants provided informed consent before the start of the survey and ensured their privacy throughout the study. The participants informed consent included the publication of anonymized responses.

Measures

Individual Characteristics

In this study, we adopted Andersen's Behavioral Model of Health Services Use as a guide for selecting predictor variables.[32] The model has been used extensively in studies on healthcare-seeking behavior. It assumes that a person's preference for service use is affected by three types of factors, including predisposing, enabling, and need factors. The predisposing factors refer to sociodemographic variables, therefore, participants' gender (male/female), age (60–70/70–80/≥80), education (elementary school and below/junior high school/senior high school or technical secondary school/college or university and above), living arrangement (alone/with a spouse only/with children or others) were included in this study. The enabling factors included resources that can inhibit or promote the service usage; hence, resident city (Chengdu/Jiaozuo/Wuxi), income per month (≤2000/2000–5000/≥5000), and access to medication (yes/no/unclear) were included. The need factors mean the demand for the services; thus, self-care capability (full capability/impaired or no capability) and the number of chronic diseases (≤1/2–3/≥3) were included.

Access to medication in the study refers to the physical accessibility, ie, the availability and geographical accessibility of medicines for those who need them for rational use. The variable could reflect the service resources and supply abilities in the living surroundings of older adults, which may further affect the choices of older adults. It was measured by "Could you obtain the essential medicines of common and frequently occurring diseases or chronic diseases from any institutions in your communities?". Responses included "Yes", "No", and "Unclear". Self-care capability in the study was defined as the capability to care for oneself independently and integrate self-care activities into daily life, which was reported by the participants themselves. Responses included "Full capability", "Impaired capability", and "No capability". The last two choices were combined with "Impaired or no capability" in the final data analysis of the study. Number of chronic diseases obtained from a multiple-choice question "Have you ever been diagnosed with one of the following diseases?". Responses included "No", "Cardiovascular disease", "Diabetes mellitus", "Cancer", "Osteoarthritis", and "Others, please clarify". We further incorporated each response of participants to categorical variables for assessing individuals' number of chronic diseases.

The Preferred Care Pattern

The preferred care pattern was determined by the question, "Which type of integrated health care and social care would you prefer to choose? (for each care type, please select the one that you most prefer)". The responses were categorized as follows: (a) Home-based health care, (b) Community-based health care, (c) Home-based social care, (d) Community-based social care, and (e) Institution-based health and social care. As mentioned, participants are required to choose one single option between "a" and "b", as well as between one single option "c" and "d". According to different combinations of responses, five preferred care patterns were identified as mentioned in the background section, including "Home-based health and social care", "Community-based health and social care", "Home-based health care but community-based social care", "Community-based health care but home-based social care", and "Institution-based health and social care". In the current study, home-based care only means formal domestic care provided by professionals, community-based care singly contains temporary daycare or community respite care, while institution-based care is related to the admissions of residential institutions for either healthcare services or social care services. Such classification could ensure the coverage of each integration between different care delivery settings and care services; thus, those patterns were mutually exclusive.

Data Analysis

Frequency and percentage were used to describe the sample characteristics, and the distribution of older adults with different preferred care patterns was compared using the Chi-square (χ^2) test.

Multivariate logistic regression (MLR) analysis and a random forest (RF) model were adopted to obtain reliable results on the predictor variables of preferred care patterns. MLR was conducted to test the effect direction and relative hazard of model variables associated with older adults' preferred care patterns. The odd ratio (OR) and 95% confidence interval (95% CI) values for the MLR model were reported. ORs are presented as measures of effect size in the study, as they quantify the strength of association between predictor variables and the binary outcome. An Odds Ratio quantifies

the change in odds of an outcome occurring (eg, success vs failure) associated with a one-unit change in a predictor variable. The prior reason for reporting OR values is to compare it to the zero-order correlation and emphasize the instances when a predictor's relationship to the outcome is reversed in the MLR model.[33] RF was employed to classify the herniorrhaphy approach. Via using stochastic discrimination, patterns amongst individually weak components could be identified.[34] This type of predictive modeling creates multiple decision trees including a random subset of variables, which assimilate into an RF. The RF model represents the average of all the individual decision trees used to classify an outcome (ie, herniorrhaphy approach).[35] Bootstrap aggregation (aka bagging) was adopted, which replaces some of the data points in each decision tree with different data points from the original dataset. Monte Carlo sampling was used to determine which factors showed the largest variable importance (VI) when predicting the preferred care patterns in the RF model.[36] If variation in a particular factor caused high variability of the predicted response, that factor was considered highly important relative to the model (ie, a larger VI).[36]

Prediction performances of the two models were also assessed in the study. The overall predictive accuracy of the MLR and RF at classifying herniorrhaphy approach was determined by the performance metrics including the area under the curve (AUC) of the receiver operator characteristic (ROC). An AUC between 0.7–0.8 is considered acceptable, 0.8–0.9 is considered excellent, and more than 0.9 is considered outstanding.[37]

Statistical significance in the differences would be confirmed in the case of $p<0.05$. Data analyses were performed with JMP® Pro software, Version 14.2 of the SAS® System for Windows®. Copyright © 2018 SAS Institute Inc., Cary, NC, USA.

Results

Characteristics and Preferred Care Patterns of the Sample

Table 1 shows the descriptive data for the five subgroups of preferred care patterns among participants. Of the total sample of 1184, nearly half of the participants (47.7%, N=565) prefer the pattern of Home-based health and social care, and approximately one-quarter (25.6%, N=303) prefer Community-based health and social care, followed by the pattern of Institution-based health and social care (14.4%, N=171). A relatively minority of individuals reported a preference for Home-based health care but community-based social care (8.0%, N=95) and Community-based health care but home-based social care (4.2%, N=50). For predisposing factors, the majority were female (55.6%, N=658), and most aged between 60 and 70 years old (47.5%, N=562), the majority owned an elementary school or below education (49.7%, N=588). A relatively small part was living alone (18.8%, N=222). For enabling factors, most of the participants were residing in Chengdu (40.46%, N=479), followed by the participants in Jiaozuo (37.3%, N=442) and Wuxi (22.2%, N=263). More than half of the participants were with income per month ≤2000 (55.3%, N=655). A great number of participants have access to medication (87.8%, N=1039). For need factors, most individuals reported that they have full self-care capability (74.5%, N=882), and most declared they have only one or below chronic disease (63.1%, N=747).

Predictor Variables of Preferred Care Patterns and Variable Importance

Table 2 shows the influences of individuals' predisposing factors, enabling factors, and need factors on preferred care patterns among participants. Compared with Home-based health and social care, MLR indicated that in terms of predisposing factors, male has a lower preference for Community-based health and social care (OR=0.584, 95% CI=0.427–0.799), as well as those aged ≥80 showed a lower preference for Community-based health and social care (OR=0.592, 95% CI=0.354–0.990) but were more willing to choose Institution-based health and social care (OR:1.856, 95% CI=1.095–3.147). Participants with senior high school/technical secondary school education are more willing to choose Community-based health and social care (OR: 2.114, 95% CI=1.357–3.291), while those with college/university or above education are more willing to choose Institution-based health and social care (OR:3.389, 95% CI=1.674–6.858). Older adults living with a spouse only (OR: 4.098, 95% CI=1.571–10.692) and living with children or others (OR: 2.816, 95% CI=1.058–7.495) are both more likely to choose Home-based health care but community-based social care, and, also, both of the two groups showed a lower preference on Institution-based health and social care (OR=0.286, 95% CI=0.176–0.466; OR=0.311, 95CI%=0.190–0.511). In terms of enabling factors, older adults in Jiaozuo city were more

Table 1 Characteristics and Preferred Patterns of the Sample

Independent variable	All participants (N=1,184)	Subgroups of Preferred Patterns (N, %)					χ^2	p
		Home-Based Health and Social Care (N=565, 47.7%)	Community-Based Health and Social Care (N=303, 25.6%)	Home-Based Health Care But Community-Based Social Care (N=95, 8.0%)	Community-Based Health Care But Home-Based Social Care (N=50, 4.2%)	Institution-Based Health And Social Care (N=171, 14.4%)		
Predisposing factors								
Gender							10.082	0.0391
Male	526(44.4)	260(46.0)	113(37.3)	49(51.6)	21(42.0)	83(48.5)		
Female	658(55.6)	305(53.9)	190(62.7)	46(48.4)	29(58.0)	88(51.5)		
Age							55.947	<0.001
60–70	562(47.5)	256(45.3)	171(56.4)	53(55.8)	27(54.0)	55(32.2)		
70–80	411(34.7)	201(35.6)	106(35.0)	31(32.6)	13(26.0)	60(35.1)		
≥80	211(17.8)	108(19.1)	26(8.6)	11(11.6)	10(20.0)	56(32.8)		
Education							67.864	<0.001
Elementary school or below	588(49.7)	326(57.7)	120(39.6)	46(48.4)	23(46.0)	73(42.7)		
Junior high school	272(23.0)	121(21.4)	72(23.8)	26(27.4)	16(32.0)	37(21.6)		
Senior high school /technical secondary school	182(15.4)	69(12.2)	70(23.1)	16(16.8)	8(16.0)	19(11.1)		
College/university or above	142(12.0)	49(8.7)	41(13.5)	7(7.4)	3(6.0)	42(24.6)		
Living arrangement							109.416	<0.001
Alone	222(18.8)	94(16.6)	38(12.5)	5(5.3)	7(14.0)	78(45.6)		
With a spouse only	516(43.6)	238(42.1)	149(49.8)	54(56.8)	28(56.0)	47(27.5)		
With children or others	446(37.7)	233(41.2)	116(38.3)	36(37.9)	15(30.0)	46(26.9)		
Enabling factors								
Resident city							118.329	<0.001
Chengdu	479(40.5)	296(52.4)	98(32.3)	42(44.2)	14(28.0)	29(17.0)		
Jiaozuo	442(37.3)	144(25.5)	160(52.8)	32(33.7)	24(48.0)	82(48.0)		
Wuxi	263(22.2)	125(22.1)	45(14.6)	21(22.1)	12(24.0)	60(35.1)		
Income per month (RMB)[a]							62.34	<0.001
≤2000	655(55.3)	333(58.9)	168(55.5)	53(55.8)	23(46.0)	78(45.6)		
2000–5000	444(37.5)	207(36.6)	113(37.3)	41(43.2)	25(50.0)	58(33.9)		
≥5000	85(7.2)	25(4.4)	22(7.3)	1(1.1)	2(4.0)	35(20.5)		
Access to medication							33.812	<0.001
Yes	1039(87.8)	509(90.1)	268(88.5)	88(92.6)	45(90.0)	129(75.4)		
No	53(4.5)	26(4.6)	11(3.6)	1(1.1)	2(4.0)	13(7.6)		
Unclear	92(7.8)	30(5.3)	24(7.9)	6(6.32)	3(6.0)	29(17.0)		

(*Continued*)

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Table 1 (Continued).

Independent variable	All participants (N=1,184)	Subgroups of Preferred Patterns (N, %)					χ^2	p
		Home-Based Health and Social Care (N=565, 47.7%)	Community-Based Health and Social Care (N=303, 25.6%)	Home-Based Health Care But Community-Based Social Care (N=95, 8.0%)	Community-Based Health Care But Home-Based Social Care (N=50, 4.2%)	Institution-Based Health And Social Care (N=171, 14.4%)		
Need factors								
Self-care capability							43.801	<0.001
Full capability	882(74.5)	384(68.0)	264(87.1)	78(82.11)	38(76.0)	118(69.0)		
Impaired or no capability	302(25.5)	181(32.0)	39(12.9)	17(17.89)	12(24.0)	53(31.0)		
Number of chronic diseases							18.884	0.0155
≤1	747(63.1)	348(61.6)	216(71.3)	56(58.95)	30(60.0)	97(56.7)		
2–3	410(34.6)	198(35.0)	83(27.4)	38(40.00)	19(38.0)	72(42.1)		
≥3	27(2.3)	19(3.4)	4(1.3)	1(1.05)	1(2.0)	2(1.2)		

Note: [a]1000 RMB is worth approximately 140.05 US dollars as of December 1, 2023.

Table 2 Result of the Multivariate Logistic Regression Model (Reference=Home-Based Health and Social Care)

Independent Variables	Community-Based Health and Social Care			Home-Based Health Care But Community-Based Social Care			Community-Based Health Care But Home-Based Social Care			Institution-Based Health and Social Care		
	β	p	OR (95% CI)	β	p	OR (95% CI)	β	p	OR (95% CI)	β	p	OR (95% CI)
Predisposing factors												
Gender (Ref: female)												
Male	−0.537	0.001	0.584(0.427–0.799)	0.168	0.470	1.183(0.750–1.864)	−0.285	0.358	0.752(0.410–1.381)	0.109	0.587	1.115(0.753–1.650)
Age (Ref: 60–70)												
70–80	−0.046	0.788	0.955(0.682–1.337	−0.294	0.252	0.745(0.450–1.233)	−0.510	0.161	0.600(0.294–1.225)	0.269	0.249	1.249(0.828–2.069)
≥80	−0.524	0.046	0.592(0.354–0.990)	−0.354	0.340	0.702(0.339–1.452)	0.094	0.822	1.099(0.485–2.490)	0.618	0.022	1.856(1.095–3.147)
Education (Ref: Elementary school or below)												
Junior high school	0.223	0.274	1.250(0.838–1.866)	0.126	0.661	1.135(0.645–1.998)	0.224	0.546	1.251(0.605–2.589)	0.212	0.416	1.236(0.741–2.063)
Senior high school /technical secondary school	0.748	0.001	2.114(1.357–3.291)	0.220	0.525	1.246(0.633–2.452)	0.079	0.864	1.082(0.439–2.671)	0.032	0.922	1.033(0.539–2.063)
College/university or above	0.372	0.206	1.451(0.815–2.581)	0.079	0.871	1.082(0.418–2.800)	−0.524	0.462	0.607(0.151–2.443)	1.220	0.001	3.389(1.674–6.858)
Living arrangement (Ref: alone)												
With a spouse only	0.462	0.059	1.587(1.001–2.516)	1.410	0.004	4.098(1.571–10.692)	0.510	0.263	1.665(0.681–4.070)	−1.251	0.000	0.286(0.176–0.466)
With children and others	0.122	0.612	1.130(0.705–1.811)	1.035	0.038	2.816(1.058–7.495)	−0.103	0.833	0.902(0.345–2.357)	−1.167	0.000	0.311(0.190–0.511)
Enabling factors												
Resident city (Ref: Chengdu)												
Jiaozuo	0.050	0.824	1.052(0.676–1.636)	0.396	0.145	1.486(0.873–2.529)	1.411	0.000	4.099(1.990–8.445)	2.032	0.000	7.627(4.555–12.771)
Wuxi	1.245	0.000	3.473(2.446–4.930)	0.095	0.754	1.099(0.608–1.987)	0.540	0.204	1.716(0.746–3.948)	1.260	0.000	3.525(2.008–6.190)
Income per month (RMB) [a] (Ref: ≤2000)												
2000–5000	0.092	0.603	1.096(0.776–1.548)	0.119	0.638	1.126(0.687–1.845)	0.698	0.036	2.009(1.048–3.853)	0.425	0.065	1.529(0.974–2.401)
≥5000	0.786	0.039	2.195(1.042–4.625)	−1.364	0.207	0.256(0.031–2.128)	0.706	0.417	2.026(0.368–11.161)	0.964	0.028	2.623(1.108–6.211)
Access to medication (Ref: yes)												
No	−0.121	0.759	0.886(0.410–1.915)	−1.500	0.147	0.223(0.029–1.691)	−0.059	0.939	0.943(0.210–4.241)	0.822	0.049	2.276(1.004–5.158)
Unclear	0.348	0.250	1.416(0.783–2.562)	0.240	0.614	1.271(0.500–3.231)	0.130	0.838	1.139(0.326–3.984)	0.909	0.007	2.482(1.284–4.797)
Need factors												
Self-care capability (Ref: Impaired or no capability)												
full capability	−0.865	0.000	0.421(0.276–0.643)	0.271	0.245	1.312(0.830–2.074)	−0.361	0.340	0.697(0.332–1.463)	−0.796	0.010	0.451(0.246–0.827)
Number of chronic diseases (Ref: ≤1)												
2–3	−0.029	0.871	0.971(0.682–1.383)	0.427	0.094	1.533(0.933–2.521)	0.223	0.506	1.249(0.648–2.408)	0.128	0.559	1.137(0.739–1.749)
≥3	−0.892	0.134	0.410(0.128–1.317)	−0.880	0.404	0.415(0.052–3.279)	−0.482	0.654	0.618(0.075–5.092)	−1.309	0.114	0.270(0.053–1.370)

Notes: [a]1000 RMB is worth approximately 140.05 US dollars as of December 1, 2023.
Abbreviations: β, coefficient; OR, odds ratio; CI, confidence interval; Ref, Reference.

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likely to choose the patterns of Community-based health care but home-based social care (OR=4.099, 95% CI=1.990–8.445) and Institution-based health and social care (OR=7.627, 95% CI=4.555–12.771). Their counterparts in Wuxi showed a higher preference for Community-based health and social care (OR=3.473, 95% CI=2.446–4.930) and Institution-based health and social care (OR=3.525, 95% CI=2.008–6.190). Older adults with income per month between 2000 and 5000 are more likely to receive Community-based health care but home-based social care (OR=2.009, 95% CI=1.048–3.853), while those with income per month more than 5000 would like to choose Community-based health and social care (OR=2.195, 95% CI=1.042–4.625) or Institution-based health and social care (OR=2.623, 95% CI=1.108–6.211). Individuals with no (OR=2.276, 95% CI=1.004–5.158) or unclear (OR=2.482, 95% CI=1.284–4.797) access to medication showed a higher preference for Institution-based health and social care. In terms of need factors, the full self-care capability was associated with a lower preference for Community-based health and social care (OR=0.421, 95% CI=0.276 to 0.643) and Institution-based health and social care (OR=0.451, 95% CI=0.246 to 0.827). All the p values are significant.

The RF model included 9 predictors. Overall, the results agreed with the MLR model results. Education, living arrangement, age, resident city, and income per month were the most relevant predictors, followed by the individuals' gender, number of chronic diseases, self-care capability, and access to medication (Figure 1).

Prediction Performance of the Multivariate Logistic Regression and Random Forest

The full performance characteristics of the two models are shown in Figure 2. The predictive accuracy for classifying each preferred pattern in the MLR model is as follows: AUC 0.71 (Home-based health and social care), AUC 0.71 (Community-

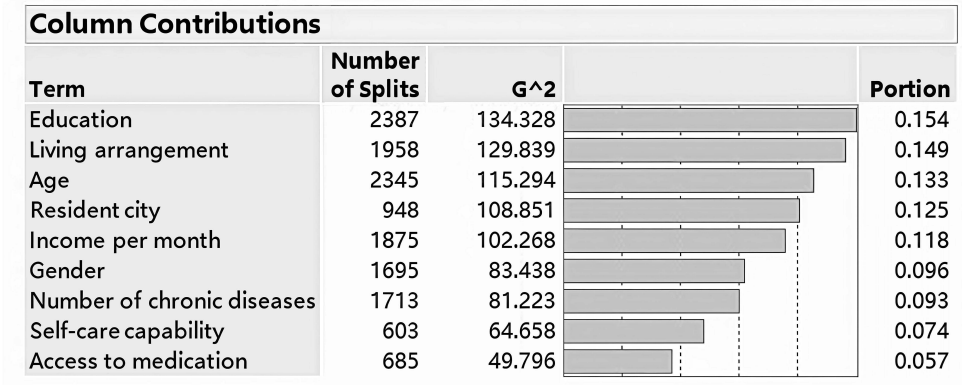

Figure 1 Variable Importance for Each Factor Used in the Random Forest Model.

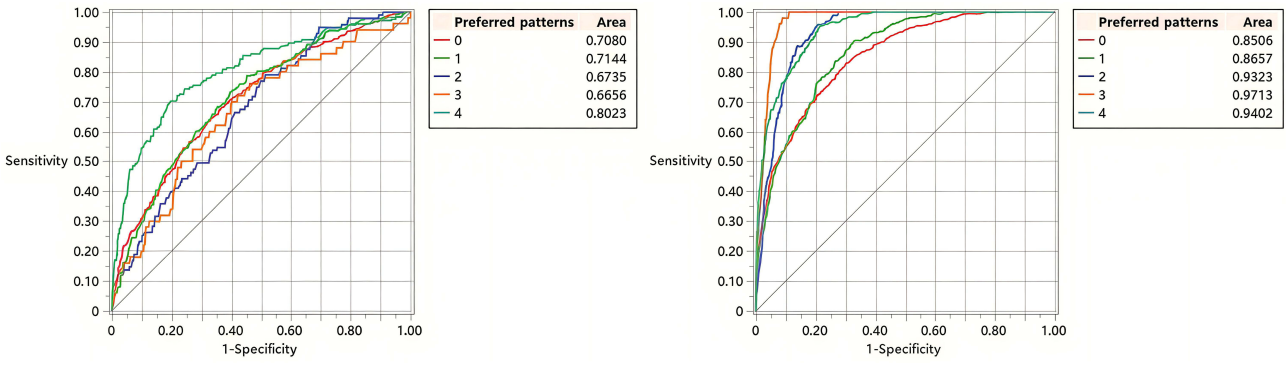

Figure 2 Receiver Operating Characteristic (ROC) Curve of the Multivariate Logistic Regression Model and Random Forest Model (Note: 0=Home-based health and social care; 1=Community-based health and social care; 2=Home-based health care but community-based social care; 3=Community-based health care but home-based social care; 4=Institution-based health and social care; Area means AOC score).

based health and social care), AUC 0.67 (Home-based health care but community-based social care), AUC 0.67 (Community-based health care but home-based social care), and AUC 0.80 (Institution-based health and social care). The RF model showed relatively higher predictive accuracy for classifying each preferred pattern: AUC 0.85 (Home-based health and social care), AUC 0.87 (Community-based health and social care), AUC 0.93 (Home-based health care but community-based social care), AUC 0.97 (Community-based health care but home-based social care), and AUC 0.94 (Institution-based health and social care). Overall, the AUC scores confirmed that the RF model best represented our data.

Discussion

In the present study, most participants selected Home-based health and social care as the preferred care pattern, followed by the pattern of Community-based health and social care. Corresponding with most previous findings,[10,21,38–40] the findings highlighted the importance of home- and community-based care again. Gender, age, education, living arrangement, resident city, income per month, access to medication, and self-care capability were significantly associated with preferred care patterns among older adults. Education level, living arrangement, age, and resident city were the most important features for predicting care patterns in the RF model. In addition, the RF model showed relatively higher prediction performances in the current study. This research might contribute to understanding how to harness the care delivery system to meet the complicated and personalized demands of older adults better.

Concerning the predisposing factors, the male gender is more likely to choose Home-based health and social care. Previous reports on the association between gender and care preference are inconsistent, with some showing no association and others demonstrating a higher preference for institutional care of males.[41,42] Such inconsistencies may be attributed to different compositions in each cohort. In the current sample, most participants have the full self-care capability and have only one or no disease, ie, they are in relatively good health condition and mostly able to take care of themselves. Under the circumstances, males have been confirmed to be more conservative in choosing care patterns,[41] and thus would like to choose the home-based care pattern in the Chinese context. Additionally, yet females tend to live longer than males, they have been confirmed to be more vulnerable to geriatric conditions.[43] Institutional care with more advanced resources might be preferred by females. Besides, participants aged 80 or above displayed a higher preference for Institution-based health and social care, as age was the third most relevant factor according to the RF model. Age has been confirmed to be a strong and consistent predictor of admission to institutional care.[42,44] As a consequence of increased longevity, a great share of older adults at advanced ages may suffer from more risk factors such as physical impairments and non-communicable diseases. With the potentially increasing care demands, they may therefore rely more heavily upon institutional care. Higher education levels are associated with Community- or Institution-based health and social care. Education was also identified as the most influencing factor in the RF model. According to previous literature, individuals with higher education levels may be related to higher ideologies and acceptance of new things with the rise of fresh concepts and care delivery modes.[45] Therefore, they are more likely to change their cognition to access care in community- or specifically institution-based settings. Living arrangement, as the second most important variable, might bring about great impacts on individual preferences. Individuals living with a spouse only or children and others tend to choose the pattern of Home-based health care but community-based social care. Given that Confucianism emphasizes collectivist culture and harmonious interdependence in a family, older adults may still prefer to stay with family members at home and receive necessary services like medical-related services in home-based settings. However, they may also have some needs for social activity or participation, therefore, they prefer the integration of Home-based health care and community-based social care. Reversely, older adults living alone often lack informal caregiving resources so they tend to actively seek external help, such as choosing to be admitted to a residential institution to attain care resources.[46] In this scenario, it is particularly important to take such disparities into account about individual preferences when delivering care services, and especially it is crucial to give emphasis to the vulnerable subgroups (eg, those with lower education levels or those living alone) and allow to better calibrate the allocation of care resources for older adults.

Regarding enabling factors, when compared with their counterparts in Chengdu, samples in Wuxi are more likely to prefer the pattern of Community- or Institution-based health and social care. Resident city is also the fourth most relevant variable. This might be caused by regional policy initiatives. Chengdu has acted on a policy named "Health Knocking

Action" (*Jian-Kang-Qiao-Men-Xing-Dong),*[47] aiming to encourage family doctor teams in primary healthcare centers to provide more home-based medical services for older adults; meanwhile, most home-visiting service items could be covered by the UEBMI or URRBMI to a large extent. Combined with the LTCI covering most home-based social care, it possibly explained the higher preference for Home-based health and social care among older residents in Chengdu. However, Wuxi aimed to direct primary healthcare centers to construct affiliated nursing homes for providing post-acute and long-term health, as a supplement to their medical function.[48] And the city gave relative incentives, such as taking per-diem payment way for providing a fixed amount for a single day in the affiliated nursing home, regardless of the nursing home's charges or costs incurred for caring for that particular individual, which encouraged older adults to access care in primary healthcare centers in their communities. Additionally, older citizens in developed regions always showed higher awareness and affordability for institutional care.[22,49] Wuxi is in an economically developed area in eastern China, which may explain the higher preference for institutional care in the city. However, Jiaozuo has not established the LTCI and has not included home-based health services in their basic medical insurance coverage. Older adults in Jiaozuo have to obtain health services in primary care centers of their communities or other health institutions for getting reimbursements. Meanwhile, Jiaozuo is in the Central Plain *(Zhongyuan)* Area of China, which formed the basis of the Chinese civilization that many are familiar with today. Therefore, older adults in Jiaozuo might be influenced more by the traditional culture of "Aging at home". These might illustrate the higher preference for Community-based health care but home-based social care in Jiaozuo. Individuals with higher incomes might prefer the pattern of Institution-based health and social care, corresponding to a great number of existing studies. As a kind of attractiveness, residential institutions often advertise some high-quality or distinctive services, while most of those services require some additional payment. Older adults with higher economic status may pursue the pattern due to their strong ability to pay for such services.[50,51] No or unclear access to medication in living surroundings is related to a higher preference for Institution-based health and social care. Access to medication is a key dimension of assessing the service supply ability of healthcare systems and may be related to older adults' concerns regarding unpredictable health events and complications of chronic diseases.[49] The nature of home and community-based care service provision relies on resources in the community, beyond individual characteristics. Lack of access to medication for community-dwelling older adults might result in increased preventable morbidity and mortality.[52] When individuals have the same degree of health problems, the difference between being able to remain independent at home with assistance and having to find alternative institutional accommodations can be explained by community resource circumstances. Since many countries have opted to shift the site of healthcare provision from hospitals to home and community settings, such evidence implies that policymakers and care providers should contribute to improving resource accessibility in strengthening the capacity of home and community care.

In terms of need factors, self-care capability showed a lower preference in Community- and Institution-based health and social care, corresponding with a lot of previous evidence.[21,23,49,53] Self-care capability largely determines the needs of older adults. Impaired or no self-care capability may decline individuals' activity abilities due to the deterioration of physical function and increased incidence of diseases. Home- or community-based care is not always sufficient to manage the complicated needs or solve urgent health conditions of those with impaired or no self-care capability, while institution-based care may have the adequate staff and resources to attend to older adults' urgent health issues that may arise, as well as daily functional needs. In the current study, an absence of significant associations between the number of chronic diseases and preferred care patterns was observed according to the MLR model. Even though such absence could be supported by results obtained by other researchers,[10,46,53] older adults with more chronic diseases did affect their care demands by causing severe cognitive function decline and higher degrees of disability.[54] Our findings could be explained by the within-sample imbalance distribution for the variables of the number of chronic diseases (individuals with 3 or above chronic diseases only account for 2.3%). Under such circumstances, the ability of the regression analysis might be limited to identify the relationship between the variable and preference choices.

The RF model is more robust than the MLR model in the study. One limitation of MLR is when multiple variables with correlations are included, serious deviation would be generated and lead to overfitting.[26] The predictor variables of preferred care patterns are of multiple correlation and interaction in this study. The RF analysis, however, uses a nonparametric decision tree approach for noise immunity, prevention of overfitting, and independence from co-linearity. As an ensemble-based machine learning algorithm, it applies multiple de-correlated decision trees to make

a prediction, and the tree-based model can be resistant to correlative variables. At a high-dimensional level, it works by randomly shuffling data for one feature at a time over the entire data set and calculating how much the performance metric of interest drops. Therefore, it performed better accuracy in the current study.

Limitations

We acknowledge several limitations. First, it was only possible to assess the care preference of the population at one point in time since the study design was cross-sectional and therefore unable to observe the dynamic changes in preferred care patterns among older adults over time. Given the rapidly changing health condition of older adults, further longitudinal designs are suggested to explore the developmental trend and preference transition of integrating care among older adults. Second, this study investigated mainly the community-dwelling older adults and excluded some with cognitive impairment or communication/hearing difficulties, resulting in a potentially biased sample and an overlook of severe care needs. Further study is expected to include a less biased sample. Besides, regional variations, cultural differences, and sample imbalances (eg, chronic disease distribution) may affect the generalizability of the study, therefore, large-scale sampling would be necessary for further exploration. Third, as the current study was based on the self-reported approach, such information as the self-care capacity, or the number of chronic diseases were not validated by professionals and therefore might be underreported. It is necessary to combine subjective and objective indicators in the future to conduct a comprehensive evaluation of the personal condition of older adults. Despite these limitations, our study does have several implications.

Conclusion

In the current study, home-based integrated care is the predominant pattern of Chinese older adults, followed by community-based care. The findings remind us that at the present stage, the government should be committed to establishing a multi-level service system based on home and community care and supplemented by institutional care. In the future, policies might be expected to respect the cultural preference for "Aging at Home" or "Aging in Place" and more efforts and incentives should be provided to home- and community-based integrated care delivery. In addition to establishing and developing professional home and community care facilities, the system should also be designed to support family or informal caregivers through training programs, financial incentives, or respite services. Beyond these, in developed areas, expanding institutional care is also essential since it may meet the needs of more affluent older adults seeking specialized services as a potential alternative. These combined efforts would help to create a more equitable and culturally appropriate care system. Gender, age, education, living arrangement, resident city, income per month, access to medication, and self-care capability are significantly associated with older adults' preferences. The related factors reported could assist in developing tailored interventions for delivering services more efficiently. The policymakers should prioritize funding and resource allocation to vulnerable populations and less developed regions (eg, central and western areas in China). These groups or areas often face systemic challenges, including inadequate access to healthcare and social services, lower economic status, and limited infrastructure. The government could implement targeted interventions for providing more responsive care, for instance, supporting older adults living alone or with limited mobility, expanding training programs for informal caregivers, investing in training health care and social care workers in underserved areas, encouraging deeper partnerships between providers of health care and social care.

Abbreviations

STROBE, the Strengthening the Reporting of Observational Studies in Epidemiology; MLR, Multivariate logistic regression; RF, Random forest; OR, Odd ratio; CI, Confidence interval; VI, Variable importance; AUC, Area under the curve; ROC, Receiver operator characteristic.

Data Sharing Statement

Further information and requests for data could be directed to and will be fulfilled by the corresponding author.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare that they have no competing interests.

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