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Hierarchical Analysis of Rural Elderly Care Service Demand Based on Kano Model: A Case Study of a Province in central China

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Abstract

Background

This study aimed to investigate the demand for elderly care services among rural seniors in Shanxi Province and to clarify the hierarchy of care service demands and their influencing factors to guide the optimization of elderly care.

Methods

A questionnaire survey using multi-stage sampling assessed expectations, dependence, and importance of various service demands based on the Kano model. Descriptive statistics, factor analysis, and multiple regression were used to identify the hierarchical demand levels and related factors.

Results

The results showed that the Average Satisfaction Coefficient (ASC) for rural elderly care service demands ranked highest for health care services (0.426 ± 0.072), followed by psychosocial support services (0.390 ± 0.055) and living support services (0.232 ± 0.094). Within these, the hierarchy from highest to lowest ASC were health management and prevention (0.474 ± 0.023), psychosocial support (0.390 ± 0.055), professional medical care (0.353 ± 0.054), emergency and assistance support (0.300 ± 0.075), and basic daily support (0.165 ± 0.023). Positive influencing factors included income, educational attainment, exercise frequency, and number of chronic diseases, while negative factors included activities of daily living impairment, depression symptoms, self-rated health status, long distance to services, and limited caregiver capacity.

Conclusions

Health management and prevention constitute primary demands for rural elderly populations. Addressing aging challenges requires prioritizing health-centered care systems, enhancing service accessibility, and encouraging healthy lifestyles and social participation. Family members should also strengthen caregiving responsibilities to help build an age-friendly society.

1 Background

China is confronting the profound challenge of population aging, which is characterized by its massive scale, accelerated pace, and regional disparities. According to the *2023 National Report on Aging Development of China*, the number and proportion of the elderly population in China is increasing annually, and the elderly population aged 60 + years will reach 297 million by end-2023, accounting for 21.1% of the total population, while those aged 65 + years will number 217 million, accounting for 15.4%

[1]. These figures significantly surpass the internationally recognized aging thresholds (10% and 7%, respectively), indicating that aging has evolved from a social phenomenon to an urgent societal challenge [2]. Compounding this issue is the reality of “aging before affluence”, which is particularly pronounced in rural areas. The *Seventh National Population Census* of China revealed that 23.81% of the rural population was aged 60 + years and 17.72% was aged 65 + years, surpassing the urban figures by 7.99 and 6.61 percentage points, respectively [3]. Since the reform era, rapid industrialization and urbanization in China have spurred rural-to-urban migration, depleting working-age adults in rural areas and intensifying elderly care burdens [4]. Projections indicate that the rural old-age dependency ratio will increase to 79.9% by 2030 and 94.7% by 2050 [5]. In addition, problems such as limited income sources, inadequate public elderly care support, and diminished family care capacity among rural elderly residents have further exacerbated the burden of elderly care. These constraints also make it difficult to meet the elderly care needs of rural residents; therefore, rural elderly face more severe elderly care problems.

Shanxi Province is likely to face exacerbated aging challenges due to its distinct socioeconomic context. According to the latest survey data from the Shanxi Provincial Bureau of Statistics, 22.61% of its resident population will be aged 60 + by the end of 2024, which is marginally higher than the national average [6]. Constrained by its consistently bottom-middle tier GDP ranking nationwide, the province possesses limited fiscal capacity to develop its social elderly care service system. Moreover, the coal-centric economic structure has created derivative problems across most regions, including environmental pollution, ecological degradation, and severe occupational health risks [7]. Compounding this pressure is household downsizing, with the average number of residents per household falling to 2.52 [8], which substantially erodes the traditional capacity of families to buffer the impact of aging. Consequently, rural elderly care challenges in Shanxi manifest as multidimensional complexities, demanding urgent governmental intervention through targeted policies and coordinated measures. However, in economically underdeveloped areas, such as rural regions, the inadequate provision of social care resources constrains the fulfillment of elderly needs. Thus, precise alignment of limited societal resources with heterogeneous service demands remains imperative.

The Kano model, a well-established demand analysis framework introduced by Japanese scholar Noriaki Kano in 1984 [9], has been extensively applied to customer satisfaction [10] and product quality management [11]. By categorizing demand attributes into Must-be, One-dimensional, Attractive, Indifferent, and Reverse elements, this model effectively identifies nonlinear relationships between service demand and user satisfaction, while quantifying the impact intensity of distinct services on satisfaction levels. In elderly care research, the Kano model provides a scientific foundation for precisely discerning hierarchical and heterogeneous service demands among the elderly, thereby facilitating the optimization of elderly care supply systems [12]. Building on the Kano model framework, we created a survey to administer to the rural elderly in Shanxi Province from the perspective of demand. In this study, we aimed to investigate the demand for elderly care services among rural seniors in Shanxi Province and to clarify the hierarchy of care service demands and their influencing factors to guide the optimization of elderly care.

2 Methods

2.1 Questionnaire Survey

2.1.1 Study Participants and Sampling

A questionnaire survey was conducted among elderly residents aged 60+ in rural Shanxi from December 2023 to October 2024, employing a multi-stage sampling design. The province is stratified into three macro-regions based on its geographic and socioeconomic profiles: Northern, Central, and Southern Shanxi. After allocating the initial samples proportionally to regional populations, we randomly selected prefecture-level cities within each region. Subsequently, stratified sampling was implemented in each city based on the population size and economic conditions, and towns and villages were randomly selected as survey units. Specifically, in Northern Shanxi, five districts/counties were sampled from Datong City. From each district/county, two towns were randomly selected, and two or three villages were randomly selected from each town, yielding a total of 1,111 valid samples. In the southern part, seven districts/counties from Yuncheng City provided two towns per unit and three villages per town, obtaining 1,738 valid samples. In the central area, three districts/counties each from Jinzhong and Lüliang Cities resulted in two towns per unit and two villages per town, collecting 969 valid samples. Ultimately, 3,818 valid questionnaires were obtained.

2.1.2 Survey Contents

A cross-sectional survey was conducted, with the content including:

(1) Basic personal information: including demographic characteristics, living conditions, educational attainment, health status, etc.

(2) Social capital level: evaluated using a social capital scale specifically developed for middle-aged and older adults. This scale encompasses five dimensions–individual, family, association, community, and macro–comprising 14 items. Items were rated on a Likert 5-point scale, with higher scores indicating a higher level of social capital.

(3) Activities of Daily Living (ADL) [13]: Assessed using the ADL scale comprising 14 items. Items are rated on a 4-point scale: 1 (complete independence), 2 (with some difficulty), 3 (requires assistance), and 4 (unable to perform). A score >1 on any item indicates impairment in that activity, while a total score >14 defines overall ADL impairment.

(4) Depressive Symptoms: Assessed using the 5-item Geriatric Depression Scale Short Form (GDS-5) [14], an instrument developed by Hoyl et al. as an abbreviated version of the 15-item Geriatric Depression Scale (GDS-15) [15]. Higher scores indicate greater severity of depressive symptoms. A score ≥2 indicates the presence of depressive symptoms.

(5) Demand for Elderly Care Services: Categorized into three core dimensions–living support, healthcare, and psychosocial support services–encompassing 36 specific service items. The questionnaire employed the Kano model, translating service demands into paired functional and dysfunctional questions, to identify demand attributes across service categories.

The questionnaire's reliability was tested using Cronbach's α coefficient. The overall scale achieved α=0.965, with functional and dysfunctional items scoring α=0.962 and 0.975, respectively. Reliability coefficients for each service dimension were: living support (functional α=0.907, dysfunctional α=0.934), health care (functional α=0.950, dysfunctional α=0.965), and psychosocial support (functional α=0.929, dysfunctional α=0.945). All Cronbach's alpha values exceed the acceptable threshold of 0.7, indicating good reliability. Validity was confirmed through factor analysis; the Kaiser–Meyer–Olkin Measure of Sampling Adequacy (KMO) [16] reached 0.977 (>0.7), and Bartlett's Test of Sphericity [17] was statistically significant (P<0.001), establishing good validity.

2.1.3 Quality Control

The questionnaire was developed based on the research objectives through an extensive review of relevant literature and policy documents supplemented by expert consultations. Before the formal research, feedback was collected through a pre-survey, and the content of the questionnaire was revised and improved accordingly to ensure that it was highly scientific and targeted. All investigators were systematically trained to master the questionnaire's content, communication skills, and implementation protocols. After the questionnaires were completed, they were checked in a timely manner to confirm whether they were complete and correct, ensuring the standardization, completeness, and accuracy of data collection. Data management involved double data entry using EpiData 3.0 with cross-validation to ensure accuracy, whereas statistical analyses strictly adhered to methodological principles using appropriate analytical techniques.

Participant Inclusion Criteria: Permanent rural residents aged ≥60 years; continuous residency in selected townships/villages for ≥6 months; adequate communication capacity to comprehend survey items and respond independently or with interviewer assistance; voluntary participation with signed informed consent. Exclusion Criteria: Individuals with severe cognitive/psychiatric impairments, profound hearing/visual deficits, or other conditions precluding survey cooperation; those providing substantially incomplete or logically inconsistent responses that compromised data validity; and non-resident populations (temporary residents, visitors, migrant workers, etc.).

2.2 Kano Model

The Kano Model, developed by Professor Noriaki Kano of the Tokyo University of Science [18], was initially applied in product quality development within the manufacturing industry and has subsequently been extensively utilized in fields such as product research and development and public services to evaluate user demands and satisfaction. The model analyzed the impact of demand on user

satisfaction, fundamentally reflecting the nonlinear relationship between product performance and user content.

(1) The transformation of the questionnaire involved adopting a structured format based on Kano's model theory. Each item of the scale is framed in both a functional and dysfunctional manner. A functional question might be, "*How would you feel if this service were provided?*", while a dysfunctional counterpart would inquire, "*How would you feel if this service were not provided?*". Each question offers five response options: "Satisfied," "As Expected," "Neutral," "Acceptable," "Dissatisfied," thereby constituting the structured Kano questionnaire.

(2) The categorization of attributes in the Kano questionnaire is achieved through its structured format, which yields 25 possible response combinations. The specific criteria for attribute classification are detailed in Table 1.

Table 1. Kano Model Attribute Classification Table

Functional Question	Dysfunctional Question				
	Satisfied	As Expected	Neutral	Acceptable	Dissatisfied
Satisfied	Q	A	A	A	O
As Expected	R	I	I	I	M
Neutral	R	I	I	I	M
Acceptable	R	I	I	I	M
Dissatisfied	R	I	R	R	Q

The Kano model categorizes attributes into five distinct types: Must-be (M) attributes represent indispensable elements whose provision prevents dissatisfaction but does not enhance satisfaction, whereas their absence significantly diminishes user contentment; One-dimensional (O) attributes exhibit a linear proportionality between service provision and satisfaction, where improved quality directly increases satisfaction; Attractive (A) attributes deliver unexpected benefits that substantially boost satisfaction when present yet cause no dissatisfaction when absent; Indifferent (I) attributes demonstrate negligible impact on satisfaction regardless of their provision status. Reverse (R) attributes denote undesired services whose provision may actively reduce satisfaction or elicit rejection. Additionally, Questionable (Q) classifications indicate potentially anomalous results owing to methodological limitations or user comprehension deviations. The service demand attributes with the highest frequency of occurrence in each category were considered as the final classification basis.

(3) Customer Satisfaction Coefficients: Based on the bidirectional questioning of the Kano model, two coefficients are derived: the Satisfaction Index (SI) and the Dissatisfaction Index (DI), colloquially termed the better and worse coefficients, respectively. SI ranges between [0, 1] where values approaching 1

indicate greater impact on enhancing satisfaction, quantifying users' "expectancy" for these demands. DI ranges between [-1, 0] with lower values signifying stronger impact, reflecting users' "dependency" on these demands. The specific formula is as follows:

$$SI = \frac{F(A) + F(O)}{F(A) + F(O) + F(FM) + F(FI)} \quad (1)$$

$$DI = (-1) \times \frac{\mathrm{F}(M) + F(O)}{F(A) + F(O) + F(M) + F(I)} \quad (2)$$

The Average Satisfaction Coefficient (ASC), defined as the arithmetic mean of the absolute values of SI and DI, enables a comparative assessment of priority levels across service demands.

$$ASC = \frac{|SI| + |DI|}{2} \quad (3)$$

2.3 Statistical Analysis

Descriptive statistics were performed using SPSS 27.0, with quantitative variables expressed as Mean±SD and qualitative variables described through proportions and rates. Factor analysis was conducted on three categories of elderly care service demands—living support, healthcare, and psychosocial support—to examine the detailed hierarchical structure. Prior to this analysis, the KMO) and Bartlett's Test of Sphericity were used to verify data suitability. Forest and scatter plots were generated using R 4.2.3 with the forestplot and ggplot2 packages to visualize the analytical outcomes.

3 Results

3.1 Sociodemographic Characteristics of the Rural Elderly in Shanxi

The study included 3,818 older adults, and their key characteristics are presented in Table 2. Males constituted 47.4% of the sample, and females 52.6%. The majority (50.2%) were aged 60-69 years, followed by the 70-79 age group (37.1%), whereas octogenarians represented a smaller proportion. Approximately 77.7% were spouses, and educational attainment was generally low, with over half of them having a primary education or below.

The prevalence of chronic diseases among older rural adults in Shanxi was 79.7%. Approximately 45.4% self-rated their health as good and 38.6% reported fair health status. Normal ADL functioning was observed in 63.5% of participants, although 27.8% exhibited depressive symptoms. Only 33.2% engaged in daily or regular exercise, whereas 10.7% had never exercised. A total of 69.8% reported never smoking and 70.9% never consumed alcohol. Regarding sleep quality, 56.7% described their sleep as “fair” or “poor.”

Regarding social capital and care status, 67.4% of participants had two or more children, 64.4% co-resided with their spouses, and 13.9% lived alone. Perceived care demands were met by 81.5% of the participants, although 7.4% reported being unmet. 68.0 Of the elderly, 68.0% co-resided with their primary caregivers, 17.4% resided within the same village or township, and 14.6% lived beyond township boundaries (different county/district or farther away). The social capital scale score averaged 45.55 ± 8.54 points.

Table 2. Sociodemographic Characteristics of the Rural Elderly in Shanxi

		n (N=3818)	Percentage □%□
Gender	Male	1810	47.4
	Female	2008	52.6
Age	$\bar{x}$ ± SD	70.16 ± 7.37	
	60 to 69 years old	1915	50.2
	70 to 79 years old	1418	37.1
	80 years and older	485	12.7
Marital status	Married	2968	77.7
	Unmarried/Divorced/Widowed	850	22.3
Education	Primary school and below	2003	52.4
	Middle school	1182	31.0
	High school and above	633	16.6
Self-rated health status	Good	1734	45.4
	Fair	1475	38.6
	Poor	609	16.0
Chronic conditions	None	774	20.3
	1 condition	1782	46.7
	2 conditions and more	1262	33.0
ADL status	Intact	2428	63.6
	Impaired	1390	36.4
Depression symptoms	Absent	2757	72.2
	Present	1061	27.8
Exercise frequency	Daily/Often	1266	33.2
	Sometimes	1064	27.9
	Seldom or never	1488	38.9
Number of children	0 or 1	1243	32.6
	2 and more	2575	67.4
Living arrangement	With children	722	18.9

	With a spouse	2458	64.4
	Alone	529	13.9
	Other	109	2.8
Caregiver capacity	Insufficient	281	7.4
	Marginally sufficient	425	11.1
	Sufficient	3112	81.5
Caregiver distance	Co-resided	2596	68.0
	Same village/township	664	17.4
	Beyond township	558	14.6
Social capital scale score	$\bar{x}$ ± SD	45.55 ±8.54	

3.2 Demand Analysis of Elderly Care Services Based on the Kano Model

3.2.1 Expectancy and Dependency of Elderly Care Services

Based on the bidirectional questions of the Kano model, the absolute values of the satisfaction and dissatisfaction coefficients, namely |SI| and |DI|, for 36 types of elderly care service demands, as well as their average ASC values, were obtained, as shown in Figure 1. The average |SI| of health care services was 0.658±0.080, while those of psychosocial support and living support services were 0.591±0.084 and 0.339±0.146, respectively. The average |DI| of health care services was 0.261±0.038, while those of psychosocial support and living support services were 0.190±0.035 and 0.123±0.037, respectively. The ASC value of health care services was 0.460±0.057, while those of psychosocial support and living support services were 0.390±0.055 and 0.224±0.094, respectively.

3.2.2 Analysis on the hierarchical structure of rural elderly care service demands

Figure 1 shows the distinct hierarchical differences in Kano attributes (attractive/must-be qualities) across the three elderly care service categories. Services A8 and A9 exhibited high expectancy and dependency scores, differing significantly from other demand types (P<0.05). To verify the hierarchical significance and identify latent demand dimensions, factor analyses were conducted for each service category (Table 3), paving the way for the subsequent exploration of influencing factors.

(1) Demands for living support services

Factor analysis was used to classify the living support service demands of rural elderly, and two main factors were extracted. Factor 1 covered the elderly dining table, bathing assistance, housekeeping cleaning, and similar items, which mainly reflected the demands closely related to the daily life of the elderly, and was named “Basic Daily Support.” Factor 2 included services such as smart phone teaching,

emergency assistance, and personal emergency response systems (PERS) which highlighting the demands for emergency safety and living support, namely “Emergency and Assistance Support.”

(2) Health care services

Two factors with eigenvalues greater than one were extracted. Factor 1 included services, such as medication guidance and health education. It mainly focused on service items related to physical health and disease prevention, so was named “Health Management and Disease Prevention Services.” Factor 2 covered items such as bedbound care assistance, family physician etc., reflecting the demands of the elderly in professional medical care and long-term care, namely “Professional Medical Care Services.”

(3) Psychosocial support services

A major factor was extracted which covered multiple demands for mental comfort services, namely “Psychosocial Support Services.”

Table 3. Factor analysis of elderly care service demands in rural Shanxi

Service Items	Factor 1	Factor 2	Factor naming	Eigenvalue	Cumulative variance contributions (%)
A1: The elderly dining table	0.692		Basic Daily Support Services [a]	4.234	35.281
A2: Bathing assistance	0.731				
A3: Housekeeping cleaning	0.820				
A4: Short-term respite care	0.803				
A5: Shopping proxy	0.806				
A6: Bill payment agency	0.741				
A7: Smart phone teaching		0.685	Emergency and Assistance Support [b]	3.496	64.413
A8: Emergency assistance		0.806			
A9: Personal emergency response systems		0.815			
A10: Home accessibility facilities		0.590			
A11: Regular home visits		0.770			
A12: Transportation assistance		0.578			
B1: Medication guidance	0.756		Health Management and Disease Prevention [b]	6.117	40.783
B2: Health education	0.794				
B3: Periodical health screenings	0.815				
B4: Disease prevention	0.801				
B5: Health record	0.795				
B6: Chronic disease management	0.805				

B7: Rehabilitation guidance	0.719				
B9: Primary medical consultation	0.699				
B11: Specialist outreach clinics	0.629				
B8: Bedbound care assistance		0.748	Professional Medical Care Services [b]	4.489	70.710
B10: Medical appointment escort		0.810			
B12: Home rehabilitation facilities		0.834			
B13: Family physician		0.602			
B14: Medical equipment rental		0.792			
B15: End-of-life palliative care		0.617			
C1: Education for the elderly	0.668		Psychosocial Support [c]	5.971	66.348
C2: Volunteer companionship	0.794				
C3: Structured social activities	0.842				
C4: Exercise and activity place	0.825				
C5: Community engagement	0.845				
C6: Legal aid & counseling	0.859				
C7: Neighborhood mediation	0.812				
C8: Pension policy advocacy	0.827				
C9: Psychological counseling	0.842				

a: KMO=0.935，Bartlett's test of sphericity，χ^2=23155.704，*P*<0.001

b: KMO=0.968，Bartlett’s test of sphericity，χ^2=42240.095，*P*<0.001

c: KMO=0.944，Bartlett’s test of sphericity，χ^2=23380.969，*P*<0.001

3.3 Multiple Regression Analysis of Hierarchical Demands for Elderly Care Services

Using the extracted factors as dependent variables and the 19 sociodemographic characteristics as independent variables, a multiple stepwise regression method was adopted to analyze the influencing factors. The regression results are shown in Figure 2.

3.3.1 Influencing Factors of Demand for Living Support Services

For the “Basic Daily Support Services” factor, the analysis results showed that income level (β = 0.098, *P* < 0.001) has a significant positive impact on it, while social capital level (β = -0.007, *P* = 0.008), depressive symptoms (β = -0.13, *P* = 0.002) and drinking behavior (β = -0.049, *P* = 0.033) were significantly negatively correlated with it. For the factor “Emergency and Assistance Support,” gender (β = 0.086, *P* = 0.048), educational attainment (β = 0.037, *P* = 0.038), living arrangement (β = 0.048, *P* = 0.016), ADL impairment status (β = 0.126, *P* = 0.002) and the frequency of physical exercise (β = 0.054, *P* = 0.001) had a positive impact on these demands, which mean elderly people who are female, have a higher level of education, living alone, have impaired ADL, and exercise regularly may have a higher demand for emergency safety and assistive services. Self-rated health status has a negative impact on the demand for this service kind (β = -0.062, *P* = 0.005).

3.3.2 Influencing Factors of Demand for Health Care Services

For the “Health Management and Disease Prevention” factor, the number of children (β = 0.086, *P* < 0.001), the number of chronic diseases (β = 0.038, *P* = 0.022), sleep quality (β = 0.055, *P* = 0.005), and exercise frequency (β = 0.086, *P* < 0.001) had a significant positive impact on these demands; distance from primary caregiver (β = -0.036, *P* = 0.008), self-rated health status (β = -0.069, *P* = 0.002), and depression degree (β = -0.134, *P* < 0.001) had negative effects. Regression analysis of the demands for “Professional Medical Care” indicated that living arrangement (β = 0.039, *P* = 0.044), distance from primary caregiver (β = 0.034, *P* = 0.013), and income level (β = 0.096, *P* < 0.001) have significant positive effects, which mean elderly people who live alone, whose primary caregivers are farther away and who have higher incomes are more likely to need professional care and support. Age group (β = -0.063, *P* = 0.018) and capacity of primary caregiver (β = -0.077, *P* = 0.022) had a significant negative impact on demands.

3.3.3 Influencing Factors of Demand for Psychosocial Support Services

The results indicated that educational level (β = 0.071, *P* < 0.001), frequency of physical exercise (β = 0.051, *P* = 0.001), and income level (β = 0.069, *P* = 0.010) had a significant positive impact on demand.

Furthermore, the VIF values of all independent variables were below 10, indicating that there was no significant multicollinearity issue, ensuring the stability and reliability of the regression analysis results.

4 Discussion

Overall, elderly care services demonstrated greater expectancy than dependency, indicating that the expectations of the elderly for these services mostly exceeded their dependence on the lack of services [19]. Most services exhibited low Dissatisfaction Index (DI) values, suggesting that they are not absolute necessities; their absence would not substantially reduce satisfaction. This pattern aligns with Kano's "attractive attributes" theory, where high expectancy coexists with noncritical dependency [20]. Across the three service categories, the trend in their demands was "healthcare services > Psychosocial Support Services > Living Support Services". Both the expectation and dependence of Health Care demands were the highest [21], while those of Psychosocial Support and Living Support decreased in sequence, indicating that the demand of rural elderly focuses on ensuring physical health, followed by mental enrichment; in terms of daily living, most elderly people are able to take care of themselves, and this kind of demand is relatively low. These findings suggest that elderly care system development should prioritize health promotion and quality of life improvement to continuously meet health demands, enhance the body, and advance healthy aging as a cornerstone strategy for China's proactive response to population aging [22].

Further analysis revealed that Health Management and Disease Prevention Services such as B3 (periodic health screenings) and B6 (chronic disease management), constituted the highest priority demand [23]. These services demonstrated elevated must-be attributes and expectancy, indicating their critical role in fulfilling essential demands. This is consistent with related studies establishing disease prevention as the core component of rural care demands, where service provision directly impacts elders' health status and quality of life [24]. For these services, older adults with distantly residing primary caregivers demonstrated lower demand, likely attributable to a preserved health status, enabling effective self-care despite geographical separation [25]. Conversely, both a larger number of children and higher physical exercise frequency positively influenced demand, indicating that family support and an active lifestyle enhance health management awareness. Elevated demand was significantly correlated with increased chronic disease burden and poorer self-rated health, underscoring the intrinsic link between health status and service necessity. These findings reaffirm that health-centered services remain paramount in elderly care systems [26].

Psychosocial Support Services ranked second, reflecting substantial demands for emotional companionship and community engagement. The high Satisfaction Index (SI) values for services such as C3 (structured social activities) and C8 (pension policy advocacy) underscored the importance of social participation and institutional support [27]. The results indicated that rural elderly people with low education and income lack psychological support and social engagement, necessitating the establishment of comprehensive psychosocial support systems to enhance community participation [28]. In addition, people with high exercise frequency are more likely to show high psychological demand,

which means those who keep exercising have a stronger concern for such services, suggesting that engagement in physical activity may enhance the elderly's pursuit of psychological well-being; therefore, moderate exercise for the elderly should be widely publicized and advocated [29].

Professional Medical Care exhibited intermediate demand levels despite its focus towards critical care and nursing, indicating the elders' significant concerns about disability and terminal care that warrant attention [30][31]. Contrary to conventional expectations, this study identified a negative correlation between advancing age and demand for these services. This counterintuitive association may stem from a multifactorial interplay involving sampling characteristics, health status variations, and social capital buffers, warranting further validation in subsequent research. Crucially, solitary-living older adults and those with distantly located caregivers demonstrated heightened demand, contrasting sharply with the patterns observed in Health Management and Disease Prevention Services. This divergence likely reflects the critical alignment of Professional Medical Care with scenarios of physical/cognitive impairment and illness-related incapacitation where self-care is untenable. When kin support is absent, such services acquire heightened immediacy over preventive care, addressing unmet clinical demand during health crises [32][33].

For Emergency and Assistance Support Services, context-specific services such as A8 (emergency assistance) and A9 (PERS) display exceptional expectancy, highlighting the demand gaps in emergency support devices for the elderly [34]. Significantly stronger demand was observed among those who are highly educated, with poor self-rated health, and get ADL-impaired [35][36]. Elevated demand in highly educated groups likely stems from heightened health awareness and proactive self-care practices, consistent with the established positive correlation between health literacy and service demand [37]. There are significant variations in the demand for such services according to self-rated health status, ADL conditions, and living arrangements, which may be related to the lifestyles of such services. The need for such services is relatively low among healthy individuals and elderly people who do not live alone. Therefore, for high-demand service groups, such as those with poor health conditions and those living alone, it is necessary to strengthen the supply of Emergency and Assistance Support Services [35][38].

In contrast, Living Support Services demonstrated consistently lower levels of both expectancy and dependency, with basic services such as A3 (housekeeping and cleaning) and A5 (shopping proxy) demonstrating a weak demand. The results indicated that older adults with a diminished demand for Basic Daily Support exhibited characteristics of low income, inadequate social capital, depressive symptoms, and routine alcohol consumption [39–41]. Higher-income individuals demonstrated significantly stronger service demands, a finding congruent with existing evidence on economic status profoundly shaping care demands [40][42]. Conversely, those with robust social capital showed reduced demand, possibly mediated by enhanced access to filial support and community-based assistance systems, which diluted their reliance on external care services [43]. Notably, elders with depressive symptoms displayed persistently low demand across multiple dimensions, potentially reflecting help-seeking avoidance and passive coping behaviors associated with depression [39][41]. Meanwhile, the

lower demand of routine alcohol consumers may indicate preserved physical health, enabling self-care in daily activities.

Elderly care demands in rural China are multifactorially determined by health status, living arrangements, income, lifestyle, depression and etc. [44][45]. Notably, heightened demand has emerged among those with ADL impairment, poor health, and low-income populations already prioritized in China's basic elderly care system through tangible assistance and disability support. This targeted alignment represents an effective countermeasure for population aging [46]. Crucially, high-demand subgroups also include older adults with distant residing, incapable, or even absent caregivers, underscoring that familial support must remain foundational. Public initiatives should reinforce filial responsibility to ensure aging with respect and support [47][48]. Finally, modifiable factors, including physical health, ADL status, and positive lifestyles such as exercise and alcohol consumption reduction, significantly influenced the demand level. It is essential to advocate that the elderly improve their lifestyle, enhance physical exercise and actively participate in social activities, so as to promote their physical and mental health simultaneously [49].

Although this study elucidates the demand characteristics, hierarchical structures, and determinants of eldercare services in rural Shanxi, some limitations warrant acknowledgment. Future research should incorporate broader geographical sampling to enhance generalizability across diverse regional contexts. Additionally, although the Kano model effectively captures demand-side perspectives, integrating the supply side dimensions yields a multidimensional framework. This expansion would substantially strengthen the theoretical evidence base for policy formulation in the elderly care system.

5 Conclusions

The findings indicate that rural elderly care needs are predominantly driven by health-related service demands rather than basic daily assistance. In response to rural population aging, elderly care strategies should shift toward integrated, health-oriented service delivery models that emphasize prevention, continuity of care, and community-based support. Improving service availability and encouraging active lifestyles and social engagement among older adults are essential for enhancing care effectiveness. Meanwhile, reinforcing the role of family caregiving remains critical to ensuring comprehensive and sustainable elderly care in rural settings.

Abbreviations

ADL, Activities of Daily Living; ASC, Average Satisfaction Coefficient; DI, Dissatisfaction Index; GDS-5, Geriatric Depression Scale Short Form (5-item); GDS-15, Geriatric Depression Scale (15-item); GDP, Gross Domestic Product; KMO, Kaiser–Meyer–Olkin Measure of Sampling Adequacy; PERS, Personal Emergency Response Systems; SI, Satisfaction Index; SPSS, Statistical Package for the Social Sciences; VIF, Variance Inflation Factor

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Ethics Committee of Shanxi Medical University. All participants were informed about the purpose of the study, and written informed consent was obtained prior to participation.

Consent for publication

Not Applicable

Availability of data and materials

Data supporting the findings of this study are available from the corresponding author upon reasonable request.

Competing interests

We declare no competing interests.

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Authors' contributions

Dahong Wu, Lu He, Qilong Feng, Jiantao Li conceived the original idea for this study. Yuxiao Wang, Yaodan Zhang, Guangxian Zeng, Haiting Zheng, Yan Tong and Jie Liu collected data. Yuxiao Wang and Yaodan Zhang verified the results. Yuxiao Wang, Yaodan Zhang performed statistical analyses and drafted the original version of the manuscript. All the authors revised the manuscript, provided important intellectual content, and approved the final version for publication.

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Figures

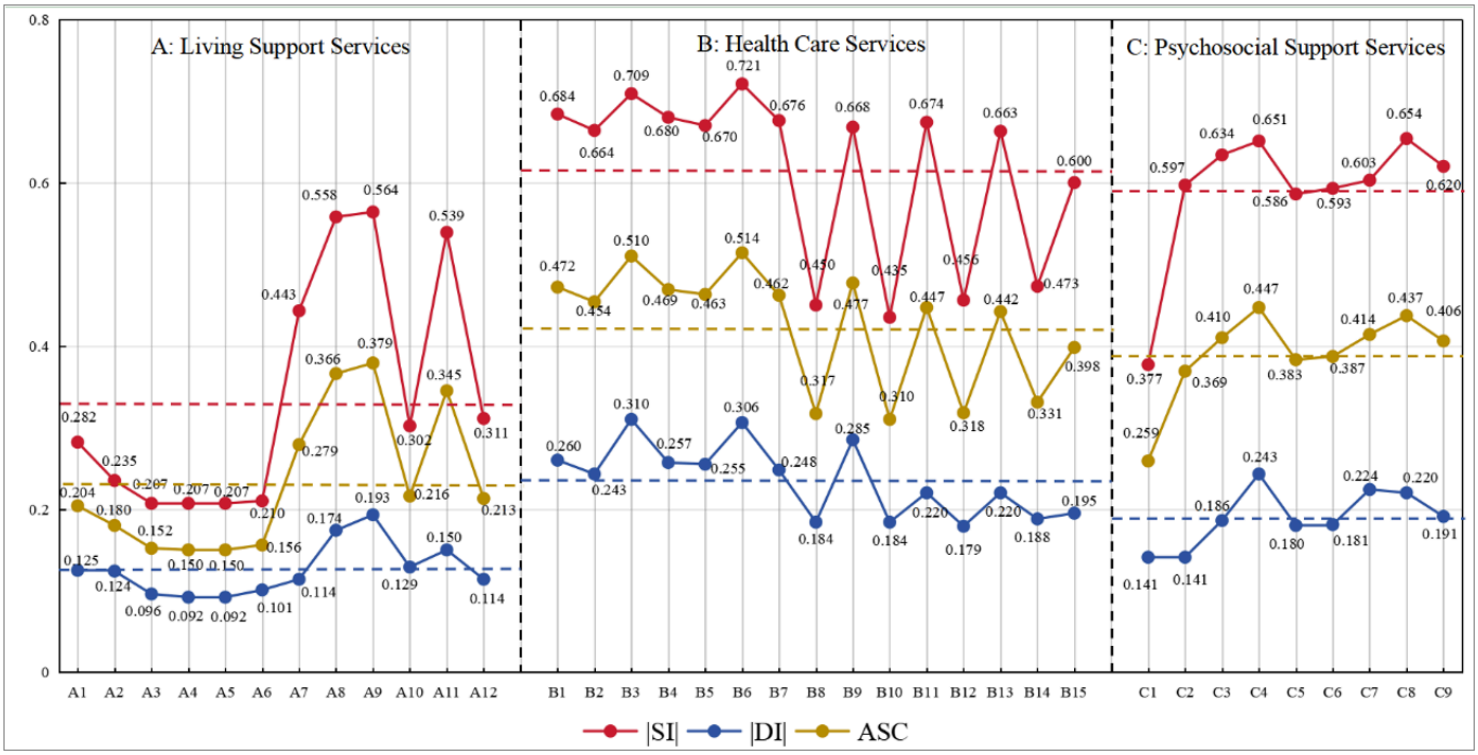


Figure 1

Line Chart of SIDIASC Values for 36 Elderly Care Service Demands

Dependent Variables	Independent Variables	β	SE	t	VIF	P value
Basic Daily Support	Depression symptoms	-0.13	0.042	-3.124	1.354	0.002
	Alcohol consumption	-0.049	0.023	-2.133	1.35	0.033
	Income level	0.098	0.028	3.537	1.552	<0.001
	Social capital	-0.007	0.003	-2.651	1.468	0.008
Emergency and Assistance Support	Gender	0.086	0.043	1.98	1.595	0.048
	Education	0.037	0.018	2.072	1.235	0.038
	Living arrangement	0.048	0.02	2.401	1.119	0.016
	Self-rated health status	-0.062	0.022	-2.789	1.658	0.005
	ADL status	0.126	0.042	3.036	1.354	0.002
	Exercise frequency	0.054	0.016	3.428	1.161	0.001
Health Management and Prevention	Number of children	0.086	0.023	3.676	1.068	<0.001
	Caregiver distance	-0.036	0.014	-2.643	1.154	0.008
	Self-rated health status	-0.069	0.022	-3.152	1.672	0.002
	Chronic conditions	0.038	0.017	2.286	1.202	0.022
	Depression symptoms	-0.134	0.041	-3.281	1.177	0.001
	Sleep Quality	0.055	0.020	2.790	1.344	0.005
	Exercise frequency	0.086	0.015	5.609	1.162	<0.001
Professional Medical Care	Age	-0.063	0.027	-2.370	1.351	0.018
	Living arrangement	0.039	0.019	2.017	1.113	0.044
	Caregiver distance	0.034	0.014	2.478	1.154	0.013
	Caregiver capacity	-0.047	0.020	-2.294	1.287	0.022
	Income level	0.096	0.027	3.528	1.556	<0.001
Psychosocial Support	Education	0.071	0.017	4.133	1.241	<0.001
	Exercise frequency	0.051	0.015	3.358	1.160	0.001
	Income level	0.069	0.027	2.593	1.577	0.010

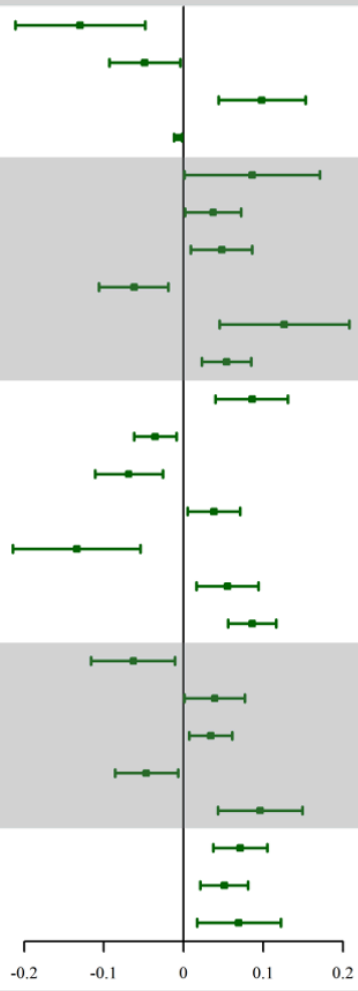


Figure 2

Forest Plot of Multiple Regression Analysis of the Hierarchical Elderly Care Service Demands

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- ElderlyCareDemandsQuestionnaire.docx