

Planning response to older people's long-term care needs: Evidence from Beijing, China

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Method Based on a questionnaire survey conducted in typical communities in Beijing, empirical analysis of urban residents' choice for caring patterns in different stages and its rationality will be made by using a decision-making tree. **Results** Our study shows that (i) at present, traditional caring pattern of family support has been transformed, leaving more than 50% of empty-nest families in Beijing. 80% urban residents in healthy stage tend to live alone, and turn to institutions endowment when they are in need of care. (ii) The present main problems are the very limited understanding and recognition of community endowment by the elderly and the severe shortage of endowment institutions, especially the large gap of beds for disabled and half-disabled elderly in endowment institutions. (iii) Caring needs from the elderly in different stages are dramatically different. Once entering into the stage of in need of care, caring needs by family support, community endowment and institution endowment increase by 2, 4 and 8 times respectively. Based on the calculation of life cycle, reasonable proportion of disabled and half-disabled elderly in institutions and community endowment are 35% and 30% in 2020. (iv) At present, demand regulation should focus on the elderly less than 70 years old and lead more young elderly into community endowment.

Keywords: social endowment, community endowment, decision tree, long-term care

Compared with other countries in the world, China has a population aging at an unprecedented speed and scale. According to the results of the sixth national population census in 2010¹, by the end of 2010, the number of elderly over 60 years old reached 178 million, accounting for 13.3% of the population and making China the only one country in the world that has more than 100 million elderly. The 'Twelfth Five-Year Plan of China Aging Development' revealed in September 2011 that, by 2015, elderly people over 60 in the whole country will increase to 221 million, accounting for 16% of the population with an increase of 8.6 million per year; by 2030, the elderly population will double; more than a third of the population will be elderly. The elderly population will peak around 2050².

With the ever increasing speed of population ageing, residents are getting old before getting rich with limited ability to support old age life. At the same time, the effects of one-child policy implemented from 1980 onwards for more than 30 years, have shown up. The average number of persons per household has been decreased, leading the ability of traditional family caring and more empty-nest families in cities declined. Therefore, it has become a major livelihood issue to strengthen the construction of endowment service system, an issue concerned by govern-

ment, society, and the masses. Problems need to be solved such as striking contradiction between supply and demand, single facilities and service, unreasonable layout, inadequate investment, and shortage of specialized talents³.

In the face of challenges, we also have opportunities in the construction of endowment service system in the society. With the enhancing comprehensive national strength and income increase of urban and rural residents, the public finances invest more into people's livelihood, which improves residents' self-protection and lays a solid social foundation for endowment service system construction³. In December 2011, the State Council issued 'Social Endowment Service System Construction Plan (2011-2015)'⁴ with a clear framework of "based on the family support, supported by the community and supplemented by institutions" proposing to focus on the needs of the elderly and build social endowment service system that answers for the situation of our country.

With the rapid development of social economy transition and policy expectations, the elderly lifestyle and concept of elderly support are shifting now at the stage of construction of new endowment concept and caring patterns. In the face of enormous demand, how to meet residents' needs of endowment service scientifically

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and carry out related resources configuration accordingly are key subjects in the construction of social endowment service system. Therefore, it is necessary to make an objective analysis of endowment demand and a scientific evaluation of its rationality and possibility, so as to provide scientific support to the demand regulation and reasonable solution to the contradiction between supply and demand of endowment service.

Therefore, academe in our country have done a great deal of theoretical exploration and empirical research on the caring needs and patterns and also made a lot of progress⁵⁻⁶. For example, based on statistical data or field survey, they conducted research on choice for caring patterns and the influencing factors⁷⁻⁹ and analyzed and forecasted the needs of facilities for institution endowment, home-based care and community day care service¹⁰⁻¹². Studies have shown that factors such as economic income, family structure, and community environment and service have important effects on the choice for caring patterns.

However, before we apply these results to actual planning and decision making, there are two major problems need further studying. The first problem is that existing researches measure and calculate caring demand generally based on historical data or residents' subjective will but lack of objective judgment of its rationality, which makes it difficult to make a decision of adjusting and controlling demand or put forward effective solutions. Second, it lacks continuity of consideration of caring demand from the elderly at different stages. Gerontology experts point out that, in real life, the elderly are likely to experience from complete self-care to complete inability to care for themselves⁶. If the living environment is changing, the elderly are not only repeatedly trapped in the sense of insecurity of adapting to new environment, but also are forced to lose many valuable objects and emotional memories closely related to their life experiences. However, most of the re-

searches focus on analysis of demand at present stage, but do not pay attention to the transformation of people's caring patterns or measures to meet the demand brought by the transformation.

In order to solve the above problems, we will focus on urban areas, and then make an analysis of the attributes, regularity and constraints in caring needs and choice for caring patterns of the urban elderly by a questionnaire survey in typical communities in Beijing, especially conduct a trend survey on choice for caring patterns in different stages and evaluate the rationality of the residents' subjective intention.

SAMPLE REGIONS AND QUESTIONNAIRE

To understand caring needs of different elderly groups, starting with spatial position, facilities, and distribution characteristics of public service and social economic attributes of population, we select some typical sample regions where we have conducted questionnaire surveys of the elderly's living conditions and endowment will.

Results of urban geography research on the type of residential space reveal significant differences in social and economic attributes and behavioral attributes of residents in different regions as a joint result of factors such as historical and institutional factors, spatial location, environment and public service level, and residential density¹³⁻¹⁵. Therefore, urban residential space is divided into different regional types. There are six types of residential communities in Beijing: old courtyard neighborhood community, newly-built commercial housing community, unit compound, economically affordable housing community, low-rent housing community, and general mixed community¹⁶⁻¹⁷. Based on the above understanding, considering factors such as the proportionality of spatial distribution of sample regions, community scale, and elderly dependency ratios in different regions, we chose 6 typical communities.

Table 1. Characteristics of older adults included in the study (n=536)

#	Street, community	Population	Location	Older adults' characteristics	n
1	Liren Street, Bai Zhifang Community	Ordinary mixed community	Southern 2 nd ring road	Retired from enterprises and institutions	101
2	Jingcheng Renhe, Donghuashi	Low-rent housing	North-eastern 2 nd ring road	Low-income, soldiers and entitled elderly	62
3	Guomei Home, Ping Fang	Newly-built commercial housing	Between Eastern 4 th and 5 th ring road	Relocated from the inner city to improve housing conditions, or came to Beijing with their sons and daughters	94
4	Longteng Community VI, Huilongguan	Economically affordable housing	Outside the Northern 5 th ring road	From inner city demolitions or came to their sons and daughters	98
5	No.5 Wanshou Road	Work unit compound	Between Western 2 nd and 3 rd ring road	Retired from enterprises and institutions	84
6	Liuyin Street, Shichahai	Old courtyard neighborhood	Central historic area within the 2 nd ring road	Old Beijing residents who have been living here for several years	97

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Each sample region represents a community type that embraces different attributes of elderly groups (Table 1). Sampling survey of 1% population in Beijing in 2005 shows that elderly dependency ratios of four core districts including Xicheng District, Dongcheng District, Chongwen District, and Xuanwu District) and Mentougou District are the highest in Beijing¹⁸. Therefore, endowment service in inner city regions is under the most pressure. At the same time, in recent years, with more land outside core districts is occupied for commercial housing and economic applicable housing construction, population density outside core districts increases rapidly. This brings many elderly people turn to their sons and daughters to ambient areas of Beijing. Therefore, 6 sample regions selected in this paper can reflect these trends in a better way.

There are two main points in this questionnaire: one is the basic property and living and endowment status of respondents including age, family structure and children, education, income and career before retiring, housing conditions (housing size and nature of property rights), social insurance, interpersonal communication, health status, needs of care from family or others and related expenses, etc. which are important factors affecting endowment will and behavior patterns. The second point is endowment will and demand including health status, status of care needs, as well as caring patterns they intend to choose at the end of life at three scenarios (stay home alone, family support, community aged care, and institutions endowment) and reasons for their choices.

From August to September in 2011, research group selected retired elderly (women over 55, men over 60) from different communities for investigation with assistance from communities and by random visits and snowballing. 536 effective questionnaires were received out of 605 questionnaires, with sample effective rate of 88.6% (Table 2). Data of family structure in the table shows that proportion of respondents in all elderly family (including living alone, and elderly group) is as high as 52.3%, revealing the seriousness of empty nest (Table 2). At the same time, the proportion of elderly in need of care is about 10%. Most of them depend on spouses and children while a few also rely on nurses or social workers.

Constricted by sampling, the elderly living in endowment facilities and hospital and those who cannot go out are not included in this survey. Comparing sample attributes with indexes in Beijing statistical yearbook in 2011, we can see that apart from the lower proportion of the elderly over 80 (accounts for 10.8% while the proportion in the whole city is 14.5%), other indexes are not quite different, which suggests that analysis results about elderly of advance age would be underestimated. But overall, those samples are representative.

ELDERLY'S CARING PATTERN CHOICE

Decision tree analysis

In order to obtain correct understanding of the influence of different factors on decision-making and accurately identify different groups, a decision tree is applied to analysis in this paper. A decision tree is a data mining method that divides samples according to the exogenous variables and explores classification rules. Generated top down, people's decision-making usually generates different solutions according to certain rules and continues this process which is like a tree with different branches if we make a draft of the whole decision-making process. Therefore, it is called a decision tree.

The decision tree analysis provides the basis for decision-making through calculating and

Table 2. Results of the questionnaire (August-September 2011) of retired women (age 55+) and men (age 60+); * = low urban security fund, social relief, etc.

Variable	Value	Frequency %
Gender (n=536)	Male	41.4
	Female	58.6
Age, years (n=530)	80+	9.5
	70-80	30.1
	<70	59.4
Family income under control of the older adult, Yuan/month (n=535)	<1,000	8.3
	1,000-3,000	40.5
	3,000-5,000	37.7
	5,000-10,000	12.1
	10,000+	1.3
Primary source of income (n=535)	Pension	89.9
	Sons & daughters	4.7
	Commercial insurance	2.1
	After-retirement work	1.0
	Other*	1.3
Health status (n=535)	Need care at various levels	10.1
	Minor ailments, basic self-care	51.2
	Healthy, no care needs	38.7
Family structure (n=535)	Living alone	11.1
	Elderly group	41.2
	Living with a child	47.1
	Otherwise	0.6
Education (n=535)	Below middle school	45.2
	High school	31.6
	College and higher	23.2

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comparing profit and loss value of different solutions under various conditions of results by using tree diagram as a tool, decision points as decision problems, solution branch as alternatives, and probabilistic branches as all kinds of results. Input conditions of decision tree analysis include the decision judgment or the basis of profit and loss calculation (dependent variable) and all kinds of decision variables (independent variables). Once there are enough samples, each probabilistic branch reflects one classification decision rules in the entire sample. After its establishment, the decision tree will be applied to each tuple in the database, and generates a classification for the database. Therefore, the decision tree analysis is the most effective way to solve the problem of classification¹⁹.

In recent years, with the development of data mining, the algorithm of decision tree analysis has been continuously improved²⁰⁻²², and has obtained wide application in management²³⁻²⁴, natural geography and remote sensing classification of land use²⁵⁻²⁷, etc. Recently, it is gradually promoted in environment and behavior, etc. For example, Xiaolu Gao applied it to the analysis of types of housing demand²⁸, and Ye Huang applied it to analyzing the quality of life of urban residents²⁹. Compared to traditional statistical methods, the biggest advantage of decision tree analysis is that it is very easy to understand the decision rules it generates and find out the decision variables that play a key role in every step of the decision.

In order to investigate the choice for caring patterns of the elderly at different stages in life, questions of choice for caring patterns are designed for different stages, such as 'in a healthy stage', 'in need of care' and 'in the final stage of the life'. From the perspective of long-term care, the following analysis will focus on choices in a healthy stage and when in need of care.

Factors that affect choice for caring patterns include: age, gender, income, family structure, housing conditions, health status, etc. Choices for caring patterns include: living alone, child support, community service, and caring institution. In each scenario, we can build a decision tree with four caring patterns as the dependent variable and impact factors as independent variables.

When in a healthy stage

For the healthy state, the results of decision tree analysis are shown in Figure 1. Based on the decision variables in the box, we can find out that

several factors such as family structure, housing size, age, and education have an important influence on decision-making in turn. Income and other variables are not the main factors of decision making which, on the one hand, suggests that economic condition does not have serious impact on the choice in healthy stage and on the other hand, since there is a certain correlation between income and education and housing conditions, secondary factors in decision making are ignored.

According to a different decision-making, respondents are divided into eight types based on significant differences in their choices for caring patterns. Table 3 is a summary of group attributes and choice ratios for four caring patterns. In general, ratios of choosing living alone, family support, community service and caring facilities in the healthy stage are 79%, 12%, 4% and 12% respectively.

Living alone: Nearly eighty percent (79%) of the elderly in healthy stage, especially those living under good housing conditions, would like to live alone.

Child support: Only 12% elderly in the healthy stage would like to turn to children. Among them, those elderly with lower education level, small house and living with their children mainly depend on their children while a third of them would like to choose child support.

Community service: Community aged care (4%) is hardly recognized among the elderly and even

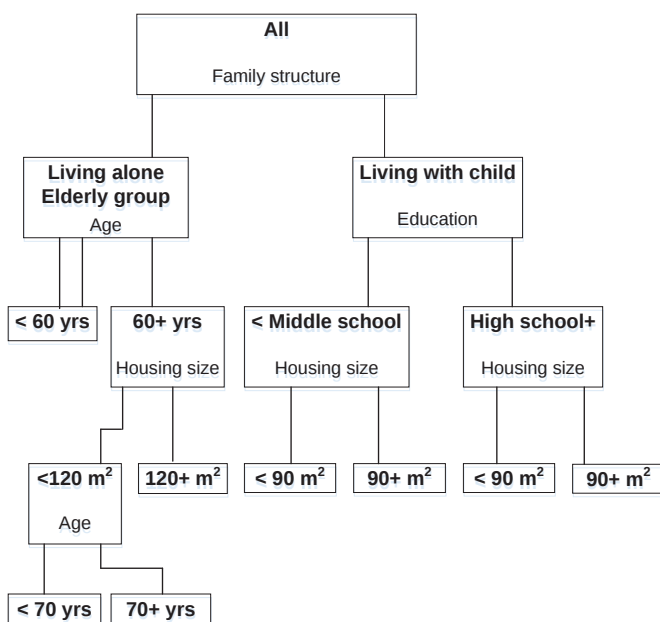


Figure 1. Decision tree for caring patterns of older adults in a healthy stage

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Table 3. Choice of caring pattern of older adults in a healthy stage

Group attribute				Choice of caring pattern, %					Demand intensity of institutions
Family structure	Age	Education	House size, m ²	%	Living alone, Elderly group	Living with child	Community service	Institution	
Living alone	<60			9.0	33.2	0.0	10.5	5.3	1.10
	60-70		<120	15.7	34.5	3.4	3.6	3.5	1.48
	70+		<120	20.7	78.9	10.2	1.8	9.2	1.62
	50+		120+	7.0	96.6	3.2	0.2	0.0	0.00
With child, otherwise		< middle	<90	13.1	63.6	31.3	0.0	5.2	0.90
		school	90+	8.9	81.2	15.8	2.2	0.9	0.16
		> high	<90	8.8	82.6	2.2	6.5	8.7	1.52
		school	90+	16.8	70.5	21.6	5.7	2.3	0.40
Total or average				100	78.5	12.2	3.6	5.7	1.00

among the newly retired and well-educated elderly only 10% accept it.

Institutions endowment (6%): Empty-nest elderly and the elderly with higher education backgrounds living with their children in a room less than 90m² are more inclined to institutions endowment.

In general, the proportion of elderly in a healthy stage who choose endowment institutions is low. In Table 3, the intensity of the elderly's need of institution endowment in each group is calculated (namely, ratio between proportion of choice for institution endowment in the group and proportion of average choice for all institution endowment). It is obvious that empty nest elderly and the elderly of higher education level living with their children under relatively poor housing conditions would rather choose institutions endowment.

When in need of care and living alone

For older adults in need of care, the results of decision tree analysis are shown in Figure 2. Attributive characters of each group and ratios of different choices for caring patterns are shown in Table 4. Obviously, choices for caring patterns change greatly in the stage of in need of care. The ratios of living alone, child support, community service, and caring facilities are 10%, 25%, 16% and 10%. Unable as they are to live independently, most elderly people still want to choose community service for home care or institution endowment, which is no doubt a result of the declining family support but also indicates that the traditional caring pattern of family support has undergone great changes.

Analysis shows that the constraint factor for institution endowment is low income. Most of the elderly whose monthly income is less than 1000 Yuan (= €7312) would choose child support (60%). In addition, housing size of more than 60m² is the threshold of decision making of community endowment for home care, which is significantly lower than that of decision making

in healthy stage (90m²). In other words, as long as the housing size is not particularly small, most elderly people prefer to live in their current house.

RATIONALITY OF CARING NEEDS

Results of the analysis above reveal big differences in decision making of choice for caring patterns in different stages. Proportions of choosing child support, community service and institution endowment by the elderly in need of care from healthy stage increase to 2 times, 4 times and 8 times respectively (Figure3). Particularly, there is a large gap between decision making of choice for caring patterns by the elderly less than 70 and those over 70 years of age. The young elderly would show strong interest in institution endowment while those over 70 are much more realistic and willing to choose community endowment for home care and child support. It obviously shows that the elderly in younger group are independent, but at the same time, in a sense, it

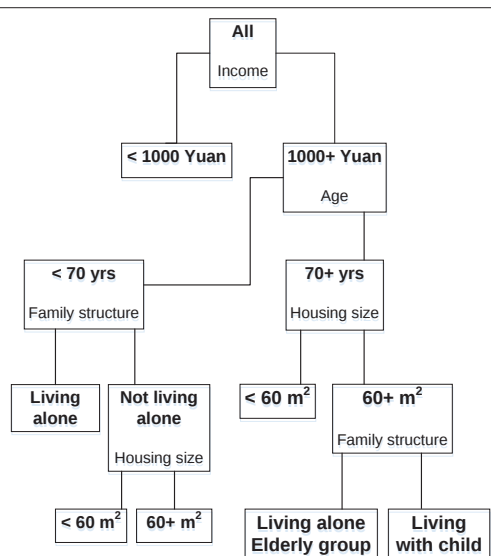


Figure 2. Decision tree for caring patterns of older adults in need of care

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Table 4. Choice of caring pattern of older adults in need of care

Group attribute					Choice of caring pattern, %				Demand intensity of institutions
Income, Yuan / month	Age	Family structure	House size, m ²	%	Living alone, Elderly group	Living with child	Community service	Institution	
1.000+	<70	Living alone		25.6	10.6	10.2	13.2	66.0	1.34
1.000+	<70	With child, otherwise	<60	6.7	18.9	12.3	9.4	59.4	1.20
1.000+	<70		60+	22.4	1.0	27.1	17.0	54.9	1.11
1.000+	70+		<60	15.7	11.9	39.5	14.9	33.7	0.68
1.000+	70+	Living alone	60+	13.1	16.2	11.4	26.0	45.5	0.94
1.000+	70+	With child	60+	7.9	8.1	31.7	24.0	36.2	0.73
<1,000				8.6	13.1	59.1	5.1	22.7	0.46
Total or average				100	10.0	24.8	15.9	49.4	1.00

also reflects certain blindness of them, because many of them are not fully aware of whether there are appropriate nursing homes and what kind of caring service the nursing home can provide to them.

Data from the Beijing statistical yearbook³⁰ shows that the number of elderly people over 60 reached 2.29 million in Beijing in 2009. The total number of elderly people in need of care is 230,000 accounting for 10% of the elderly as a conservative estimation but would increase in the future. On the other hand, the total number of beds in adoption agencies registered by the civil affairs department is 26,300; 68% of the elderly in those agencies are capable of independent living. Obviously, if 50% elderly among those 230,000 in need of care should turn to a nursing home, there will be a shortage of provision of service leading to a gap of 90,000 beds.

Not only the living stability of the elderly will decrease, but also the risk of excessive configuration of resource will increase, once the excessive demands of institution endowment are met. Therefore, the solution to this problem must be to increase the number of beds in endowment institutions, especially beds for disabled elderly, and reduce needs of institution endowment by particularly enhanced demand guidance for young elderly according to above analysis.

Opposite to the elderly under 70, only 35% of elderly over 70 would like to turn to institution endowment when they are in need of care, which is regarded as approximately reasonable. If 10% of the elderly are in need of care, beds in endowment institution would account for about 3.5% of the total elderly population. At present, the total number of beds in endowment institution is about 1% of the total elderly population. The 'Social Endowment Service System Construction Plan (2011-2015)³ proposes that every 1000 elderly should have 30 caring beds on average by 2015. According to these figures, the plan of institution endowment accounting for 35% of caring patterns by 2020 is relatively appropriate. Namely, 50% elderly hoping to choose institu-

tion endowment are in need of care, and 15% out of them should shift to a different caring pattern. At the same time, it should be noted that institution endowment are guaranteed to meet the demand of the elderly in need of care, elderly who are disabled or half-disabled.

Analysis shows that with the increase of age, the proportion of elderly in need of care is experiencing an S-shaped growth. Many elderly quickly enter into the stage of in need of care at the age of about 80. According to the life cycle, elderly under 70 will enter into the stage of in need of care after about 10 years. Therefore, if we can provide caring beds in endowment institution that account for about 3.5% of the total number of the elderly in 2020 and properly meet the need of care from disabled and half-disabled elderly, we can smoothly achieve the policy goal of 'supplemented by institutions'. At that time, the expected ability of family support will decline. Therefore, in order to achieve the goal above, the proportion of community endowment should at least raise by over 30%, by transferring about 15% of the total needs into this section (Figure3).

CONCLUSION

In the above research, we have conducted a questionnaire survey in typical communities in Beijing and analyzed urban residents' choices for caring patterns and endowment willing in different stages with a decision tree analysis.

Firstly, the results reflect that the traditional caring pattern of family support in China has been transformed. At present, empty nest families account for more than 50% of elderly families in Beijing. 80% of the elderly in a healthy stage choose to live alone while 50% of the elderly in need of care would prefer institution endowment. The existing main problem is that the elderly have limited recognition of community endowment since only 4% of the elderly in a healthy stage and 16% of the elderly who cannot live independently turn to institution endowment. On the one hand, the insufficient propaganda of community endowment might

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lead to the lack of understanding of community endowment by the elderly. On the other hand, there are differences between service (including content and patterns) and actual demand from the elderly. From the perspective of the existing statistics of elderly adoption agencies, the supply falls short of demand significantly while nearly 70% of beds are provided for the elderly who are entirely self-care, leaving a large gap of beds that provide help and nursing service for the elderly who are unable to care for themselves. Therefore, we should enhance the construction of endowment institutions, especially to increase facilities oriented at disabled or half-disabled elderly.

Secondly, caring needs vary in different stages. Demand of family support, community endowment and institution endowment from the elderly in need of care from self-care stage increase to 2 times, 4 times and 8 times respectively. Once the excessive demands of institution endowment are met, not only the living stability of the elderly will decrease but also the risk of excessive configuration of resource will increase. Based on the calculation of caring needs of different life cycle, we believe that in 2020, 35% of disabled and half-disabled elderly would choose endowment institution, which is appropriate. All kinds of endowment institutions should build corresponding capacity for supporting service. At the same time, in 2020, there will be at least more than 30% of disabled and half-disabled elderly who will turn to community endowment, in order to meet their actual needs. Therefore, we should vigorously develop community service such as household service, day care, nursing home, etc.

The research also suggests that the elderly's choice for caring patterns and facilities is made dependent on comprehensive consideration of factors such as housing condition, income education and family structure. It should be noted that dependence on institution endowment by young elderly less than 70 is too high with a ratio of more than 60%, in the plan for the future endowment. These elderly are not very rich with little support from a child, but they are well-educated with good housing conditions and are favorable to community endowment. Therefore community endowment should focus on encouraging and guiding young elderly in choosing caring patterns.

Policy implications from the above conclusion is apparent that objective analysis and evaluation of caring needs provide a scientific basis for proper demand regulation and reasonable allocation of public resources and the solution of the sharp contradiction between supply and demand of endowment service. The scope of this

study is still very limited since there are huge regional differences and differences between urban and rural areas in demand of social endowment service in China. In practice, the quality of life of urban and rural elderly is not only affected by the natural environment, economic development condition and culture, but also constricted by the institutional environment. To truly establish a social endowment service system that answers to Chinese national conditions, we need to strengthen information exchange in every regions at all levels, and conduct more in-depth, comprehensive and integrated research by combining attributes of different area, urban and rural areas, and communities.

Therefore, the different requirements of endowment services should be paid more attention in pension planning. However, the space requirement of endowment facilities and services is a dynamic change over time. Hence, for Chinese cities at present, how to fully analysis the elderly space requirements of different services at an early stage of the endowment plan is very important for the reasonable planning and layout of the facilities. Simulation, as a kind of analysis method, which is beneficial to reflect the change of spatial distribution and the evolution of the population age structure of old people in the society and urban development process. Thus, in the endowment planning practice of the future, it is recommended to use a dynamic analysis method to predict potential space requirements of elderly endowment services, such as long-term and daycare services. Endowment pattern analyses mentioned in this study can be used as the basis of the work, while further analysis of requirements on different endowment services and its spatial distribution of future cities built on the basis is our next work.

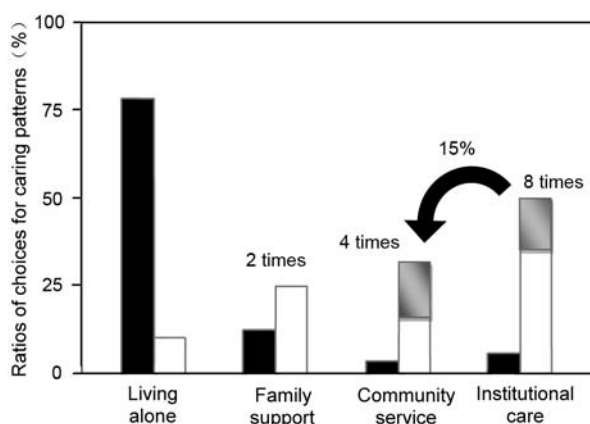


Figure 3. Caring Patterns; Differences in choice frequency for caring patterns between healthy adults (black) and those in need of care (white); It is estimated that by transferring about 15% of the total needs (shaded part) from 'Institutional care' to 'Community service', a good balance would be reached

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