



Health Economic Study on the Old-Age Service for Rural Residents in China: A Literature Review

Zuhui Huang¹, Yuzhou Wang^{2*}, and Linxing Chen³

¹Department of School of Public Management, Zhejiang University, China

²Zhejiang Yinfeng Dahongqiao Technology Co., Ltd, China

³Department of Business Administration and Marketing, School of Logistics and E-commerce, Zhejiang Wanli University, China

Abstract

The structure of China's population is aging rapidly, causing growing economic challenge on the country and its people. Old-age related burdens of rural residents are greater than those of urban residents due to several reasons, among which income level and health facility availability are the most relevant. Chinese government has launched a series of new social insurance policies to help them, including the New Rural Pension Scheme (NRPS), New Rural Cooperative Medical Scheme (NRCMS) and Long-term Health Care Insurance System (LHCIS). But when executing these policies, regional differences started to emerge, leading to different fee level, government subsidy and service package. Rural residents as well as old-age care providers will face various types of uncertainty when making health decisions. Such uncertainty is also challenging researchers. Recent adoption of quality-adjusted life year (QALY) and consumer's willingness of to pay (WTP) for cost-benefit analysis does provide some theoretical basis for analyzing old-age social insurance policies, but with the level of complexity of Chinese rural situation and continuously adapting policies, a flexible and dynamic health economic approach is in need. This paper reviews the development of health economics and its application in old-age service issues, and introduces key research results and methods in this field. It also sums up recent studies on the old-age service for rural residents in China, and offers some implications in using health economics to facilitate current research.

Keywords: Rural residents, Old-age care, Uncertainty, Cost-benefit analysis

Introduction

Aging is one of the major challenges for any country in the 21st century. In 2017, 13% of the world's population was over 60 years old; this number is 17.3% in China [1]. To continuously raise the living standards of its people after the elimination of serve poverty, Chinese government has made clear resolution to safeguard Chinese people's twilight years, but the task is difficult. Compared with 2010, the proportion of people over 60 years old in 2016 has increased by 3.5 percent, 18.3 percent among which were disabled [2]. Chronic non-communicable diseases (CNCd) account for an estimated 80% of total deaths and current healthcare resources for elders with CNCd in China may be insufficient to cover the emerging aging population [3]. By 2020, the elderly population is expected to reach about 255 million. 118 million will live alone in "empty nests" with no children by their side and the elderly dependency ratio will incline to about 28 percent [4], putting more burden on younger generation.

For rural residents, their old-age-related worries are more

urgent than those living in cities. Their relatively secluded physical and psychological barriers to information make it difficult for them to effectively understand and accept the benefits of newly-invented old-age services [5]. They are accustomed to a relatively simple life form where old-age care relies on family and income on land. Both are being deprived by the process of urbanization. According to the recent China Health and Retirement Report, with decreasing numbers of young farmers, the speed of aging in rural population is fastened and the living standard for the "left-behind" parents is dropping [6]. The income, size and structure of family are the bases for rural residents when making health-related decisions, where affordability of the services is the main concern. Therefore China's national policies on old-age care, including the New Rural Cooperative Medical Scheme (NRCMS), New Rural Pension Scheme (NRPS) and Long-term Health Care Insurance System (LHCIS), currently pay more attention to provide basic support for rural residents, leaving a great deal of tasks for local government to set detailed regulations and standards in order to meet various types and levels of demand for rural old-age care. In addition, the effects of household registration policy, birth control policy and retirement policy [7] are still in place, urban-rural gap is closing but still large [8], making it more difficult to establish an economic model to measure the cost-benefit of old-age service for rural residents. Without one quantitative model, further adjustment to regulate health market will be less accurate and less efficient.

This paper first summarizes researches in health economics and introduces the cost-benefit tools commonly used for analyzing old-age service. Then it focuses on China's NRCMS, NRPS and LHCIS, pointing out the particularity of China's rural old-age care systems, followed by some implications for future research.

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***Corresponding author:** Yuzhou Wang, Department of Economics, Zhejiang Yinfeng Dahongqiao Technology Co., Ltd, China, Tel: 0086-13777373238; Email: wangyuzhou92@hotmail.com

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Review of Health Economics

There is a positive correlation between economic development level and life expectancy, so it's not a surprise that the population structure of developed countries is the first to face aging. It is generally accepted that one's demand for health care and long term care will increase when they grow older, but the demand for health care differs from that of consumables or public goods. How to accurately predict the market behavior in the field of health is a particular problem in economics. Arrow, in his 1963 paper "Uncertainty and the welfare economics of medical care" [9], gave a very systematic review of the characteristics of the health care market and suggested that the free market alone cannot provide health care well. He emphasized that the uncertainty of utility and of the demand in the future are the main reasons why competitive equilibrium cannot be reached under market condition. In addition, he introduced concepts such as externalities of health care services and humanitarian-based consumer spillovers to complement the characteristics of the market.

Another perspective, put forward by Grossman [10] in his theory of health demand, suggests that there is a deeper source of demand for health care, which is "health" itself. He believed that health could determine the amount of time an individual could spend creating money and goods. Based on the theory of human capital, he regarded "health" as a kind of investment. Individuals can influence their stock by investing in "health". He also established the complementarity of health insurance, education and nutrition level in obtaining "health", followed by the invention of demand model of "good health" and the demand model of medical service. One of the basic assumptions of this theory requires individuals to have clear expectations about their future health [11], and healthy depreciation rates accelerate with age so it affects the opportunity cost of buying health.

But since uncertainty could not be overlooked, many scholars tried to explain the uncertain factors while using the framework of health demand theory. Some believed competitive equilibrium could be reached even with uncertainty. Pauly [12] thought that issues like moral hazard derived from uncertainty could be explained and controlled by market mechanism and need not be intervened. Others tried to breakdown uncertainty into probability. Phelps [13] examined the reasons for changes in the rate of health depreciation and changes in the individual's demand for health care services. Cropper [14] examined the relationship between the probability of illness and the demand for health care services. Dardanoni and Wagstaff [15] examined the randomness of health depreciation rates and morbidity rates. These studies provide a basic theoretical framework for health economics, making it possible to quantify health and its benefit for individual.

As the average human life expectancy continues to increase and new medical technologies emerge, the uncertainty in the health market has been enriched. Individual needs for health differentiate into more dimensions and now cover longer time spans [16]. Traditional health demand models based on human

capital doesn't seem proper to describe long-term care for the elderly, as these services are not intended to return them to the labor market [17]. To optimize cost-benefit analysis, researchers tried different dependent variables, such as the length of life remaining [18] and the degree of reduction in risk of death [19]. The most popular method is to calculate the marginal willingness to pay (WTP) of the demander for certain units of quality-adjusted life year (QALY). The length and quality of life extension are taken into account by this method, so are individual preferences for health.

Generalized WTP holds that an individual's WTP is determined by three broad benefits, including the health values improved, the future costs saved and the productivity gained from health promotion in the theory of human capital [20]. And as Arrow pointed out, the benefits not only varied from person to person in terms of the amount actually received, but also varied greatly in the benefits that each perceived, which affected the value of health improvements and the amount spent by the individual [21]. To tackle this, QALY can provide a relatively objective measure of the utility of health care services. Although it is prone to have sample preferences [22], QALY has done well in the public domain working with WTP [23-26].

QALY is originally invented to measure the effectiveness of medical intervention. But a recent series of reports [27] by the International Society for Drug Economics and Outcome Research Task Force on health valuation systems suggested that it could also be applied to the cost-benefit analysis of health care services, though they left many open places for improvement. Their simplified version of QALY focused on general health outcomes while removed many factors that might be relevant to health decisions, such as previous illness severity, fairness, injury risk prevention [28]. These factors might be critical for the elderly, without them any analysis would face a mismatch between a simplified QALY and a generalized WTP. This report ends by suggesting that a patient-specific value-weighted model need to be developed to provide a detailed value assessment basis for cost-benefit tools in health field, and to help patient select health services.

QALY evaluation system can be very useful in the study of old-age services with a few modifications. Long-term health care services for persons with disabilities or chronic illness and varying degrees of incapacity [29], which differs from medical care because of its purpose. Chronic illness and disabilities are irreversible; this also affects people's WTP which is no longer dependent on their remaining life span [30]. Therefore when try to study long-term health care service using QALY approach, the weight of complete health should be adjusted, since people tend not to expect complete health in old age [31]. The capability-approach proposed by Sen [32] brings additional hints to measure the utility of long-term health care, which emphasizes the actual function and capability, rather than based on ordinal utility. Based on Sen's theory, Coast [33] invented an improved method called the ICEPOP Capability index (ICECAP-O) for the elderly, but its applicability and effect vary between different types of chronic diseases and ability levels [34-36].



Old-age Service for Residents in Rural China

1. Rural old-age care in China and its particularity

Rural residents' demand of general medical service and long-term care service in China is increasing mainly due to aging population and rising household income [37,38]. However this income growth rate has high local differences [39]. Two other factors were found to be significantly related to the demand, education and whether or not to live with children [40]. Additionally, rural residents often underestimate the possibility of losing normal living conditions after possible serious illness and do not take necessary precaution, thus many potential demand still remains implicit [41]. High diversity of family conditions and different expectations of old-age care represent the major difficulty for researchers and policy makers during data collection and making estimation.

Urban-rural disparity also has important impact on rural old-age care. Urbanization has drawn out young people from rural region and agriculture, leaving older residents behind in "empty nests", causing several unique phenomena. First of all, lower economic growth in rural region is coupled with higher level of aging [8]. Second, the negative effect of reduced family size and increased the old-age dependency ratio on older residents' health is exacerbated by living alone, given that elder rural residents particularly rely on family support. Xiang [42] pointed out that although rural young and middle-aged people chose to work in cities could increase the overall household income, the time and willingness of younger generation to take care of their parents were reduced, which in turn reduced the health status of elderly people. And such decline was proportional to the number of family members. The total social and economic burden of rural residents (65.5%) is higher than that of urban residents (34.5%) in terms of the proportion of the expenses on old-age care to the family income [43]. And as the secure income from land declines [44], elder rural residents must face the challenge of changing their income structure, which is difficult for anyone without proper skills, physical shape and opportunity. This major external factor will further complicate old-age care related analysis because it adds another layer of decision for rural residents, which is whether or not to migrate or to be registered as urban residents. Arguments has been made [6], that despite the inconvenience and loneliness of living in a rural region, the fear of pollution and higher cost of living in city among other life style concerns have deterred older rural residents from moving into cities, even to live with their children. Then it's no longer a simple cost-benefit analysis of old-age care, rather of accepting the modern life.

Zhao and Zhou [45] described the particularity of the old-age care problem in rural China as the complexity of the aged population, the monotonous way of providing for the aged, the lack of funds, the lack of policies, the scattered system and the unclear main body of responsibility. They believed that a sustainable old-age care system should combine the effort of three main participants: individual, society and government. Compared with rural old-age care shortage summarized by Weinhold [46], including the shortage of providers, improper

distribution, quality defects, and limited access, seem Chinese researchers are more convinced that government involvement is necessary. Although it's hard to neglect the influence of government, the real challenge remains how to give real support for the people, or at least meet their expectations of life quality improvement brought by old-age services, no matter who provides them. In the next section, we will see that great effort has been made to adapt old-age care systems to local conditions, but differences on individual or family level and disparities between urban and rural region create various uncertainty when trying to measure the value of health for rural residents, making cost-benefit analyses very complicated. The health market still awaits more accurate economic description.

2. Three main systems for rural old-age care in China

The New Rural Pension Scheme (NRPS), New Rural Cooperative Medical Scheme (NRCMS) and the Long-term Health Care Insurance System (LHCIS) piloted in some cities together compose the main system to guarantee the provision of old-age care for rural residents [47]. Before introducing individual progresses, a brief summary of these systems are given in Table 1.

The NRPS has covered every administrative region in 2017 and full coverage of rural residents is estimated in 2020, the next main task is to improve its efficiency by refined regulation and incorporating market mechanism, otherwise though short term welfare gain can be achieved, by 2050 a net welfare loss is expected due to demographic changes, compulsory taxation [48]. Meng's study [49] also emphasizes the need for professional operation of funds. Commercial operation can help balance supply and demand, optimize insurance price, and make pension fund sustainable. But currently, the commercial old-age insurance has low demand in the rural areas of China. The main reasons are rural residents' low income and the low level of the insurance awareness [40]. As stated above, rural residents are more accustomed to bank savings, not knowing that commercial insurance can be both secure and flexible, meanwhile offers a level of protection against inflation [50]. Study has proven that [51] with current level of urban-rural disparity, a multi-pillar coexistence of government and commercial pension scheme is the only way to make it sustainable meanwhile facilitate flow of market attention to the rural region. On a micro level, Shih-Jiunn [52] explained the complementarity of savings-based commercial insurance to social insurance through the supply curve and consumer surplus. Since the current premium subsidy's increase is not in proportion to the premiums paid by the insured, such complementarity could be helpful not only to fulfill the demand, but also to unveil the implicit demand and raise public awareness, increase general welfare. In addition, there are new ways to provide income for the elderly with deepened reforms of rural land ownership, such as rural housing reverse mortgage. Ren [53] found that these new reforms on land and NRPS can be complementary to each other too. Sound old-age insurance can induce rural residents to take more risky use of land, which in turn increases their wellbeing. This income can improve nutrition intake, better access to health care, increase



Table 1: Summary of three main systems of old-age care in China.

	New Rural Cooperative Medical Scheme	New Rural Pension Scheme	Long-term Health Care Insurance System
Start	2003	2009	2016
Function	Provide basic health services, alleviate poverty caused by illness	Provide income for basic livelihood	Provide subsidy and basic life care for the long-term disabled
Funding	Personal fee, collective support and government subsidy	Personal fee, collective support and government subsidy	Transfer from the medical insurance, gradually shift to collective support
Premium	Annual premium ¥ 220 in 2018	Annual premium Self-select level from ¥ 100 to ¥ 500	Annual transfer around 0.1% Additional premium is optional
Benefit	Covers at least 50% of medical expense for serious illness (Chronic and mild illness are less or not covered)	Minimum pension funded by government + Compensation according to chosen annual premium level	Home patrol services for rural residents with various proportion of reimbursement starting from 70%
Major goals in next phase	Increase coverage of chronic diseases; Promote preventive measures; Reimbursement for non-local residents; Promote overall planning for medical insurance in urban and rural areas, link up to long-term care insurance; etc.	Reduce difference and inequality of different types of pension between urban and rural residents; Enrich income channels together with agricultural and land policy; etc.	Summarize experience and launch more pilot cities; Create more long-term care services for rural residents; Explore new financing mechanisms; etc.

informal care, and increase leisure activities and a better self-perceived economic status, thereby improving the health status of rural residents [54].

In term of NRCMS, its task is more complex as it is directly related to the goal of achieving health. Since major hospitals are highly regulated by government, there are indeed studies focused on the supply side based on regional cases [55-57]. Wang and Chen [58] analyzed the third-party payment mode of NRCMS. Their paper pointed out that under NRCMS, patients received treatment from pre-designated supplier, this increased the effective demand but put the supplier on a monopoly position, and reimbursement ratio alone cannot effectively constrain the moral hazard [59]. In order to insert supply side control, a detailed standard fee list and a budget cycle is designed by official department. Chan and Zeng [60] used the conceptual framework of dynamic optimization model to study the “average quota per period” of such budget cycle, which provided a new perspective for hospital cost control behavior. This “average quota per period” system requires hospitals to dynamically and regularly comply with cost limits. It could also explain hospitals’ behavior of adjusting fees and extending length of hospitalization stay. This article also said that the supply-side reform of NRCMS must be market-oriented; otherwise every major medical institution must pass the national assessment to be registered, which brought complexity to market research. Some regions have taken the lead in trying the “separated management and professional operation” model [61]. While reducing the cost and promote optimal allocation of health resources, professionals from private sector introduce electronic clearing system, paving the road for connect urban and rural medical account, making it easier for non-local residents to be reimbursed. Despite cost control, another problem for NRCMS is its coverage for preventive measures and chronic disease, which is little or none. This not only drives patients with long-term illnesses occupy untargeted medical resources [62], but also reduces the possibility of early intervention; both use health resources in a very inefficient way.

Long-term health care services provide care for people with varying degrees of disability. In some developed countries, people make insurance deposits when they are young like they do with pension, and receive basic life care which helps them carry out daily life activities when they grow older in addition to basic medical services. It is difficult to meet the real needs of the disabled elderly only by providing financial support and general health care; doing so could bring loss to other medical care users. As Soumerai [63] suggested, specialized long-term care services should be provided for the disabled elderly with chronic diseases or degenerative diseases, and this system should be independent of health care system for the treatment of diseases. Otherwise, the inpatient treatment of disabled elderly people with no therapeutic value will pose a threat to the health care system. Comparing to that in urban areas, the proportion of disabled elderly in China rural areas is higher [64]. There is no national system of long-term care services in China. The first four pilot cities were set up in the 2016 under the guidance from the Department of Social Security on piloting the long term care insurance system [47], followed by another 11 pilot cities shortly afterwards. The funding channels for insurance are different in each city, and the grading, management and specific services provided are different too, but they all follow the principle of “combining medical intervention with daily care” [65]. Firstly they operate under the medical care system, then gradually become independent, so some scholars think that China’s long-term care insurance should be more accurately called “long-term medical care insurance” [66-67]. Although rural residents can also participate in LHCIS in pilot cities, the number of service station in rural areas is small and the level of subsidies is insufficient to compensate for the equity between urban and rural areas [67]. Take the Qingdao model as an example, Lu [68] considered the system of community health centers as mobile clinics could supplement the demand of the disabled elderly in rural areas, plus a lower co-payment rates which is set at 30 percent for other urban residents with low levels of basic health insurance and



rural residents. Without specific data, it is unclear whether such subsidy could benefit supply or demand end, though it's certain that LHCIS also needs to evolve as local conditions changes, like NRCMS.

While commercialization of the old-age care system can facilitate efficiency, it should be noted that powerful government regulation is one key factor to reduce uncertainty, forming trust and regulate health market. According to the experience of developed countries [69], the government should bear limited liability, and the individual contribution is necessary to ensure a sustainable operation of such insurance. But in China's case, the current information gap between rural residents and health market is too large for any individual or family to make reasonable decisions. Without government inspection and endorsement in every way, Chinese rural residents are not confident enough to put their future life on the hands of professional strangers or to feel satisfied and safe with any social services [6].

For questions regarding the extent of market participation in health, info-tech companies are working with the Chinese government to promote online documentation of personal health as the first step to accurately measure people's behavior related to health, setting a good example of cooperation between public and private sector. Rural residents in some places are eagerly enjoying the convenience of online health services including remote diagnoses and buying some medicines online [6] thanks to the full coverage of 4G signals. Without violating people's privacy, basic online behavior like browsing and clicking can be documented to indicate their preferences, even basic quantitative experiment is also possible. The sensitivity for risks and opportunities of new technology is one of the advantages for inviting private companies to join the health market, but to reach their full potential in a controlled manner, researchers should offer standard procedures and measurements to guide the whole process at very beginning, create more efficient algorithm to exact information from big data about rural residents.

Research Prospect

China's particularity in old-age care issue requires both public and private sectors to provide its rural residents with affordable services. Government participation is essential to disperse uncertainty and to lead the cost-benefit analysis. As the demand of old-age care is complex and urge, multiple ways to enrich old-age care supply should be considered. Traditional medicine precisions and non-public medical servers need to be carefully regulated. Whether job opportunities within the existing health care system should be created for them and other part-time precisions should also be evaluated. Using the health economics principle based on sufficient and accurate data can avoid unnecessary intuitive trials, and such results might offer valuable experience for countries worldwide.

Meanwhile, the three major current policies targeting old-age service of rural residents needs further refinement. They have different functions, different research focus and future goals. NRPS guarantees the origin of income, mainly trying to expand the channels of the income, promote its sustainability

and be the bridge of related policies. Studies on NRCMS and LHCIS now focus on whether these policies can save or balance health expenditure of individual and the country in a long run, and how do they affect the supply and demand of health service market. The current data is more about health expense, and there is a lack of data on the amount of health improved or perceived of the elderly, whether in forms of QALY, Capability index or WTP, which can only be obtained from longitude studies on elder people. Together with specific theories, these data are the prerequisites for the introduction of market mechanisms into old-age care, which seems to be the common pathway for old-age services in the future. Policy makers can also benefit from a detailed portrait of health demand and supply in rural area, as it is interlinked with poverty elimination and rural development.

The experiment of LHCIS is in pilot stage. Because it aims to improve the quality of life rather than offer a cure, the evaluation system for medical service needs adjustment. For example, whether the cost-effective threshold of \$50,000 based on WTP-per-QALY [70] can be used to evaluate the effectiveness of long-term medical care is worth discussing. Such amount of cost could be easily reduced with early preventive method [71], especially for some chronic diseases caused by environmental factors and traditional habits [72], like exposure to pesticide or consuming preserved foods, which may speed up the course of diseases such as neurodegeneration or cancer. According to the fourth sample survey of the living conditions of the elderly in urban and rural areas in China, more than 70% of the disabled elderly in our country are due to neurodegeneration. Since long term health is an accumulated function of both physical and psychological event with great deal of uncertainty, it's difficult to weigh the pleasure gained by enjoying unhealthy food against the risk of cancer, but it's useful to know the probability and people's WTP to set proper insurance premium and to help individual make better decisions. For other operations commonly relate to health gain, like regular health examination and coverage of chronic disease expenditures, questions should be around cost-benefit or pricing.

On a more fundamental level, the definition of rural or farmer is undergoing changes. Formally they are relatively obvious in China due to household registration policy. Since this boundary is being broken down as China tries to balance urban-rural development and closing the urban-rural gap [73], some rural regions now share many advantages as well as problems of cities, urban and rural residents in the future might differ only in terms of income or their own opinion. In LHCIS pilot city for example, a person's insurance fee is no longer linked to household registration type, rather to one's income level and disability level [68]. The insurance content is now divided into workers and residents, not rural residents and urban residents.

Because the content of rural is evolving, studies also need to catch up. Past studies addressed plenty of difficulties when mentioned old-age care in rural areas, often described the disadvantages and seldom highlight the advantages of rural areas. Rural areas have a great natural environment and slow pace of life among other positive features when choosing an old-age care facility location. With the narrowing of the urban and



rural gap, more urban residents are willing to adopt the “5 + 2” lifestyle, meaning spending 5 weekdays working in city and 2 days of weekend in countryside. More and more elderly citizens are coming to developed rural regions for their retirement [74,75]. It is expected that the demand for old-age care service in rural areas will increase significantly in the future, which will bring new challenges to rural land policy, financial management and so on. Research of old-age care in rural areas should not only aims at the people who have such need, but also regard the rural areas as a cultural community of human settlement, which requires researchers to grasp the regional development of urban and rural area, to define their studying population with detailed characteristics under different natural and cultural background. Sorting out the relationship between supply and demand ends of the old-age care market, even for the most regional and unique features, can give the market and national government essential clues.

This paper summarizes the studies in the field of health economics, especially on the problem of old-age services in rural China. At present, scholars have conducted cost-benefit analysis in different areas of China, providing vital references for further optimization of the old-age care system. Future analyses with more detailed data of individual preferences are needed in order to formulate general theory. Quantified tools like QALY and WTP need to adapt themselves to the particularity of rural China, in order to incorporate coming big data. Such study should also fit into a larger picture of China’s rural revitalization strategy, which has put rural old-age services on an important position. Huang Zuhui’s interpretation [76] of this is that urban and rural areas need to be deeply integrated in population migration, industrial development and organizational system, and effective rural self-control should be implemented according to the characteristics of regional rural areas. Rural areas are not only a geographic concept and rural residents are not a group of people tied by household registration, but also by culture and history. The goal of future research, in addition to find optimal allocation of medical resources, reduce medical cost and help government fulfill its roll, also need to shed light on inviting market mechanism, help rural areas build up its own strength in terms of the natural environment and traditional customs, attracting more “new farmers” and social capital to rural development. Public popularization and academic application of health economics can help individuals, market participants and scholars to understand the meaning of “health” more rationally and objectively under Chinese condition, also reducing the cost of government regulation and control.

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