

## **Health service support system for aging people in smart communities from the social support perspective**

*(Full Paper)*

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### **ABSTRACT**

Smart community provides opportunities to develop the elder care system with information technologies for elderly people. Most existing studies on elder care system are from the macro level and there lacks practical development in this area, especially has ignored diversified elderly people's health needs. This study tried to investigate the elderly people's health needs by conducting interviews in two smart communities (Sanli community and Tieli community in Hefei city, Anhui province). We have interviewed 16 older adults and 16 of their grown-up children in the communities. With the help of Nvivo12, health needs about elderly people are coded into 57 free nodes and 8 tree nodes elderly people, which are further divided into four aspects based on the social support angle, information needs, instrument needs, substance needs, and emotion needs. Finally, we developed the health service system of smart communities from the subjects and functions of social support perspective. Through this study, we can better understand health needs of older adults and provide references for the development of health services in smart communities.

*Keywords:* Older adults, smart communities, health needs, health services, social support.

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### **INTRODUCTION**

With the rapid development of information technology, especially the development of internet technology, informatization levels in urban populations have seen a rapid progression. Countries and government organizations have been developing the policy plans and relevant blueprint, which lean heavily on information and internet technology to promote the rise of smart cities (Zheng *et al.*, 2013). Smart communities have been proposed (Wu, 2013) as an important part of smart cities, among which smart health care system plays an important role. More and more residents are inclined to seek daily medical needs from communities rather than from large hospitals (Wu, 2017). In the "13th five-year plan" for the development of China's undertakings for the older adults, it was proposed to build a comprehensive information network and service platform for eldercare in the community with the achievements of modern science and technology. The platform aims at generating convenient and efficient services for older adults living in the community, and actively promoting health services. Shared elder communities are the main place where old adults spend the final years of their lives. These shared communities provide housekeeping, business, and entertainment service. It is expected that health services gradually play a more central role in the community service with the general improvement of people's health consciousness.. For example, the community can provide disease prevention and control, primary diagnosis and treatment of common diseases, management and rehabilitation services for chronic diseases and so on. This trend can change health service models in the community and improve the level of service, gradually taking the responsibility of "gatekeeper" of residents' health (Zhao, 2014).

Presently many countries across the world are facing the issue of aging population. In China, "The 13th five-year plan for the development of undertakings for the older adults and the construction of the elder care system" predicts that the number of elderly people over 60 years older will increase to about 255 million, accounting for 17.8% of the total population by 2020. Elderly people living alone or without family support network will increase to about 118 million, and the old-age dependency ratio will increase to about 28 percent. For this reason, social security for the older adults continues to rise. China has the largest elderly population in the world, accounting for about one fifth of the world's elder population. The unique national conditions of "getting old before getting rich" makes the social problem of elder-care extremely urgent in the 21st century. China will face a period of severe aging and pension problems. Besides, due to their physical needs and vulnerability, adults have even more urgent needs for health care compared to other groups. For this reason, scholars have found that the development of health services for older adults is insufficient, and health needs of older adults are not satisfied (Wang, 2018; Ma & Zhou, 2018).

In practice, problems like tax regulation, unclear policies, single service content and lack of pertinence are prominent (Wu, 2017). In particular, the health services associated with older adults has a series of problems including uneven quality of

information, insufficient accuracy of data sources, unreasonable service and a lagging data update (Qian *et al.*, 2018). According to a report by Tencent entitled “big health industry data insight report” in 2019, the older adults are the main force within the health industry, and they are interested in obtaining health knowledge, exchanging health information, seeking health products and process of medical treatment, especially in sharing health information and product use (Tencent, 2019). The older adults have gradually become the focus of health care services. Existing research on older adults’ health service needs in smart communities is too general. The older adults’ health care needs are not clear, and the health services of smart communities lack theoretical guidance. This study aims at exploring old adults’ health needs through semi-structured interviews and constructing a health service system for smart communities. We expect to contribute to the personalized health management service, enrich the relevant theory of health services and promote the development of health service of smart communities in practice.

## LITERATURE REVIEW

### Health Needs

The existing research on health needs mainly focuses on the field of medical healthcare and information science. The former focuses on certain type of disease and specific user group, while the latter pays more attention to health information needs. For example, the health needs of patients with scoliosis are mainly mental and physical health needs (Xue, 2019). Pregnant women’s health needs in clinics of obstetrics and gynecology are related to nutrition, fetal education and analgesia (Xie & Liu, 2018). The health needs of college teachers are regular physical examination, health education methods, disease prevention, healthy life and healthy diet (Zhao *et al.*, 2012). The health needs of trafficked people are an individuals’ entitlement to healthcare, availability of healthcare resources, providers of key knowledge, and the unique demands of trafficked individuals (Williamson *et al.*, 2020). There is a difference in mental health needs of rural residents and their urban counterparts, mainly access in prescription medications (Kirby *et al.*, 2019). For health information needs, some scholars have found that breast cancer and diabetic patients are interested in topics such as nutrition, specific diseases, and fitness (Cleveland *et al.*, 2008). The health information needs of cancer patients undergoing chemotherapy mainly focus on disease treatment and symptom control (Youssef *et al.*, 2019). Pregnant women pay more attention to health information regarding the unborn child, nutrition and childbirth (Ghiasi, 2019). As for the health needs of the older adults, it is found health care and related diseases is the main content of health information queries (Hou & Sun, 2015). The health needs of the urban elderly are more likely to come from medical consumption, chronic disease care and medical insurance (Song & Liu, 2007). Abdi *et al.* (2019) believed that older adults face physical, social and psychological challenges and are in urgent need on information support in social activities, relationships and mental health. Palmer *et al.* (2014) found that older adults living in the community were paying close attention to bladder health, nocturia, drug safety, physical activity/exercise through a “health hydrate” project. It is found that the research on older adults’ health needs is not clear and the connotations are macro. Older adults’ health needs tend to be diversified with multi-level characteristics. For example, Stephen (2012) said that elderly care needs an all-round and multi-angle excavation.

### Health Service

Western health services developed earlier than Chinese services. The health service practice and theoretical development are relatively mature, for instance, Britain's National Health Service has an established information service system to increase the system efficiency of health services. It also brings the health service competition at the community level, which aims to fundamentally protect the health of the residents, and make it easier to get satisfactory health service (Liu *et al.*, 2013). The community level health care services reduce hospital costs yet community users can make diagnoses of diseases according to relevant data and have timely feedback on a resident’s health status (Breslow *et al.*, 2004). Some communities construct health-monitoring systems that can integrate and share medical resources and health information (Stefanov *et al.*, 2004). There are also communities that build health management systems to guide community users by tele-therapy (A1-Attas *et al.*, 2012; Beul *et al.*, 2010). Chinese scholars started relatively late and mainly focus on the technology and countermeasures. Liu & Wu (2007) put forward technologies of using residential networks and built a health service system for primary care. Yan (2018) designed remote collection platforms for community health services by using Spring, Spring MVC & Mybatis (SSM), and achieve dynamic effect in JSP by Java Script+jQuery, through which doctors can diagnose remotely based on the physiological characteristics of users. At the same time, Zhang *et al.* (2013) proposed the “hospital & community & family” health service model for chronic diseases, by which patients can share health information, make full use of medical resources and establish close doctor-patient relationship. Yue & Li (2014) proposed that community health services should be given high priority in the social system, so that social organizations can take full role in the process and the health consciousness of community users can be enhanced. Concerning research on health services for the older adults, Niwa & Nishi (2017) suggested the information platform for smart communities should pay more an attention to the acquisition and sharing of data for older adults. Hamada *et al.* (2019) used people aged 75 years or older in Japan as samples and concluded that consultations with physicians and an increased use of inpatient services are key factors. Buchner *et al.* (1997) found older adults living in a community are concerned with health services regarding short-term exercise map, gait, balance, and physical health status. However, in the research on China's national conditions, especially the smart communities, this new pension mode is rarely found.

### Social Support

As a classical sociology theory, social support theory has been playing a central role. Previous studies have different

classification scheme on social support. Wineman (1990) proposed social support includes emotional support, financial support and companionship while Cutrona (1989) thought social support includes instrumental and emotional support. Riffle *et al.* (1989) divided social support into emotional support, social integration, network support, self-esteem support, material support and information support. Overall, it can be said that social support is divided into subjective support and objective support. Subjective support includes emotional support, while objective support includes material support, information support, economic support and so on. In recent years, social support theory has been applied to the field of the aging care in explaining aging behavior. Li (2019) further divided the functions of social support for older adults into basic life support, emotional support, social relationship support, and security support, and the main object of social support included community workers, pension service institutions, and volunteer groups. Fang (2013) believed that social support for older adults who have not had offspring should come from the government, communities, social organizations and the elderly themselves, and communities should care about the differences in gender, education level, income, social policies and other factors. Kempen *et al.* (2012) found that the impaired vision of older adults in community-living demands more social support, especially professionals' nurses providing quality care. It can be found that social support theory may guide the development of elderly care services.

In general, the research on the health service system of smart communities for older adults was not systematic and in-depth, especially the health needs of older adults, which are not thorough and multivariate. Health service systems in smart communities lack the guidance of relevant theories. So we try to explore health needs of older adults and build the related health service system from the perspective of social support.

### METHODOLOGY

#### Research Method

We have conducted a semi-structured interview based on the grounded theory method. The ground theory approach is a qualitative research method generally accepted in practice (Strauss & Corbin, 1990). It is more applicable to the explorative research that aims to develop theories. Theories are generated through interview analysis. There are three steps for ground theory approach: open coding, axial coding, and selective coding.

#### Research Object

This study selected two representative smart communities: Anhui province (Sanli community and Tieli community in Hefei city). The world health organization (WHO) defines those as above 60 years of age in developing countries as older adults, so the average aged person in this study is over 60 years old. In order to interview efficiently, we selected the older adults who can communicate clearly. In order to better understand older adults' health needs, we also interviewed their children. Finally, 16 older adults and 16 grown-up children agreed to participate in the study. The demographic information is shown in Table 1.

Table 1: Demographic information.

	Category	Count	Category	Count
	Older adults		Their children	
Gender	Male	10	Male	9
	Female	6	Female	7
Age	60-65	8	20-30	3
	65-70	6	30-40	6
	>70	2	>40	7
Education	Unschooling	2	unschooling	0
	Private schools / primary schools	6	Private schools / primary schools	4
	Junior high school	5	Junior high school	6
	High school/ technical secondary school	2	High school/ technical secondary school	3
	University (including junior college) or above	1	University(including junior college) or above	3

#### Research Procedure

In the early stage of this study, the recruitment was conducted mainly through the cooperation with the community. We posted posters to introduce the purpose of the study, the conditions of the objects, the time required for the interview and the remuneration. The final interview time was determined to be from 1/5/2019-3/5/2019, during the May Day holiday, so the available time of users was relatively abundant. Before the interview, we coded 16 old people as A1, A2... A16 and 16

grown-up children as B1, B2... B16. The interview process was divided into two groups, which of one group interviewed the older adults and which of the other group interviewed their grown-up children. Each group was composed of two researchers, which of one of responsible is to ask questions and the other for records. The interview is conducted in a face-to-face manner. Before the formal interview, it is necessary to explain the purpose of the interview to the interviewees, tell them that the whole process needs to be taped for later data analyzing, and promise that the recorded content will only be used for academic research and no personal information will be disclosed. At the same time, researchers should pay special attention to the emotional state of the older adults, and timely adjust the interview structure and content, so as to facilitate the interviewees to fully express their views. The whole interview follows the logical progressive and divergent thinking mode. We mainly ask about health needs, difficulties, benefits, suggestions etc.. The questions are: ① what health needs do you/your parents have? ② Do you/your parents have any other health needs? Can you say more? ③ What is your current community like, and do you/your parents have any difficulties? ④ What health services does your community provide for you/your parents? Detailed questions are shown in Table 2.

Table 2 : Interview questions.

#	Question to older adults	Question to their children
1	What health needs do you have?	What health needs do your parents have?
2	Do you have any other health needs? Can you say more?	Do your parents have any other health needs? Can you say more?
3	What is your current community like and do you have any difficulties?	What do you think of your current community and do your parents have any difficulties?
4	What health services does your community provide for you?	What health services does your community provide for your parents?
5	Do you think the health services in your community have helped your health?	Do you think the health services in your community have helped your parents' health?
6	Do you have any other health needs that are not being met? What is that?	Do your parents have other health needs that are not being met? What is that?
7	Please provide suggestions about health services in your community.	Please provide suggestions about your parents' health services in your community.

### DATA ANALYSIS AND RESULTS

After the interview, the researchers need to translate the recording into text, in which of older adults were encoded as X1, X2,... , X16 and their children are encoded as Y1, Y2... Y16. The entire coding process is handled in Nvivo11, which are powerful and flexible qualitative analysis software developed by QSR (Qualitative solutions & research) in Australia. This software is specially designed for large-scale qualitative research projects, with convenient data input and output, which provides 8 main functions: internal, node, set, queries, models, links, classifications, folders, so that the process of qualitative research and analysis is speed up (Bauer & Gaskell, 2000; Norman et al., 2006). The whole process of this study was conducted by browsing and coding at the same time. The specific details are as follows:

#### Open Coding

In this process, 32 transcribed texts needed to be encoded, three of which are randomly reserved for a saturation test. It should be noted here that in order to better reflect the real health needs, the encoded nodes must ensure their primitiveness as much as possible. For example, a participant whose code number is A6 said that “I have diabetes, so I like watching health shows on TV around a sensible diet, exercise and the different types of diabetes”. We will code (select) key phrases Diet, exercise, types of diabetes. The other participant coded for A13 said that “my children bought me some instruments which can test my blood pressure, blood sugar and so on, but I always forgot how to use and must seek help from my children every time. Especially, when each test finished, it will generate a lot of data which is hard to understand. I can't determine if my blood pressure or blood sugar is high or low, I really wish there was some training”. We will encode the usage of the instrument, the interpretation of the health data and training. Finally, we coded out 137 free nodes, and the operation process in Nvivo12 is shown in Figure 1:

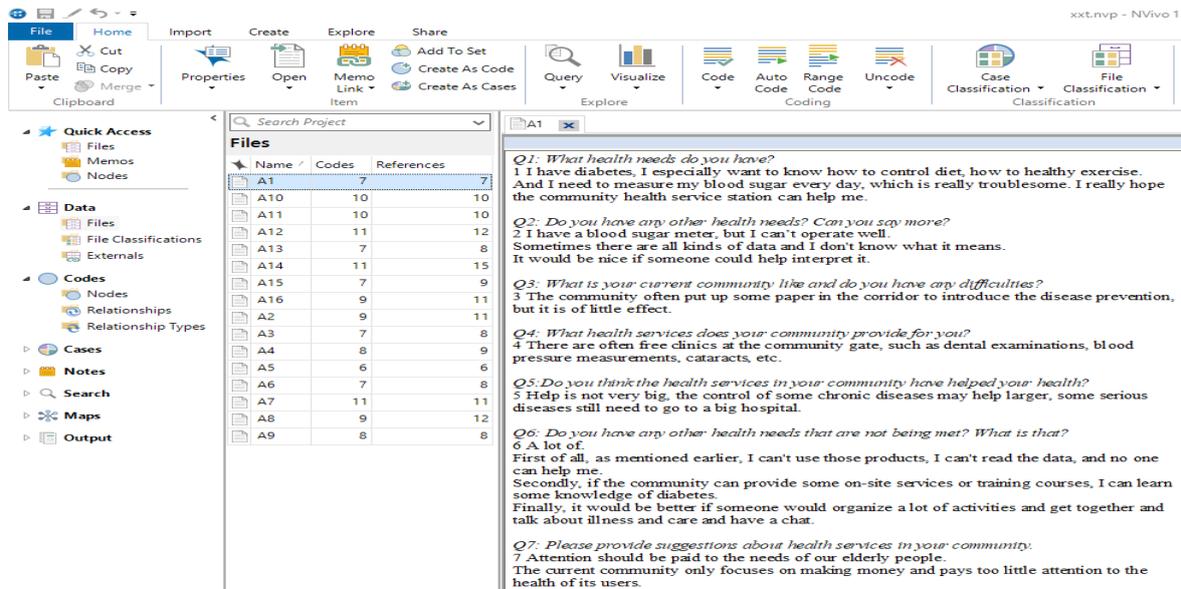


Figure 1: The process of open coding.

### Axial Coding

Axial Coding is to sort out the free nodes obtained in the open Coding process, then merge the nodes with repetition and similar meanings, and further summarize them into higher level tree nodes. For example, treatment and seeing doctors is a similar concept, collectively referred to as treatment. Use and operation are also a similar concept, therefore are unified to the use.

Exercise, diet, sleep, longevity are the nodes mainly involved in daily healthy life. We put them into one category and named them as daily health. Similarly, diagnosis method, diagnosis result, prescription, treatment plan, medical record are the nodes mainly involved in the diagnosis and treatment process related to the disease. We put them in one category and named diagnosis and treatment. However, from Open Coding process, we found that the health needs of the older adults were relatively scattered, with 69 nodes with a frequency of 3 or below. In order to highlight the main health needs of older adults, the nodes with a frequency above 3 were selected for analysis in this study. Finally, after repeated induction and discussion, the research team finally obtained 57 free nodes and 8 tree nodes. At the same time, after the saturation test, we found that the internal consistency of the code reached 90.07%, which met the research requirements, and allowed for the continuation to the next operation.

### Selective Coding

In this process, we need further summaries the free nodes and tree nodes to find the hierarchical relationship, parallel relationship or causal relationship. Through analysis, we consider that there is a parallel relationship between different tree nodes. Based on existing research on the classification of social support (Wineman, 1990; Cutrona, 1989; Riffle *et al.*, 1989), and combining with results in axial coding, finally, the 8 tree nodes were divided into 4 higher levels: information needs, instrument needs, substance needs, emotion needs. Information needs contain daily health, pathological knowledge, diagnosis and treatment. Instrument needs contain the use, booking, pay, etc. related to wearables devices and mobile terminals. Substance needs contain purchase, reimbursement ratio, nursing home fees, home care fees and so on related to medical insurance and medical cost. Emotion needs are related to mental health that involved patient support, help, loneliness, depression, etc., the specific whole node is shown in Table 3.

Table3: Health Needs.

Tree Nodes	Tree Nodes	Free Nodes
Information	Daily Health	Diet, exercise, health maintenance, sleep, nutrition, longevity, health care, lectures, popular science, physical examination
	Pathological Knowledge	Types of disease, pathologic etiology, symptoms, complications, preventive care, rescue measures, precautions
	Diagnosis and Treatment	Diagnosis method, diagnosis result, prescription, treatment plan, medical record, medicine, prognosis
Instrument	Wearables Devices	Usage, data interpretation, function, effect, product category, health privacy, experience, health certification
	Mobile Terminals	Register/login, book, pay, search, notify, comment
Substance	Medical Insurance	Payment/purchase, insurance rules, insurance coverage, reimbursement ratio

	Medical Cost	Nursing home fees, home care fees, household service fees, drug fees, hospital fees, treatment fees, examination fees, education fees for the elderly
Emotion	Mental Health	Disease communication, patient support, help, understanding and tolerance, inferiority, loneliness, depression

**DISCUSSION**

After the three coding stages - open coding, axial coding, and selective coding, we identified 57 free nodes, 8 tree nodes, and corresponding 4 core tree nodes. Next, we will build the service system from the perspective of subjects and functions of social support. The subjects of social support involved in this study are government departments, enterprises, medical service institutions, smart communities, volunteers and so on. The main functions are as follows: information support, instrument support, substance support, emotion support, as shown in Figure 2.

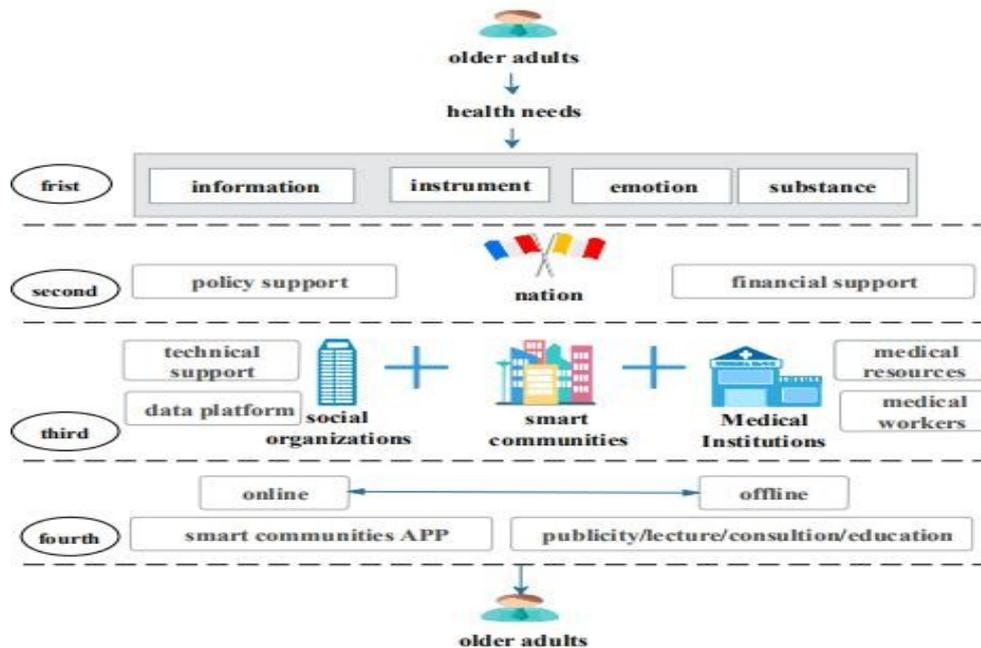


Figure2: Health service system.

The first layer refers to health needs of older adults. It belongs to the basic level and is the driver of health services in smart communities. According to the results of the interview, the health needs of older adults are divided into information needs, instrument needs, substance needs and emotional needs. But there are also variations within the health needs of older adults, for example, an interviewee coded A3 said that “I pay special attention to healthy diets.” Some books and fitness TV programs that often discuss food safety and how to match dishes are very helpful to me.” Another interviewee coded A9 said: “I don't pay special attention to healthy diets, nor do I limit my diet too much, I think too much attention will lead to the lack of nutrition in the body, as long as it is not too much.” So smart communities also need to pay attention to the characteristics of the older adults and provide targeted health services.

The second layer is about policies and regulations. As a decision-maker, the nation provides policy and financial support for the health services of older adults in smart communities, providing substance support in terms of medical insurance and medical cost. The optimal outcome is that the government should increase the policy support in the provision of care for the aged, intensify top-level design and overall planning for the older adults in smart communities, and establish a data standard system. In addition, current governmental departments should gradually increase the investment in the construction of health service platforms of smart communities, especially the support for the key technology. The nation should also increase financial support for health services of older adults. For example, the financial subsidy and reimbursement amount of medical expenses for older adults with major diseases or chronic diseases should be gradually increased, so as to relieve the financial pressure of such families in terms of health services and care services to a certain extent.

The third layer is about resources and cooperation. Smart communities need to cooperate with other organizations, such as medical institutions, social organization. Medical organizations such as hospitals, private clinics and community health service stations should provide education, training, health lectures, free diagnosis, tele-medicine, psychological counseling, door-to-door services, etc. Then help to realize the daily health, treatment, monitoring and distress measures of other multi-dimensional health service. Social organizations include the internet companies, electronic manufacturing enterprises, volunteers, elderly organizations and housekeeping organizations. Internet companies and electronic manufacturing

enterprises can provide instrument support for the development of health services in smart communities. Enterprise developers should regularly provide experiential teaching on the use of wearable devices and mobile terminal products and train the older adults on the use of electronic products. Volunteers, elderly institutions and housekeeping organizations should take a unified approach to smart communities to form a united service system, the old people can seek for help by urgent button, then related organizations can obtain effectively key information at the fastest speed, so as to provide information and emotion support. So this layer can provide information, instrument and emotion support.

The fourth layer is about service form/type. The key type is a combination of online & offline health services, online mainly through smart community APPs, The older adults can not only input, collect, query and analyze the health data, but also have various functions such as registration, medical treatment, housekeeping, first aid and user communication. For offline, the community should build a health service site where the older adults can consult and learn by themselves. At the same time, the community should provide information support, for example, regularly carry out daily health consultation, health lectures, as well as the publicity, education and learning education of common diseases. Then encourage more volunteers to participate in elderly care services, they can organize regular visits and one-to-one health reviews that can imply various functions of social support. This layer can also provide information, instrument and emotional support.

### CONCLUSION

Based on the health needs of older adults, this study conducted interviews with 16 older adults and 16 of their grown-up children in two representative smart communities. We identified 57 free nodes, 8 tree nodes by open coding, axial coding, further combination with the classification of social support, the health needs of the older adults were divided into 4 core tree nodes. Finally, from the perspective of subjects and functions of social support, it further constructs the health service system of smart communities. In summary, this study can help us to enrich the research of the health needs and health services of the older adults in smart communities, therefore raising health consciousness of the older adults and guiding development of smart community health information services. At the same time, this study also has several constraints. In this study, the elderly participants are independent and can take care of themselves, whilst there is a population of individuals who are disabled and totally dependent on other, this population's health information needs should also be explored. Besides, we only collected data from two smart communities, so need to expand the number of participants. Finally, the health information service system needs to be tested in practice.

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