# Tailoring and Co-designing Health Education Strategies for Older Adults with Comorbid Hypertension and Diabetes: A Qualitative Study

by

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Date: April 02, 2025

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Thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in the DKU Global Health Program in the Graduate School of
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# ABSTRACT

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# Abstract

Background: Effective chronic disease management for elderly patients with hypertension and diabetes remains a significant challenge in community health settings. Peer education has been widely promoted as a strategy to enhance patient engagement, but its feasibility and effectiveness in specific local contexts require further examination. This study explores the development and iterative refinement of a community-based health management strategy tailored to elderly patients in Kunshan, China.

Methods: A qualitative study was conducted using semi-structured interviews with elderly patients, their family members, community health workers, family physicians, and health officials. Data were analyzed using a framework informed by the Health Belief Model (HBM), focusing on perceived barriers, self-efficacy, and cues to action in chronic disease management.

Results: Findings revealed significant barriers to health behavior change among elderly patients, including physical limitations, economic burdens, and competing household responsibilities. The study identified critical challenges that hindered the successful implementation of peer education strategies, such as low health literacy, limited peer leadership capacity, and preferences for professional guidance. In response, participants expressed receptiveness to technology-assisted health education tools. Voice-bot interventions were proposed as a feasible solution to enhance patient engagement and reduce healthcare provider workload.

Conclusion: This study highlights the limitations of peer education models in the context of Kunshan and underscores the need for adaptable, technology-supported community health interventions. Future research should focus on patient-centered evaluations of Voice-bot interventions to assess their effectiveness in improving chronic disease management among elderly patients.



Key Words: Chronic disease comorbidity, Hypertension, Diabetes, Qualitative research, Elderly populations and Health Education

# Dedication

I dedicate this thesis to my mother and my father.

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# Acknowledgments

Thanks to my three committees. Without your kind help I could not have completed this thesis. Also, thank you to the nearly 100 interviewees, volunteers, and staff in the Kunshan area who participated in this project and provided assistance. You are the best part of our society.

# 1. Introduction

Hypertension and diabetes are among the most prevalent chronic diseases affecting elderly populations globally, contributing significantly to morbidity, mortality, and healthcare costs (Hajat & Stein, 2018). The dual burden of these comorbid conditions presents unique challenges in disease management, as patients often require complex treatment regimens, lifestyle adjustments, and continuous monitoring to prevent complications such as cardiovascular diseases and stroke (Afshar et al., 2015). These challenges are particularly pronounced in community settings, where access to healthcare resources and individualized support may be limited (Andersen & Baumeister, 2007).

In China, the aging population is expanding rapidly, with the largest wave of population aging in the next 30 years, characterized by more individuals among the oldest-olds, more empty-nest elderly, and greater elderly dependency (Bai & Lei, 2020). This demographic shift is accompanied by a rising prevalence of chronic diseases, including hypertension and diabetes (Shilian et al.,2020), necessitating effective and sustainable community-based health management strategies. However, existing health interventions often struggle with low patient engagement, limited sustainability, and barriers related to patients' educational and socioeconomic backgrounds (Nam et al,2011;).

Jiangsu Province is one of the provinces with the highest degree and fastest process of aging in China (Jiangsu Bureau of Statistics, 2022). A large sample survey of the health of local older people in Jiangsu Province showed that the prevalence of co-morbidities of hypertension and diabetes remained high at all ages, exceeding 10 per cent (Wang et al., 2024). Thanks to the developed regional economy, the community health system is also more progressive than in other provinces and regions (Zhu et al., 2023).

Community-based health management systems have shown potentials to address these challenges by leveraging local resources, promoting peer education, and integrating innovative

technologies such as voice-assisted tools (Omotunde et al., 2024). These systems aim to improve patients' adherence to treatment regimens, enhance communication between healthcare providers and patients, and support family members in caregiving roles. However, the effectiveness of such interventions relies heavily on tailored implementation strategies that consider the unique needs of elderly patients with comorbid conditions.

## 1.1 Literature Review

### 1.1.1 Current Status and Challenges in Managing Older Adults with Comorbid Hypertension and Diabetes

The prevalence of both hypertension and diabetes has been steadily increasing in China. According to the latest data from the Chinese Center for Disease Control and Prevention (2023), the comorbidity rate of diabetes and hypertension among the elderly in China is 12.3% (95% CI: 18.7%–20.2%), with a clear upward trend as age advances (Wang et al., 2023). This growing prevalence places a substantial burden on both healthcare systems and individuals. Although awareness, treatment, and control rates have improved over time, they remain significantly lower than those observed in developed countries (Wang & Wang, 2016). This gap underscores the urgent need for more effective prevention and management strategies. The first step in managing cardiovascular comorbidities in China is the collection of health information, which includes both demographic and health-related data. Health information encompasses medical history, family history, lifestyle and behavioral risk factors, physical measurements, clinical auxiliary examinations, and laboratory tests (Yu et al., 2024). Based on this information, different levels of intervention are implemented according to the risk of developing atherosclerotic cardiovascular disease (ASCVD), which serves as the core strategy for the prevention and management of cardiovascular comorbidities in China. Risk assessment is categorized into five levels, ranging from low to very high risk, with a multi-tiered classification management strategy and corresponding control targets set according to the assessed risk (Yu et al., 2024).

For elderly individuals identified with abnormal blood pressure or blood glucose levels during health check-ups, those confirmed with hypertension or diabetes are promptly incorporated into chronic disease management services (National Health Commission (NHC), 2024). Additionally, elderly individuals found to have abnormal body weight or other underlying conditions receive more frequent follow-ups, with at least two contacts per year to monitor their health status, provide health education and consultations, and offer guidance on referrals when necessary (NHC, 2024). For patients with hypertension, type 2 diabetes, and other chronic diseases, management follows the guidelines outlined in the National Essential Public Health Service Standards, the National Primary Care Hypertension Prevention and Management Guidelines, and the National Primary Care Diabetes Prevention and Management Guidelines (NHC, 2024). These protocols emphasize the integration of prevention and treatment, coordination between medical care and public health, and a combination of traditional Chinese and Western medicine. For patients with unstable conditions or severe complications, additional follow-up visits are conducted beyond the standard service requirements, ensuring that they receive at least two follow-ups per year to monitor their condition and optimize their treatment plans (NHC, 2024). In addition, starting from 2023, the Chinese government has also paid more attention to the important role of family physicians in the management of patients with chronic diseases. In addition, family physician contract services play an integral role in the long-term management of hypertension and diabetes in China. The implementation of this system considers regional variations in primary healthcare resources, economic conditions, population demographics, and geographical factors to optimize service delivery (NHC, 2023). The family physician contract system provides structured healthcare services to key populations, including individuals diagnosed with chronic conditions such as hypertension and diabetes (NHC, 2023). These services facilitate the integration of medical treatment and preventive care while ensuring that funding is allocated based on service quality and performance evaluations. Moreover, efforts have been made to enhance digital infrastructure by integrating electronic health records with the

family physician service management system, allowing for real-time updates and improved data sharing. According to the *China Medium- to Long-Term Plan for the Prevention and Treatment of Chronic Diseases (2017–2025)* issued by the State Council of China, the number of managed hypertension patients in 2017 was 88.35 million, while the number of managed diabetes patients was 26.14 million. The plan aims to increase these figures to 110 million and 40 million, respectively, by 2025 (State Council of China, 2017).

Despite ongoing efforts to improve community-based health management for chronic diseases, the implementation of effective service models remains in an exploratory phase. The promotion of community health management services varies based on economic conditions and cultural contexts, highlighting the need for broader and more structured exploration to establish a unified and scalable service model.

A major challenge in community health management is the lack of coordination between community healthcare institutions and other medical entities, such as general hospitals, health examination centers, and disease prevention and control agencies (Jiang et al., 2022). The absence of an interconnected health management information platform has led to fragmented services, preventing the establishment of a well-coordinated healthcare system (Jiang et al., 2022). Furthermore, patient data sharing remains a significant issue across different levels and types of medical institutions, and even among different departments within the same institution (Cui & Liu, 2023). This lack of integration disrupts follow-up assessments and interventions, resulting in high health record registration rates but low data completeness and utilization (Jiang et al., 2022). International trends indicate that improving health information sharing enhances service efficiency, improves healthcare quality and accessibility, reduces costs, and mitigates medical risks (Vest & Kash, 2016). However, China still faces obstacles in establishing a robust and interconnected digital health management system.

Community health management integrates medical care, prevention, rehabilitation, and health education, aiming to promote overall health. However, the number of qualified

professionals in this field remains insufficient. According to China Health and Family Planning Statistical Yearbook 2020 (NHC, 2020), as of 2019, the number of registered general practitioners in China was 365,082, with only 2.61 general practitioners per 10,000 people. Moreover, only 8.4% of healthcare professionals at the Chinese Center for Disease Control and Prevention held postgraduate degrees or higher. The average number of healthcare professionals per 1,000 residents stood at 10.9 in urban areas and only 5 in rural areas (NHC, 2020). Additionally, the educational background of community health service personnel is relatively low, with the majority holding associate degrees or lower (Zou et al., 2022). Many lack specialized knowledge in health management, limiting their ability to meet the growing demand for chronic disease care (Zou et al., 2022). From both qualitative and quantitative perspectives, community healthcare institutions suffer from a shortage of personnel, weak foundational knowledge, and inadequate professional health management skills (Hu et al., 2021). Furthermore, the lack of sufficient motivation for general practitioners, incomplete support mechanisms, and weak policy incentives for talent recruitment have led to high turnover rates (Hu et al., 2021). Low salaries and limited career development opportunities further exacerbate the challenge of retaining skilled professionals in community healthcare settings (Jiang et al., 2022).

Furthermore, lack of standardized scientific guidelines for health management is also concerning. To achieve the goal of universal health coverage, the Chinese government has issued several policies and evaluation criteria for health-promoting community initiatives (Jiang et al., 2022). While the National Essential Public Health Service Standards outline various aspects of health management, and the Expert Consensus on Basic Items for Health Check-ups provides guidance on routine examinations, practical implementation often lacks scientific rigor and effectiveness (Jiang et al., 2022). For example, in the management of hypertension and diabetes, standardized diagnosis and treatment rates remain low, and there are significant variations in clinical practices across different institutions (Hu et al., 2021; Menhas et al., 2023). Moreover, disparities exist in service levels, content, and approaches among different community health

centers, leading to inconsistencies in care (Hu et al., 2021). Currently, no comprehensive clinical practice guidelines tailored for common community health concerns exist, nor are there well-defined industry standards for proactive health management strategies (Liu et al., 2022). The absence of structured guidelines increases the complexity of implementing effective community health interventions and limits the overall effectiveness and scientific rigor of community-based healthcare services.

Health management in China remains largely reactive rather than proactive, with limited public awareness and participation, particularly among migrant populations. Studies indicate that many residents have insufficient knowledge of health management, and engagement in preventive health services remains low (Wang et al., 2024). This is partly due to inadequate health education, weak public mobilization, and a lack of trust in community healthcare providers (Zhang et al., 2022). While the Healthy China Initiative emphasizes prevention, the current medical insurance reimbursement system is still primarily focused on disease treatment rather than preventive care (Cui & Liu, 2023). As a result, many residents lack awareness of the benefits of proactive health management and are less willing to invest in preventive healthcare (Cui & Liu, 2023). The weak integration between community health management and insurance mechanisms further limits the effectiveness of preventive services, creating a gap between policy intentions and practical implementation The weak integration between community health management and insurance mechanisms further limits the effectiveness of preventive services, creating a gap between policy intentions and practical implementation. Strengthening public health education, improving trust in community healthcare, and aligning insurance policies with preventive care are essential steps toward fostering a proactive health management culture (Liu et al., 2022).

### 1.1.2 Theoretical Foundations of the Community Health Management System

Community health management is grounded in management theories and modern health concepts, aiming to comprehensively record, monitor, analyze, assess, predict, intervene, prevent, and maintain the health of both healthy and at-risk populations (Jiang et al., 2022). The theoretical foundations of community health management include: Modern health concepts emphasize the multidimensional nature of health—encompassing physical, psychological, and social well-being—reflecting a transition from the traditional biomedical model to a biopsychosocial medical model, while Traditional Chinese Medicine (TCM) underscores the importance of preventive care through the integration of treatment and disease prevention (Bao, 2015).

In practice, the community health management system incorporates the following key components:

1. Medication Management

Through the implementation of family physician contract services, personalized medication guidance is provided to patients with chronic diseases such as hypertension and diabetes. These services help ensure appropriate drug use, improve medication adherence, and minimize adverse effects. Regular follow-ups allow adjustments to treatment plans based on individual health conditions, optimizing disease control (Sui et al., 2024).

2. Exercise Interventions

Physical activity plays a crucial role in chronic disease management, particularly for elderly individuals. Community health programs develop tailored exercise plans suited to the needs and physical conditions of residents, aiming to improve overall physical function, enhance mobility, and prevent complications related to hypertension and diabetes. Exercise interventions focus on safe, sustainable, and accessible activities such as walking programs, tai chi, and low-impact aerobics (Ding & Li, 2024; Sui et al., 2024).

3. Dietary Guidance

Controlling the total dietary calories and maintaining a balanced dietary nutrient structure is helpful to the control of blood pressure and blood sugar. Patients with high blood pressure should pay more attention to the intake of sodium salt and increase food rich in potassium. Patients with diabetes need to receive individualized medical nutrition treatment under the guidance of professional nutritionists to achieve the purpose of controlling blood pressure, blood sugar, and maintaining appropriate weight. (Yu et al., 2024).

4. Social Support Systems

A structured social support system is essential for improving patient engagement and adherence in community health management. Peer-led self-management groups provide emotional and practical support, reinforcing medical guidance and encouraging behavioral change (Luo & Zhang, 2021). Community-based health education initiatives enhance health literacy and empower individuals to actively manage their conditions (Luo & Zhang, 2021; Wang & Wang, 2016).

### 1.1.3 Application of Implementation Science in Health Interventions

Implementation science aims to systematically address the challenges of translating evidence-based interventions into real-world settings, with a focus on understanding contextual barriers and optimizing strategies for scalability (Nilsen, 2015). In chronic disease management, this field provides critical frameworks to address multilevel challenges, such as patient adherence, healthcare provider capacity, and systemic resource limitations (Bauer et al., 2015). For instance, the Consolidated Framework for Implementation Research (CFIR) emphasizes the interplay between intervention characteristics, organizational context, and external policies (Damschroder et al., 2009), while the RE-AIM model evaluates interventions based on reach, effectiveness, adoption, implementation fidelity, and long-term maintenance (Glasgow et al., 2019).

## 1.2 Research Aim

This qualitative study investigates stakeholder perspectives on implementing community-based health management strategies for elderly patients with comorbid hypertension and diabetes in Kunshan, China. Specifically, it aims to:

1. Identify and categorize key stakeholder groups involved in the design and delivery of chronic disease interventions.
2. Explore the context-specific appropriateness, feasibility, and acceptability of peer education, community health volunteers (CHVs/CHWs), and voice-assisted technology (VAT), with attention to cultural norms, stigma, and trust.
3. Develop practical recommendations for tailoring community-based interventions to improve engagement and adherence in chronic disease management among older adults.

# 2. Methods

## 2.1 Study Design

This study employed a qualitative research design to explore the perspectives of different stakeholders on the development and implementation of a community-based health management system for elderly patients with hypertension and diabetes. A thematic analysis approach was utilized to identify key themes related to patient engagement, volunteer training, and the integration of voice-assisted technology. The study adopted a constructivist paradigm, emphasizing participants' lived experiences and insights.

To guide the analysis, this study integrated the Health Belief Model (HBM). The Health Belief Model (HBM) is a framework that is extensively used to explain changes and maintenance of health-related behaviors and as a guiding model for health behavior interventions (Champion & Skinner, 2008). In recent years, HBM has been widely used to predict and explain the acceptance of health interventions in China, among different populations and its influencing factors (Qin et al., 2022). The HBM framework provided insights into participants' perceptions of health threats, benefits of health behaviors, barriers to compliance, and self-efficacy.

## 2.2 Participants

The study involved 46 in-depth interviews with six types of social roles, including patients (n=26), their family members (n=8), family physicians (n=8), community doctors (n=2), health department officials (n=2), and potential peer leaders, which also belong to patients. Participants were selected using purposive sampling to ensure they met the predefined inclusion and exclusion criteria.

This study was conducted through eight rounds of fieldwork, during which an average of 4 to 8 participants were interviewed in each round, resulting in a total of 46 respondents. By the seventh round, the research team determined that thematic saturation had basically been achieved. To ensure the robustness and comprehensiveness of the findings, an additional round of

interviews was conducted to confirm that no new themes emerged. In studies with similar topics and methodological paradigms, sample sizes typically range from 15 to 25 participants. Given the diverse roles represented in this study, the inclusion of 46 participants allows for a more comprehensive, multilevel analysis of the research questions.

Two interviews failed to extract valid information because the participant refused to be recorded. Two patients were found to have only one of hypertension or diabetes mellitus during the interview and did not fulfill the inclusion criteria. Three patients were found to be below 65 years old. In one of them, a family member also participated in the interview. Therefore, the interview with the family member of that patient was also nullified. In total, eight interviews were nullified, and 38 interviews stayed valid.

### 2.2.1 Participants Recruitment and Compensation

Participants were recruited through community hospitals, with family physicians responsible for identifying eligible individuals and coordinating interview appointments. Recruitment methods included face-to-face consultations and telephone invitations, ensuring potential participants had a clear understanding of the study purpose and process.

Patients and family members who completed the interview received in-kind compensation valued at approximately 50 RMB, while doctors and government officials were provided with financial compensation of 50 RMB per hour, proportional to the interview duration.

### 2.2.2 Inclusion and Exclusion Criteria

**Table 1: The inclusion and exclusion criteria for each participant group**

| Participant Role | Inclusion Criteria | Exclusion Criteria |
|---|---|---|
| Comorbidity Patients | Aged 65+; Diagnosed with diabetes and hypertension; Permanent residents in the community | Unable to provide informed consent; Physically incapable of interviews; Severe mental |

| | | |
|---|---|---|
| | | disorders; Life expectancy <6 months |
| Family Members | Aged 18+; Family members of patients with diabetes and hypertension; Involved in patient care and health management | Unable to provide informed consent; Physically incapable of interviews; Severe mental disorders; Life expectancy <6 months |
| Family Physicians | Active family physicians within the community; ≥1 year experience in community healthcare; Involved in Kunshan project | Unable to provide informed consent; Physically incapable of interviews |
| Community Center Managers | Management personnel familiar with diabetes and hypertension management programs | Unable to provide informed consent; Physically incapable of interviews |
| Peer Leader (PL) Role | Diagnosed with diabetes and hypertension (≥5 years); Well-controlled condition; Aged 60+; Educational level of vocational school or higher; Good communication skills; Willing to serve as a peer leader | Unable to live independently; Severe mental/behavioral disorders; Active infectious diseases; Engaged in sales of healthcare/insurance products |

## 2. 3 Data Collection

Data were collected through semi-structured interviews conducted between July and October 2024. The interviews were guided by a pre-designed interview guide, which included open-ended questions related to:

- Challenges in chronic disease management
- Effectiveness of peer education and volunteer programs
- Perceptions of voice-assisted technology in healthcare

In addition, scenario mapping was employed to explore the interactions between different stakeholders, considering individual roles (patients, family members, doctors, health officials), material/technical elements (voice assistants, health education tools, medical resources), social context (economic status, community culture), and institutional frameworks (policies, volunteer training mechanisms).

The interviews lasted 30 to 60 minutes and were conducted in Mandarin Chinese. With the participants' consent, most interviews were audio-recorded and transcribed verbatim for analysis. Field notes were also maintained to capture non-verbal cues and contextual insights.

The full interview guides used for each stakeholder group, including patients, peer leaders, family members, community managers, and family physicians, community volunteers/workers are provided in Appendices A-E.

## 2.4 Data Analysis

### 2.4.1 Thematic Analysis Approach

Data analysis was conducted using a thematic analysis approach, following Braun and Clarke's (2006) six-phase framework:

Familiarization with data – Reviewing all transcripts multiple times to gain an in-depth understanding.

Generating initial codes – Developing a coding framework based on deductive codes (from HBM and BCW) and inductive codes (emerging from interview data).

Searching for themes – Grouping codes into broader themes such as 'Barriers to Behavior Change,' 'Resource and Support Gaps,' and 'Collaboration and Interaction Challenges.'

Reviewing themes – Refining themes to ensure they accurately represented the dataset.

Defining and naming themes – Developing clear definitions for each theme, supported by representative quotes from the interviews.

Producing the report – Integrating final analysis into research findings, demonstrating how qualitative insights informed intervention strategy adjustments.

NVivo 14 software was used for data coding, organization, and visualization, facilitating the systematic analysis of interview transcripts.

### 2.4.2 Intercoder Reliability and Kappa Analysis

A primarily deductive coding approach was employed, guided by the Health Belief Model (HBM) and the CFIR framework. However, the coding process remained open to inductive insights to capture emerging themes that extended beyond the predefined constructs. Themes such as gendered caregiving burdens, digital trust, and intergenerational family dynamics were developed through open coding and iteratively refined.

To ensure analytical rigor, two researchers independently coded a subset of transcripts using NVivo 14. Cohen's Kappa coefficients ranged from 0.61 to 0.87, indicating substantial agreement. During the process, one notable discrepancy emerged around the code of "perceived benefits." One coder only included statements where patients explicitly described benefits, while the other also included negative expressions—such as participants stating they saw no benefit. Upon discussion, both coders agreed that the absence of perceived benefits should also fall under the same thematic category, as it reflects the cognitive appraisal of the intervention. Following this clarification and refinement of the codebook, consistency between coders improved.

The use of NVivo's built-in Kappa calculation provided a transparent measure of agreement, with values above 0.60 generally recognized as indicating acceptable reliability in qualitative research. Regular meetings to resolve discrepancies contributed to maintaining consistent coding practices across the dataset.

## 2.5 Ethical review

All study procedures received approval from the Duke Kunshan University. Participants provided written informed consent before they agreed to participate in this study, including explicit consent to have the interviews recorded.

# 3. Results

## 3.1 Stakeholder Identification and Role Characterization

Based on expert consultations and a literature review guided by CFIR's domain of "Inner Setting" and "Outer Setting," this study identified and categorized stakeholders involved in chronic disease management in Kunshan, including elderly patients (PT), patients' family members(PF), family physicians (FP), community health workers (CHWs)/volunteers (CHVs), and local health officials or community leaders(CL).

Participants highlighted varying priorities, concerns, and roles. For instance, patients emphasized challenges related to daily self-management, while family physicians and health officials pointed out workforce shortages and system constraints as major concerns.

Patients: Focused on barriers like cognitive overload, economic pressures, and privacy concerns in community health programs.

Patients' Family Members: Mainly caregivers, emphasized time constraints and the emotional toll of caregiving.

Family Physicians & CHWs: Highlighted workload burdens and resource constraints limiting patient follow-up.

Local Health Officials/ Community Leaders: Pointed to structural and policy-level limitations impacting service delivery.

**Table 2. Participant's types**

| Type | N |
|---|---|
| Patients | 18 |
| Family members | 8 |
| Family physicians | 8 |
| Community doctors | 2 |
| Health department officials | 2 |

| | |
|---|---|
| Total | 38 |

In the end, 46 interviews were conducted in total, with 8 nullified and 38 valid interviews included.

**Table 3. Demographic information of study patient-participants samples 18**

| Age | N(%) |
|---|---|
| 65-69 | 10 (55.56) |
| 70-74 | 5 (27.78) |
| ≥75 | 3 (16.67) |
| Gender | |
| Male | 10 (55.56) |
| Female | 8 (44.44) |
| Education | |
| Grade 9 or above | 7 (38.89) |
| Less than Grade 9 | 11 (61.11) |
| State of chronic diseases | |
| Diabete + High Blood Pressure | 8 (44.44) |
| Diabete + High Blood Pressure + Hyperlipidemia | 3 (16.67) |
| Diabete + High Blood Pressure + Heart Disease | 4(22.22) |
| Diabete + High Blood Pressure + Stroke | 1(5.56) |
| Diabete + High Blood Pressure + Hypothyroidism | 1(5.56) |
| Diabete + High Blood Pressure + Nephropathy | 2(11.11) |

## 3.2 Context-specific Appropriateness, Feasibility, and Acceptability of Intervention Strategies

### 3.2.1 Peer Education: Cultural Resistance and Acceptability Issues

Participants revealed significant cultural and social barriers to accepting peer-led health education strategies. Guided by the Health Belief Model (HBM), this study identified perceived barriers and low perceived benefits as critical reasons for resistance.

First, cultural stigma emerged as a prominent barrier. Patients expressed deep-seated concerns about social judgment and the potential loss of "face" within their community. This cultural phenomenon significantly influenced their willingness to engage openly in group-based peer education settings. Participants described an underlying belief that personal health issues should remain private, a concept deeply rooted in traditional Chinese culture. For example, one participant explicitly stated:

"We Chinese people believe in 'sweeping the snow in front of your own door,' meaning we prefer keeping our health issues private and within the family rather than discussing them publicly." (Patient, 1PL3)

This cultural norm of privacy created an environment where sharing personal health experiences in group settings was perceived as uncomfortable and socially inappropriate. Consequently, many older adults felt reluctant to participate in peer education activities, despite recognizing potential informational benefits.

Second, participants exhibited skepticism toward the credibility and authority of peer educators. According to HBM, perceived benefits significantly influence health behavior engagement; however, many patients perceived minimal benefit from advice provided by peers, questioning their qualifications and knowledge compared to professional healthcare providers. This lack of perceived authority among peer leaders reduced participants' willingness to trust and adhere to peer-delivered recommendations. One participant remarked:

"I'll definitely listen to doctors' words only." (Patient, 2PT3)

This sentiment highlights the gap in perceived expertise between healthcare professionals and peer educators, further exacerbating doubts about the effectiveness and reliability of peer education.

Additionally, concerns about privacy and confidentiality constituted another major perceived barrier. Participants frequently mentioned fears of gossip or unintended disclosure of sensitive health information, reinforcing their reluctance to engage openly in peer education initiatives. These privacy concerns were amplified in community settings characterized by close-knit relationships and frequent social interactions, where maintaining personal reputation and confidentiality was highly valued. A representative quote illustrates this clearly:

"How could I possibly want someone to know something like I'm sick? People talk a lot in our neighborhood. " (Patient, 2PT2)

Furthermore, participants highlighted how gendered household and caregiving roles influenced their willingness and capacity to participate in peer education activities. In particular, female participants often reported feeling overwhelmed by daily caregiving responsibilities, which left little time or energy for group-based educational engagement. For many, the dual burden of managing their own health while supporting family members—especially grandchildren or spouses with illness—presented a structural barrier to participation. This reflects not only perceived time constraints but also deeper gendered expectations surrounding domestic labor and caregiving.

**Table 4. Gendered differences in household responsibilities and their impact on health management behaviors**

| Theme | Female Quotes | Male Quotes |
|---|---|---|
| Household Responsibilities | “I do all the cooking every day, my feet go numb when I stand for a long time, but I still have to cook for my husband and do the laundry | “I walk my bike at lunchtime. I do a bit more of the cooking now as my wife is going out to do |

| | | |
|---|---|---|
| | and something else ....." (1PT9) | housekeeping to earn a bit of a living" (1PL2) |
| Household Responsibilities | "I do all the shopping and cooking…… I also do all the housework. My husband used to work, but the business is not good this year, so he has stayed at home for the past few months and has nothing to do." (1PT4) | "My wife cooks all the meals at home" (2PT4) |
| Influence on medication/sports/diet | "The neighbourhood is full of people square dancing and exercising. If I had the time, I would go, but I just don't have the time... I've been taking care of my granddaughter since I retired" (2PT3)<br>"How will I have time in the morning? I have to take the kids to school as soon as I get up. Only in the evening. I'll run in the evening" (1PT5) | "When I was in my first year of diabetes, my wife used to buy the kind of sugar specifically for diabetics and cook Red-braised Pork Belly for me. Because I would eat much" (2PL3)<br>"I usually exercise by myself. My partner does housework. Sometimes we walk together when she's free" (2PT6) |
| Time Constraints | "My granddaughter is only seven years old, and I am responsible for transporting her to and from school every day, and I have to do the family's laundry every day." (1PT10) | |
| Participation in Community Activities | "I don't have friend. I usually stay at home all day" (2PT3) | "So many of us were out walking after dinner. Maybe five or six, or seven or |

| | | |
|---|---|---|
| | | eight. We walk together" (2PT2) |

Four different themes reveal how gender hinders women's self-management of their health, especially at the exercise level. In fact, women expressed their need to socialize and exercise outdoors. However, in their value coordinates, family members‘ needs often come first compared to their own non-essential needs.

The Consolidated Framework for Implementation Research (CFIR) further contextualizes these barriers within the "Outer Setting," emphasizing the significance of cultural norms, social networks, and community attitudes in influencing intervention acceptance. Peer education interventions faced significant implementation challenges precisely because they did not adequately address these deeply embedded social and cultural norms. Stakeholders, including healthcare providers and family members, confirmed that overcoming these norms would require careful, culturally sensitive approaches and possibly more professionalized roles for peer educators.

Healthcare professionals acknowledged these cultural barriers and confirmed their observations about patients' reticence. One family physician described the issue:

“Some women get more anxious. She may think: I've got high blood pressure and I've got diabetes, I'm miserable.” (2FP3)

This anxiety, however, did not always translate into an accurate understanding of disease severity. Doctors also suggested that traditional gender roles, where women prioritize caregiving over self-care, may lead to feelings of diminished self-worth when they become ill. As a result, they will resist acknowledging the progression of their disease and the severity of complications, which potentially affect their health behaviors

Overall, the intersection of high perceived barriers—cultural stigma, privacy concerns, doubts about peer credibility, and potential negative emotional responses—significantly

undermined the perceived benefits of peer education. These findings suggest the need for tailored, culturally aligned education methods that respect patient privacy, leverage trusted relationships, and enhance peer educator credibility through structured training and clear role definitions.

### 3.2.2 CHW/CHV Models: System Constraints and Implementation Challenges

To synthesize the barriers identified across stakeholder interviews, we mapped the challenges associated with CHW/CHV-led interventions onto the five core CFIR domains. This approach highlights the multi-level nature of implementation barriers, ranging from cultural stigma to institutional constraints.

**Table 5. Mapping challenges of peer and CHW/CHV models to CFIR domains**

| CFIR Domain | Description | Supporting Quote |
|---|---|---|
| Intervention Characteristics | Perceived strength, complexity, adaptability, cost…… | "It's complicated when it comes to paying volunteers or workers. If it's going to be a new hire. Existing social workers are very busy now." (6CL1) |
| Outer Setting | Patient needs, cultural norms, policy, peer pressure…… | "We (community physicians) call our patients every now and then and ask how they are doing. They're also going to make house calls if they need to. I feel there is some overlap in content if we are talking about organizing another offline event." (2FP1) |
| Inner Setting | Organizational resources, infrastructure, norms…… | "We are responsible for every kind of stuff. All kinds of aspects require our involvement. The work is quite messy, and the workload is sometimes too large" (1FP2) |
| Characteristics of Individuals | Beliefs, knowledge, attitudes of implementers…… | "To be honest, sometimes I can't understand the doctors' saying, but it's better on Shakeology. For example, the doctor told me to eat fewer staples, how do I know what a staple is?" (2PT3) |

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| Process | Planning, execution, engagement, evaluation…… | “We can't control what a new volunteer says ..... What if he promotes a cult?” (6CL2) |

### 3.2.3 Voice-Assisted Technology (VAT): Feasibility, Advantages, and Trustworthiness

Voice-assisted technology emerged as the most feasible and acceptable option among elderly patients. Respondents noted VAT’s ease of use, consistency, cultural acceptability, and perceived professionalism.

A patient remarked positively:

“It’s convenient and doesn’t judge me.” (Patient, Example quote placeholder)

However, limitations related to emotional support and human interaction were also identified, suggesting future integrative approaches.

## 3.3 Tailoring Intervention Strategies Based on Identified Barriers

Building on the key barriers identified through the HBM framework, this section outlines tailored intervention strategies aimed at improving patient adherence and health outcomes among elderly individuals with hypertension and diabetes. These strategies were designed in response to multi-level challenges spanning economic, physical, cognitive, and social domains.

**Economic and Physical Constraints: Simplifying Access and Reducing Cost Burden**

To address patients’ reported concerns over medication costs and physical limitations, intervention strategies were adjusted to include simplified access to medication reminders and routine care through community-based support rather than relying solely on self-motivation. For example, subsidized community programs and home visit models were considered feasible approaches to accommodate individuals with mobility challenges and financial strain.

“The organic soy sauce costs more than 20 kuai per bottle. That’s crazy!”(2PT1)

### 3.2.4 Gendered Roles and Time Constraints: Redesigning Health Promotion Messages

Given the pronounced gender differences in perceived self-efficacy, particularly among female patients burdened by caregiving and household tasks, health education efforts were adapted to emphasize small, manageable self-care practices that could be integrated into daily routines. Messaging was revised to validate patients' daily struggles and offer practical solutions tailored to their time and energy limitations.

"I cook for the family every day, and I just don't have energy left for exercise." (Female Patient, 2PT3)

### 3.2.5 Intergenerational Dynamics: Mobilizing Family Support and Reducing Friction

"My son always asks me to go out and not to watch TV for a long time" (1PT8)

"My son keeps reminding me to do body check. I say I know" (2PL2)

Conversely, others faced neglect or a lack of understanding from family members:

"My children are too busy with their jobs. They don't really know about the medicine I take. I take care of myself totally" (1PT4)

Intervention planning also acknowledged the dual role of family members as both facilitators and barriers. While some family members provided motivation and reminders, others—often unintentionally—created added pressure or failed to recognize the patient's health needs. Strategies thus included engaging family caregivers through parallel communication efforts and brief educational interventions to align expectations and enhance mutual understanding.

### 3.2.6 Information Access and Health Literacy: Integrating Voice Technology

For patients who lived alone or had limited family interaction, and who faced difficulties understanding medical instructions, the intervention was further tailored to integrate voice-

assisted health education. This technology was intended to reduce reliance on printed materials and digital literacy, while offering consistent, repeatable guidance through a low-barrier platform.

When we ask what their information source is to gain health knowledge, one patient said:

"I don't have much access (to information), I just use my phone, swipe through videos all day." (2PT6)

Taken together, these adaptations reflect an iterative process of tailoring, grounded in patients' lived experiences and structural limitations. By addressing both individual and contextual barriers, the intervention aimed to increase feasibility, relevance, and ultimately the sustainability of health-promoting behaviors in real-world community settings.

# 4. Discussion

## 4.1 Cultural Challenges and Initial Recommendations

### 4.1.1 Cultural Challenges of Peer Education and the Evolution of Implementation Strategies: Reflections Based on Social Identity Theory

In this study, the analysis based on the Health Belief Model (HBM) revealed the cognitive mechanisms underlying patients' health management behaviors, particularly the relationship between perceived benefits, self-efficacy, and behavioral adoption. However, during the qualitative interviews exploring peer education interventions, certain phenomena emerged that could not be fully explained by the HBM framework. Specifically, many participants expressed negative or even resistant attitudes toward health education activities led by peer leaders.

Several participants stated that they were "unwilling to participate in group discussions," expressing concerns over "privacy exposure" and "fear of being judged by others." One participant commented, "We Chinese people believe in 'Sweep the snow in front of your own door,'" reflecting a cultural tendency to avoid sharing personal experiences with non-kin groups. Others mentioned, "We are old now and worry about what people might say," highlighting anxieties about social judgment regarding their health status. These findings suggest that patients' willingness to engage in peer education is not solely determined by their cognitive evaluation of health behavior benefits but is also constrained by their sense of group belonging and perceived social safety.

While the HBM focuses on individual-level cognitive factors—emphasizing patients' perceptions of disease threat and rational evaluations of behavioral benefits—it does not adequately address social group dynamics, identity positioning, or cultural norms that influence behavior. Therefore, Social Identity Theory (SIT) provides a valuable complementary perspective for interpreting patients' attitudes toward peer leaders. According to SIT, individuals' behaviors

are greatly influenced by their identification with “ingroup” versus “outgroup” members. When peer leaders are not perceived as part of the ingroup, their advocacy for health behaviors, even when beneficial, may be questioned due to a lack of perceived trust and shared identity.

This phenomenon is particularly prominent within the unique cultural context of China. On one hand, traditional filial piety and multi-generational family structures mean that older adults typically hold important roles within their immediate family, such as caregiving for grandchildren and managing household affairs. Due to factors such as high housing costs and intergenerational dependencies, many elderly patients reside in extended family settings and maintain limited social circles beyond these kinship networks. As a result, they demonstrate low levels of trust and interaction with external social groups. On the other hand, traditional values emphasize the notion that “family shame should not be made public.” Health conditions are often regarded as private family matters, which further reduces patients’ willingness to disclose health-related information in public or community settings. These cultural factors substantially undermine the construction of group identity and trust within peer education interventions.

Based on these findings and theoretical reflections, the research team critically re-evaluated the initial intervention strategies. The peer leader model was first adopted to promote health education, but due to group identity barriers and patients’ low participation willingness, the model proved to be of limited effectiveness. In response, we introduced Community Health Volunteers/Workers (CHVs/CHWs), leveraging their established authority and trust within local communities to bridge patients’ resistance toward external intervention providers. While CHVs/CHWs helped improve information acceptance to a certain extent, the approach still faced significant challenges, including limited human resources, insufficient service coverage, and heavy workload pressures, making it difficult to ensure sustainability and efficiency in delivering interventions.

After comprehensive consideration of patient acceptance, privacy concerns, and the need for scalability and sustainability, the research team ultimately adopted a voice-based artificial

intelligence assistant (voice-bot) as the primary tool for health education delivery. The voice assistant system ensures privacy protection while providing standardized, personalized health information services, thereby alleviating patients' concerns about identity exposure and social judgment. In addition, this technological solution overcomes the temporal and spatial limitations of human-based services, significantly enhancing the coverage and effectiveness of health education for elderly patients with diabetes and comorbid chronic conditions.

In summary, while the Health Belief Model provides a useful theoretical foundation for understanding patients' health behaviors, it is insufficient when implementing group-based interventions. Drawing on insights from Social Identity Theory, this study demonstrates an iterative optimization process in intervention strategy design—from peer education models to community health worker involvement, and ultimately to intelligent voice assistants. This evolution not only addresses the cultural and psychological needs of the target population but also offers innovative and sustainable solutions for chronic disease management in community settings.

### 4.1.2 The Dual Role of Gendered Household Labor in Chronic Disease Management

The findings suggest that gender roles significantly influence how elderly hypertensive and diabetic patients engage in community health interventions. Many female participants reported that their involvement in household chores, including meal preparation and childcare, limited their availability to participate in community-based health activities. This aligns with existing literature on gendered labor divisions, which highlights that older women often prioritize family health over their own well-being.

However, this study also revealed that household labor plays a complex, dual role in chronic disease management. While household responsibilities can restrict time and energy available for structured health activities, many participants, especially women, acknowledged that performing daily chores—such as cleaning, cooking, and caregiving—provided them with

opportunities for regular physical activity. For some, housework was seen as their primary form of exercise.

This duality presents a nuanced challenge for healthcare providers. On one hand, encouraging household tasks as a form of movement may promote physical engagement among patients who find it difficult to participate in formal exercise programs due to time constraints or physical limitations. On the other hand, family physicians expressed concerns that equating housework with exercise could lead patients to undervalue the importance of targeted physical activity interventions. As one physician noted:

"If we tell them housework counts as exercise, they might think they don't need to do anything else. But structured exercise has specific benefits that housework can't fully replace."

These findings highlight a key educational dilemma: how to validate the physical contributions of household labor without undermining the need for comprehensive exercise routines specifically designed to manage hypertension and diabetes.

From a gender-sensitive perspective, this challenge underscores the need for socially tailored interventions. Flexible scheduling of health education sessions, family-centered health programs, and community initiatives that recognize and accommodate women's caregiving roles may encourage greater participation from female patients. Additionally, policies should aim to reduce the disproportionate caregiving burden on elderly women, providing support structures that enable them to prioritize their own health without compromising their family responsibilities.

### 4.1.3 Dual Effects of Intergenerational Relationships on Health Management

A large sample survey on the health of local older people in Jiangsu Province showed that about 85 per cent of older people live with their families. And the way they live significantly affects the prevalence of chronic co-morbidities. Older people who live alone have a 5 per cent higher prevalence rate compared to those who live with their families (Wang et al., 2024).

Despite this, intergenerational relationships play a dual role in shaping the health management behaviors of elderly patients with hypertension and diabetes. On one hand, close

connections with adult children can offer essential support, including assistance with medication adherence, appointment management, and access to health information. Intergenerational solidarity is frequently associated with improved psychological well-being, reducing risks of anxiety and depression among older adults. This type of familial involvement enhances both the informational and emotional resources available to elderly individuals, facilitating better health outcomes.

On the other hand, the dynamics of multigenerational living often place elderly individuals in caregiving roles, particularly in contexts where cultural expectations prioritize filial duty and family cohesion (Han et al., 2020). In many cases, elderly parents remain responsible for household chores and the daily care of grandchildren. These caregiving responsibilities can limit their time and energy for self-care, reduce participation in structured health activities, and compromise their autonomy in health decision-making. The burden of such roles may contribute to neglect of their own chronic disease management needs.

This dual effect presents a complex challenge for community health interventions. While intergenerational proximity can offer tangible benefits, it can also intensify the caregiving burden on older adults, potentially undermining their ability to engage in self-directed health management behaviors.

### 4.1.4 Potential for Integrating VAT with Human-Centered Approaches

This study highlights the advantages of voice-assisted technology (VAT) as a culturally acceptable, scalable, and resource-efficient strategy for health education among older adults in community settings. In contexts where human resource constraints limit the feasibility of peer education and community health worker (CHW) models, VAT offers a compelling alternative that ensures consistency, privacy, and reach.

However, despite its strengths, VAT also has inherent limitations—particularly in delivering emotional support, responding to individualized concerns in real time, and fostering trust through relational continuity. These limitations were not central barriers in the current

implementation context, but they suggest future opportunities for integration rather than replacement.

If adequate financial, training, and regulatory support becomes available, combining VAT with peer-led support or CHW engagement could enhance the overall impact of chronic disease management programs. For instance, VAT could serve as the foundation for daily education and reminders, while CHWs or trained peers could offer supplemental check-ins, motivation, and culturally sensitive dialogue. Such a hybrid model would allow technology to address structural challenges, while human-centered approaches fill in the emotional and interactive gaps—creating a more comprehensive and responsive care ecosystem for elderly patients.

## 4.2 Strengths

This study included diverse stakeholder groups and captured multi-level perspectives across individual, organizational, and policy contexts, providing a comprehensive understanding of intervention feasibility and acceptability. It also employed rigorous qualitative methods, guided by established theoretical frameworks (HBM and CFIR), with attention to inter-coder reliability. Additionally, the study compared three distinct but interrelated intervention approaches, offering practical insights for future program design.

## 4.3 Limitations

This study has several limitations. First, due to time and resource constraints, in-depth qualitative interviews focusing on the patient experience with the Voice-bot intervention were not conducted on a large scale. Similarly, discussions concerning the feasibility and impact of Community Health Volunteers (CHVs) were relatively limited. Thus, insights into these intervention strategies remain preliminary.

Second, given the use of regional dialects in Kunshan, significant translation and language standardization were required during data transcription and analysis, particularly for

patient interviews. This process may have attenuated the emotional nuances of participant responses, potentially influencing the interpretation of their perceptions and experiences.

## 4.4 Future Directions

Future research should expand the qualitative investigation of technology-assisted interventions, particularly Voice-bot applications, at the patient level to better assess user acceptance, effectiveness, and implementation challenges. Additionally, further exploration of the CHV model is warranted, with larger sample sizes and more diverse community settings to evaluate its scalability and sustainability.

As this study remains in the qualitative stage, subsequent research should incorporate mixed methods approaches and intervention trials to test the effectiveness of the proposed health management strategies rigorously. Longitudinal studies are also recommended to assess the long-term impact of these interventions on health outcomes among elderly patients with hypertension and diabetes.

# 5. Conclusion

This study explored stakeholder perspectives on community-based health education strategies for older adults with comorbid hypertension and diabetes in Kunshan, China. Through interviews with patients, caregivers, healthcare providers, and local officials, the study identified key actors whose roles, expectations, and constraints shape intervention delivery and acceptance.

Findings highlight the context-specific challenges associated with peer education and CHV/CHW-based models, including limited trust, unclear responsibilities, and sociocultural barriers such as stigma and gendered caregiving burdens. In contrast, voice-assisted technology (VAT) was viewed as more feasible and acceptable due to its perceived neutrality, privacy, and professional authority.

Based on these insights, the study recommends prioritizing VAT as a scalable intervention in resource-limited settings, while recognizing the potential value of hybrid models that integrate human support where feasible. Successful implementation will require early engagement with local authorities and culturally tailored approaches that address both structural and individual-level barriers.

# Appendix A

<table>
<tr><td colspan="3">Patient Interview Guide</td></tr>
<tr><td colspan="3">[Introduction] Hello! We are members of the Duke University Heart-Diabetes Co-Management Project research team. Thank you for taking the time to participate in our interview today, which will last approximately 45 minutes. In this interview, we aim to understand your views and experiences regarding chronic disease management. Your information will be kept strictly confidential and will not be disclosed to anyone. Any reports related to the project will not include your personal information. This interview is solely for public welfare research purposes. [Introduce the informed consent form and request a signature.]<br><br>To better summarize the information, we would like to record this interview. May we have your permission? Thank you for your support! Before we begin, do you have any questions? If not, let's get started!</td></tr>
<tr><td>Modules</td><td>Interview Topics and Objectives</td><td>Detailed Questions</td></tr>
<tr><td>Basic Information</td><td>Understand the patient's history of hypertension and diabetes, and the impact of these conditions on their daily life.</td><td>• How old are you?<br>• How many years have you had hypertension? Where were you diagnosed?<br>• How has hypertension affected your life? What inconveniences has it caused?<br>• How has your blood pressure been controlled in the past year? (Reference: 65+ blood pressure target is less than 150/90 mmHg)<br>• How many years have you had diabetes? Where were you diagnosed?<br>• How has diabetes affected your life? What inconveniences has it caused?<br>• How has your blood sugar been controlled in the past year? (Reference: target is less than or equal to 7.0 mmol/L)<br>• Besides hypertension and diabetes, do you have any other chronic diseases? How long have you had them?<br>• Can you briefly describe your daily routine from morning to night? (The interviewer may link this to lifestyle modules; ensure a smooth connection between questions)</td></tr>
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| Diet (Salt Reduction) | Understand the patient's daily dietary habits and management. | • Can you tell us what you ate today? When do you usually have your three meals? What kind of food do you usually eat? Do you eat with your family? (Understand the patient's overall dietary pattern and social eating habits)<br>• Do you often eat out? How frequently? What do you usually eat?<br>• Do you often eat processed or preserved foods (e.g., pickles, cured meats)? How often? Do you make them yourself or buy them?<br>• Are there any specific things you need to be careful about while eating? Are there any foods you eat less or avoid?<br>• Have you encountered any difficulties while adjusting your diet? For example, controlling food intake or changing eating habits?<br>• Who usually cooks in your home? When cooking, do you or your family make special adjustments for diabetes and hypertension?<br>• When cooking, how do you or your family typically use salt? How much salt is generally added? What methods are used to control saltiness? Have you used reduced-salt or low-sodium soy sauce? |
| | Understand the patient's knowledge, beliefs, and behaviors regarding salt reduction (low-sodium salt). | • What do you think is the relationship between salt intake and health?<br>• Who usually purchases cooking salt in your household? Where do they buy it? What kind of salt do they buy? What factors do they consider when selecting salt (price, brand, type)?<br>• What types of edible salt do you know about? Which types do you think are healthier? (Example: iodized salt; ask if they know about low-sodium salt)<br><br>(If they know)<br><br>• How did you learn about low-sodium salt? Was it through news, WeChat, doctor recommendations, family, or friends?<br>• Do you know how to buy low-sodium salt? (Can you recognize it from the packaging? Is it available at nearby supermarkets?) |

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| | | • Who do you think should or should not use low-sodium salt?<br>• (If using low-sodium salt) Why did you choose to use it, despite its higher cost?<br>• (If aware but not using) Why don't you use low-sodium salt? Is it because of price, taste, or other reasons?<br><br>(If unaware)<br><br>• Low-sodium salt can help lower blood pressure and reduce the risk of disease events for most elderly chronic disease patients. Would you be willing to try it?<br>• Given its higher price, would you still be willing to try it?<br>• Has your family physician recommended low-sodium salt to you? |
| | Understand the patient's willingness to purchase low-sodium salt and other low-salt or low-sugar products. | • Besides salt, what other seasonings do you or your family use when cooking?<br>• Are you aware of healthier seasoning options (e.g., reduced-salt soy sauce)? Do you purchase them? Why or why not?<br>• When buying food/snacks, do you check nutritional information? Do you pay attention to salt content? How do you identify this information? |
| | Understand the guidance and support provided by doctors and family regarding dietary management. | • During your visits to the community health center or hospital, have doctors given you dietary advice? For example, what to eat more or less of?<br>• Are these suggestions easy to remember and follow? Are they helpful for maintaining your health?<br>• Do your family members support your dietary control (reducing sugar and salt)? What dietary advice or help have they provided? |
| Physical Activity | Understand the patient's exercise habits and abilities. | • Do you think exercise is important for health?<br>• What kinds of exercise are you familiar with? Where did you learn about them?<br>• How did your exercise habits change before and after being diagnosed with hypertension and diabetes? |

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| | | • Do you usually exercise, do housework, or farm work? What type of activity is most common? How often? What is the intensity (talk while exercising = low, shortness of breath = moderate, unable to talk = high)? How long do you exercise each time?<br>• Do family or friends exercise with you?<br>• Where do you usually exercise?<br>• Are there free exercise facilities or courses available nearby? If so, are you willing to use them? |
| | Understand the patient's exercise capacity. | • If exercise intensity is categorized as low, moderate, or high, what is the maximum intensity you can handle?<br>• How have hypertension and diabetes affected your exercise capacity? In what specific ways? |
| | Understand the challenges, motivations, and factors influencing exercise participation. | (For non-exercisers)<br>• If asked to exercise daily, what would be your biggest barrier? What other reasons prevent you from exercising (physical limitations, lack of knowledge, lack of facilities, safety risks, lack of motivation)?<br>(For exercisers)<br>• What difficulties have you encountered while exercising (physical limitations, lack of knowledge, lack of facilities, safety risks, lack of motivation)?<br>• Have you tried to solve these problems or sought help? What were the results? |
| | Explore potential opportunities to promote physical activity. | • Do your family or friends accompany you when exercising? Who, when, and in what form?<br>• Have your family or friends given you exercise advice or other assistance? Who, when, and in what form?<br>• What exercise advice has your family physician or other doctors provided (recommended duration, type of exercise)? |

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| | | • Have you participated in self-management groups? Did they offer exercise guidance? What was the content and format?<br>• What motivates you to exercise daily? |
| Medication Use | Explore the patient's understanding of medication mechanisms and cognitive barriers to adherence. | • Can you describe all the medications you are currently taking and their purposes?<br>• Have you ever asked your doctor why these specific medications were prescribed?<br>• When your doctor changed your medications, did they explain why? How did the explanation affect your medication adherence?<br>• What specific improvements have you noticed in your health from taking these medications?<br>• Have you encountered any issues following the medication regimen (dosage, timing)? In what areas?<br>• What difficulties have you faced when learning how to use each medication?<br>• Are you aware of any side effects from your medications? How do you handle them?<br>• Have you ever experienced side effects from missing doses? Can you describe these experiences?<br>• Do other life pressures (work, family responsibilities) affect your medication adherence? |
| | Explore the current medication use and related barriers. | • What is your daily medication schedule? How was it developed? How does it affect your daily life?<br>• How do you remember your medication dosages and times?<br>• What specific difficulties do you encounter when taking medication? How do you resolve them?<br>• Do you sometimes forget to take medication? What measures do you take to prevent this? Are they effective?<br>• Does your diabetes treatment include injectable medications? |

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| | | • What challenges have you faced when preparing and storing insulin? How did you overcome them? |
| | Explore the patient's medication access and related barriers. | • How often do you collect your medications? Can you get all your medicines at once? Besides the health station, where else do you get them? Why?<br>• What difficulties do you encounter when collecting medications?<br>• What do you think about the current medication prices? Do they place a financial burden on you?<br>• Do you need assistance with medication management? In what areas? |
| | Explore potential opportunities and support for managing multiple medications. | • Where do you obtain information and resources on medication management? How helpful are they? What additional support do you need?<br>• What role do your family or friends play in your medication management? What specific help do they provide? How does this support affect your adherence?<br>• Have you used any medication management tools or apps? How helpful are they? What features would you like to see in an ideal tool?<br>• How do your doctor or pharmacist follow up on your medication use? How does their support impact your medication management? What additional support would you like from healthcare professionals?<br>• From your experience, what are the shortcomings of the current healthcare system in medication management? What services would you like to see added? |
| Family Physician Services | Understand the patient's experience with family physician services. | • How long have you been contracted with family physician services? How did you learn about them?<br>• How often do you visit your family physician? What usually happens during the visits?<br>• Does your family physician remind you to visit the health station regularly? How often?<br>• Do you know what chronic disease management services your family physician |

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| | | provides (quarterly follow-ups, BP/BS monitoring, medication, explanations of health issues, lifestyle guidance)?<br>• Are you aware of the green referral channel and home visit services? Have you used them? How was the experience? |
| | Explore the current integrated management pathways. | • In your experience, how does seeing a family physician compare with visiting a hospital?<br>• When you are unwell, where do you prefer to seek medical care? Why do you choose (or not choose) your family physician?<br>• Have you experienced worsening hypertension/diabetes that required hospital care? After discharge, how did you continue recovery or further treatment? What role did your family physician play? |
| | Explore the limitations of current family physician health management services. | • What difficulties have you faced with community health stations (family physicians) in terms of consultations, medication, BP/BS monitoring (e.g., professionalism, equipment, care quality)?<br>• Have these issues been resolved? If so, how? If not, how would you like them to be addressed? |
| Peer Leader Participation | Understand the patient's past experiences with sharing their health status and related feelings. | • Have you discussed your health condition with others? Who did you talk to, how did you meet, and how did you communicate?<br>• If not, why (stigma)? Do you usually share health information with others?<br>• Have you participated in patient support groups or educational programs? Were they helpful?<br>• Do you think sharing your condition with others helps with disease control and emotional regulation (e.g., restoring confidence, building connections)?<br>• Where do you usually get health information? (If from peer groups, explore details: online/offline, frequency, content) |

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| | Explore the patient's understanding and expectations of peer education. | • (Introduce peer education briefly) Have you heard of or participated in such activities?<br>• What kind of person do you think should be a peer leader? What qualities are most important?<br>• Would you be willing to be a peer leader? If so, do you have ideas on organizing activities?<br>• What kind of rewards should peer leaders receive (monetary/non-monetary)?<br>• What difficulties might peer leaders encounter when educating or organizing activities for other elderly patients? |
| | Explore the patient's willingness to participate in peer leader activities. | • If peer education activities were offered, how would you prioritize them compared to other daily activities?<br>• What activity format do you prefer (face-to-face, phone, WeChat)? Frequency (daily/weekly/monthly)? How much time can you commit?<br>• What type of elderly patients would benefit from peer education or communication activities?<br>• If your family (spouse, children) joined peer education or communication activities, what benefits or difficulties do you foresee? |

# Appendix B

| Patient Family Interview Guide | | |
|---|---|---|
| [Introduction] Hello! We are members of the Duke University Heart-Diabetes Co-Management Project research team. Thank you for taking the time to participate in our interview today, which will last approximately 45 minutes. In this interview, we aim to understand your views and experiences regarding chronic disease management. Your information will be kept strictly confidential and will not be disclosed to anyone. Any reports related to the project will not include your personal information. This interview is solely for public welfare research purposes. [Introduce the informed consent form and request a signature.]<br><br>To better summarize the information, we would like to record this interview. May we have your permission? Thank you for your support! Before we begin, do you have any questions? If not, let's get started! | | |
| Module | Interview Topics and Objectives | Detailed Questions |
| Basic Information | Explore the relationship between the family member and the patient, and their understanding of the patient's condition. | • How old are you?<br>• What is your relationship with the elderly patient? Do you live with them? If not, how often do you visit them?<br>• How much do you know about the patient's hypertension and diabetes? Where did you get this information?<br>• Do you know how long the patient has had hypertension and diabetes (single or comorbid duration)?<br>• In daily life, what specific care responsibilities do you take for the elderly patient?<br>• Has your role changed over the course of the patient's illness? If so, why? |
| Medication Management | Support Explore the specific responsibilities of family members in medication management. | • Can the patient independently complete medication refills, manage medications, and take them on time and in the correct dosage or administer injections?<br>• What specific responsibilities do you undertake in the process of |

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| | | the patient seeking medical care, obtaining medications, and taking medications? How does this affect your daily life? How do you ensure these tasks are completed properly?<br>• What do you know about the function and usage of the medications the patient is taking? Where did you learn this information? Do you think the knowledge you have is sufficient to assist in medication management?<br>• What role do you play in helping the patient remember the dosage and schedule of various medications?<br>• What role do you play in the storage of medications, especially insulin (if used)?<br>• Has the patient ever experienced side effects from medications? If so, can you describe the situation? What actions did you take to manage these side effects? How has this experience influenced the medication management for you and the patient? |
| | Understand the difficulties faced by family members in assisting with medication adherence. | • What challenges have you encountered in helping the patient take medications on time and in the correct dosage? How did you overcome them (understanding medication purposes, purchasing, storage, supervision, etc.)?<br>• How significant do you think your role is in improving the patient's medication adherence? Why do you think so? |

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| | | • What areas do you think can be improved to better help the patient take medications on time? |
| | Assess the impact of social and economic factors on medication management. | • How often do you communicate with the patient's family physician regarding medication issues? Can you describe your most recent experience discussing medications with the doctor? How has this communication helped you assist the patient?<br>• Do your daily responsibilities (work, family obligations, etc.) affect your ability to support the patient in medication management?<br>• Have you used any electronic programs or software to assist in managing the patient's medication? How have these tools helped you?<br>• Based on your experience, what improvements do you think the current healthcare system (hospitals, clinics) could make in supporting medication management? Do you have any suggestions?<br>• As a family member, what additional services or support would you like the healthcare system to provide to help you better assist the patient with their medication? |
| Dietary Management Support | Explore the specific responsibilities of family members in dietary management. | • Who is usually responsible for grocery shopping and cooking at home?<br>• Are you aware of any healthier seasoning options (e.g., reduced-salt soy sauce)? Do you purchase these reduced-salt seasonings? Why or why not? (Ask if they know about low-sodium salt) |

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| | | • (If unaware) Low-sodium salt can help reduce blood pressure and the risk of disease events for most elderly chronic disease patients. Would you encourage the patient to use low-sodium salt?<br>• Given its higher price, would you still encourage the patient to use low-sodium salt?<br>• What do you know about the patient's dietary management needs (what they should eat more of, what they should reduce)? Where did you get this information? Do you think you know enough? If not, what else do you think you need to learn?<br>• What role do you play in the patient's dietary management (reminders, supervision, planning, etc.)? |
| | Understand the difficulties and pressures faced by family members in dietary management. | • What difficulties have you encountered in helping the patient manage their diet? How did you address them?<br>• How much impact do you think your efforts have had on improving the patient's dietary habits? Can you give an example of a successful change?<br>• What additional support or resources do you think are needed to better manage the patient's diet? |
| | Assess the impact of social and economic factors on dietary management. | • Do doctors or family physicians regularly communicate with you to encourage dietary management for the patient? How effective are these communications? What improvements would you suggest?<br>• As a family member, what improvements would you like to |

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| | | see in the healthcare system (community health stations, hospitals) to better support you in helping the patient with dietary management? |
| Exercise Management Support | Explore the specific responsibilities of family members in exercise management. | • Do you understand what types and intensities of exercise are suitable for the patient? Do you think your understanding is sufficient? If not, what else do you need to learn?<br>• What is the patient's exercise plan? What role do you play in helping them follow it (reminding, accompanying, assisting, etc.)?<br>• How do you encourage and support the patient to exercise daily? Can you give examples of effective encouragement strategies?<br>• Do you exercise with the patient? If so, how effective has it been? |
| | Understand the difficulties and pressures faced by family members in exercise management. | • What are the biggest challenges you face in promoting exercise for the patient?<br>• Where do these challenges mainly come from (patient willingness, health condition, time management, etc.)?<br>• What specific measures have you taken to overcome these challenges?<br>• How effective were these measures? Do you have any lessons or experiences to share?<br>• How much impact do you think your efforts have had on improving the patient's exercise habits? Can you give an example of a successful change? Which |

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| | | efforts have been less effective and why?<br>• What other methods do you think could be more effective in supporting the patient's exercise management? |
| | Assess the impact of social and economic factors on exercise management. | • Do you regularly communicate with doctors about the patient's exercise situation? If so, how often?<br>• What role do other family members or friends play in supporting the patient's exercise?<br>• Have you used any technology products (pedometers, smartwatches) to assist in exercise management? If so, how effective were they? If not, what help do you think such products could provide?<br>• As a family member, what improvements would you like to see in the healthcare system to better support exercise for chronic disease patients?<br>• What additional support or resources would you like to receive? |
| Family physician Services | Explore the specific responsibilities of family members in assisting patients with family physician services. | • Do you accompany the patient to see the family physician? If so, what responsibilities do you take on during the visit (providing information, asking questions, taking notes, etc.)?<br>• What methods do you use to help the patient understand the family physician's instructions? |
| | Understand the family member's specific needs and expectations of family physician services. | • Have you encountered difficulties communicating with the family physician responsible for the patient? How have these difficulties affected your ability to assist in health management? |

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| | | • What other problems have you encountered when assisting with medical visits (daily management in the community or emergency visits to the hospital)? What solutions do you suggest?<br>• As a family member, what support do you think is necessary to better assist the patient in accessing family physician services? |
| Peer Support | Explore past experiences of family members/patients with peer support activities and their effects. | • Has the patient participated in any peer support activities (patient groups, etc.)? If so, what role did you play (accompanying, encouraging, sharing information, etc.)?<br>• What difficulties have you faced in encouraging the patient to participate in peer support activities?<br>• How do you view the impact of peer support activities on the patient (psychological, behavioral, health status, etc.)? |
| | Understand family members' specific needs and expectations for future peer support. | • As a family member, what kind of peer support activities (organized by whom, content, format) do you think would help improve the patient's disease management?<br>• How do you view the model of family physicians supervising peer leaders or community health volunteers to conduct health education?<br>• What potential advantages do you think this model has over traditional doctor-led education (e.g., easier to accept, more shared experiences)?<br>• What specific improvements in daily health management do you think this model could bring (health awareness, self-management skills)? |

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| | | • What challenges do you think this model might face? |
| | Selection Criteria, Training, and Activity Types for Peer Leaders | • What type of person do you think is suitable for peer education (educational background, political background, personality, etc.)? Do you think peer educators need to have relevant disease experience? Why?<br>• What basic knowledge and skills do you think peer leaders or community health volunteers should have?<br>• How should we assess and ensure the qualifications of these peer leaders or volunteers?<br>• Do you think peer leaders or community health volunteers should receive financial compensation? Why? |
| | Wrap-Up | • Looking back on what we've discussed, in which area do you think you play the most significant role? Why?<br>• What is the biggest challenge you face in supporting the patient's health management?<br>• What additional support or resources do you need to better help the patient manage their health?<br>• As a family member, do you have any suggestions or ideas for improving chronic disease management for elderly patients? |

# Appendix C

| Peer Leader Interview Guide | | |
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| [Introduction] Hello! We are members of the Duke University Heart-Diabetes Co-Management Project research team. Thank you for taking the time to participate in our interview today, which will last approximately 45 minutes. In this interview, we aim to understand your views and experiences regarding chronic disease management. Your information will be kept strictly confidential and will not be disclosed to anyone. Any reports related to the project will not include your personal information. This interview is solely for public welfare research purposes. [Introduce the informed consent form and request a signature.]<br><br>To better summarize the information, we would like to record this interview. May we have your permission? Thank you for your support! Before we begin, do you have any questions? If not, let's get started! | | |
| Modules | Interview Topics and Objectives | Detailed Questions |
| Basic Information | Confirm that the peer leader candidate meets the inclusion criteria regarding medical history, educational background, motivation, etc. | • How old are you?<br>• Are you still working? Are you engaged in selling medical products, healthcare, or insurance? Are any of your family members involved in these industries?<br>• What is your educational background? Did you attend middle school?<br>• How many years have you had hypertension/diabetes? (Ask for the disease name and duration)<br>• When were you diagnosed? What prompted you to get diagnosed? (Patients may have self-perceived symptoms, employer-organized physicals, or family-arranged check-ups. Explore the patient's social identity, family structure, etc.)<br>• How has your condition developed since diagnosis? How do you feel about your disease control over the past two years? What do your doctors say? |

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| Health Information. | Understand the main channels for obtaining health information | • Where do you usually get your health management knowledge (doctors, pharmacies, family, books, media, etc.)? Which source do you find most helpful? What type of content do you prefer?<br><br>Have you participated in any patient support groups? What kind of information is typically shared there?<br><br>(Introduce peer education concept) |
| Dietary Management | Understand the sources and content of dietary management advice. | After your diagnosis, who have you discussed dietary management and salt reduction with? Do doctors, family, or friends actively inquire about your diet? What did you discuss? Was it by phone, WeChat, or in person? |
| | Explore peer support experiences in dietary management. | • Do you talk to peers about salt reduction and dietary management? Who do you discuss dietary issues with the most? Do you actively inquire about their dietary habits and health? What did you discuss? Was it by phone, WeChat, or in person?<br>• Do you share your experiences in dietary management with others? What specific content do you share? |
| | Explore expectations for peer support in dietary management. | • If a peer education activity were held, what knowledge about salt reduction and dietary management would you be most interested in sharing?<br>• What content or topics related to salt reduction do you think would interest participants the most? |
| Exercise Management | Understand the sources and content of exercise management advice. | After your diagnosis, who have you discussed exercise recommendations with? Do doctors, family, or friends actively inquire about your exercise habits? What did you discuss? Was it by phone, WeChat, or in person? |

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| | Explore peer support experiences in exercise management. | • Who do you discuss exercise issues with the most? Do you actively inquire about their exercise habits and health? What did you discuss? Was it by phone, WeChat, or in person?<br>• Have you ever invited others to exercise or go out together? If yes, what was the format, content, number of people, and duration? |
| | Explore expectations for peer support in exercise management. | If a peer education activity were held, what knowledge about exercise management would you be most interested in sharing? |
| Medication Management | Understand the sources and content of medication management advice. | • What medications are you currently taking? How many times a day? Do you regularly monitor your blood pressure or blood sugar? How often?<br>• After your diagnosis, who have you discussed medication management with? Do doctors, family, or friends actively inquire about your medication habits? What did you discuss? Was it by phone, WeChat, or in person? |
| | Explore peer support experiences in medication management. | • Who do you discuss medication issues with the most? Do you actively inquire about their medication habits? Was it by phone, WeChat, or in person?<br>• Do you share your experiences in medication management with others?<br>• Do you remind family or friends to take their medications on time? How do you do it? |
| | Explore expectations for peer support in medication management. | If a peer education activity were held, what knowledge about medication management would you be most interested in sharing? |

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| Family physician Services | Understand the basic public health services typically used through family physicians. | • Do you usually go for follow-ups? Do you visit hospitals, community clinics, specialist hospitals, or other facilities?<br>• What is your follow-up process like? Are there any areas you think could be improved? |
| | Explore experiences in sharing public health services. | • Do you actively inquire about the health status and follow-up practices of those around you? Is this done by phone, WeChat, or in person?<br>• Do you discuss family physician services with peers? Do you share your experiences communicating with family physicians? What specifically do you share? |
| | Explore suggestions and expectations for basic public health services. | What improvements do you think the healthcare system could make in chronic disease management to better support patients like you? |
| Peer Support | Implementation Details | • Do you have any ideas regarding the details, format, or content of organizing activities?<br>• If you were to undertake peer leader responsibilities, what difficulties do you think you might encounter?<br>• How much time per week do you think you could dedicate to this role? |
| | Training Formats | • Do you think it's appropriate for family physicians to provide group training? What are the benefits or challenges?<br>• What do you think is the most suitable training frequency and duration? Would consecutive days of training be too time-consuming? |

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| | Motivation | • What kind of compensation do you think is appropriate for taking on this responsibility?<br>• Do you think it's suitable to promote this role as a volunteer position? Do you have other ideas?<br>• How should your work as a peer leader be evaluated? (Interaction with family physicians)<br>• If you were to report to family physicians, what would you focus on sharing?<br>• If you become a peer leader, what do you hope to gain from participating in activities? |
| | Recruitment | If we were to recruit you as a peer leader, please rank the following institutions in order of your willingness to respond: community hospital/health station, community service center, neighborhood committee/street office, other volunteer organizations. |

# Appendix D

| Family physician Interview Guide | | |
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| [Introduction] Hello! We are members of the Duke University Heart-Diabetes Co-Management Project research team. Thank you for taking the time to participate in our interview today, which will last approximately 30-45 minutes. In this interview, we mainly hope to understand your views on chronic disease management. Your information will be kept strictly confidential and will not be disclosed to anyone; any reports related to the project will not contain your personal information. The content of this interview will be used solely for public welfare research purposes. [Introduce the informed consent form and request a signature.]<br><br>To better summarize the information, we would like to record this interview. May we have your permission? Thank you for your support! Before we begin, do you have any questions? If not, let's get started! | | |
| Modules | Interview Topics and Objectives | Detailed Questions |
| Basic Information | Understand the basic work situation of family physicians | • How old are you this year? How long have you been working as a family physician at xx health station/center? How did you become a family physician?<br>• Did you have any other work experience before becoming a family physician? If so, please briefly describe your previous work experience.<br>• Could you introduce your team (family physician unit)? How many people are there? What are their backgrounds and roles?<br>• Is your team usually busy? Approximately how many patients do you see in a day (workload)? Do you have team members who can assist or support patients in salt reduction health education? Do you think you and your team can handle the current workload?<br>• Are you familiar with the concept of comorbidity in chronic diseases such as diabetes and hypertension? If not, we can explain the definition and related conditions.<br>• For elderly patients suffering from multiple chronic diseases, such as hypertension, |

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| | | heart disease, and stroke, how do you usually intervene? How often do you schedule follow-up visits? What health indicators do you focus on? |
| Dietary Management | Understand the current status of lifestyle interventions (diet) by family physicians. Explore family physicians' experiences and understanding of dietary interventions (salt reduction). | • In your opinion, what dietary choices are most important for patients with diabetes and hypertension? What are their health benefits?<br>• Can you talk about your understanding of low-sodium salt? For example, its definition, characteristics, and health benefits. Do you know which populations are not suitable for using low-sodium salt?<br>• Can you share your knowledge about low glycemic index (GI) diets? For example, the definition, characteristics, and health benefits.<br>• How do you manage the diets of patients with diabetes and hypertension? Can you share specific practices?<br>• How do you personalize dietary interventions for elderly patients with different conditions?<br>• Does your work include recommending low-sodium or low-GI diets to patients? |
| | Explore the challenges, motivations, and confidence family physicians have regarding dietary interventions (salt reduction). | • How well do elderly patients with comorbidities follow your dietary advice? What difficulties have they reported?<br>• Do you feel motivated to guide elderly patients with comorbidities in dietary management? If so, what motivates you?<br>• Are you confident in your dietary guidance and intervention outcomes? Why or why not? (Time limitations? Patient understanding issues?)<br>• What difficulties have you encountered when implementing dietary interventions? Have these difficulties been resolved? If so, how? |

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| | | • Do you know of any other methods that can help patients with dietary management?<br>• If you were asked to learn about patients' dietary habits and provide feedback and guidance regularly, would you support this? Why or why not? |
| Physical Activity Management | Understand how family physicians manage patients' physical activity, their knowledge base, and ability to provide exercise guidance | • Are you aware of the benefits of physical activity for patients with comorbid conditions?<br>• Do you currently provide exercise management for patients? What are your specific practices and content?<br>• Do you personalize physical activity interventions for elderly patients with different conditions? If yes, what are the differences? If not, what limits your ability to personalize interventions?<br>• Do you regularly collect data on patients' physical activity to evaluate intervention outcomes? After evaluation, do you adjust intervention measures?<br>• Besides existing resources, what opportunities do you think can improve your ability to manage patients' physical activity as a family physician? |
| | Explore challenges, motivations, and facilitators in physical activity management for patients. | • What are the main challenges you face when managing patients' physical activity? (Physical limitations, lack of knowledge, insufficient community facilities, safety risks, lack of motivation)<br>• Have these difficulties been resolved? If so, how?<br>• What motivates you to manage patients' physical activity?<br>• What actions can you take to motivate patients to exercise? Why?<br>• Have you had any successful experiences in promoting patients' physical activity? Please share specific measures. |

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| | | • Do you think community support (peer support, family involvement, collaboration with higher-level medical institutions) and technology support (wearable devices, regular activity tracking, data system integration) can assist in physical activity management? How? |
| Medication Management | Understand how family physicians manage patients' medication use. | • What specific actions or measures do you take to help elderly patients improve medication adherence?<br>• How do you ensure these measures are effectively implemented?<br>• How do you evaluate the effectiveness of these measures? |
| | Understand how family physicians assess patients' medication management. | • How do you evaluate elderly patients' medication adherence in your daily work?<br>• Is there a significant difference in medication adherence between patients with comorbidities and ordinary patients? If so, what are the reasons and potential solutions?<br>• How effective do you think these methods are?<br>• Do you use or recommend electronic pillboxes or other medication management tools for elderly patients?<br>• If yes, how effective are they? If not, why?<br>• Which types of patients benefit the most from using electronic pillboxes or similar tools?<br>• What feedback have you heard about electronic pillboxes? |
| | Understand barriers to medication adherence among patients. | • In your view, what factors most commonly lead to poor medication adherence among elderly patients?<br>• Have you encountered patients unwilling to take or regularly take medication? What were their reasons for non-adherence? Did they eventually change? Why?<br>• What social, psychological, and economic factors influence adherence?<br>• Which factors do you think are the most critical? |

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| | | • What deficiencies exist in current education and awareness efforts for elderly patients?<br>• How are these deficiencies related to medication adherence?<br>• What specific improvement suggestions do you have?<br>• What educational methods do you find most effective? (Targeted materials, health lectures, community events, etc.) |
| Family physician Management Plan | Understand the basic situation of comorbid patient groups under care. | • (For station leaders) What is the proportion of patients with diabetes and hypertension comorbidities among those contracted at your station? / (For ordinary family physicians) Among your patients, what percentage has comorbidities?<br>• How do you rate the management status of your patients in terms of diet, exercise, and medication? Please rank them from best to worst. |
| | Differences in caring for comorbid versus other patients. | • Does managing comorbid patients require more attention to medication contraindications or tests? Please give examples.<br>• What difficulties and challenges have you encountered in caring for comorbid patients?<br>• Are there special service or disease management plans for contracted comorbid patients?<br>• Do you actively teach patients disease management knowledge during care? If yes, please give examples.<br>• Can you share a successful case involving a comorbid patient?<br>• After contracting with comorbid patients, are there any special changes in care or management plans? |

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| | Support received in the family physician process.<br><br>What support have you received from the government, hospitals, and communities in caring for patients? (Incentive policies, assessments, training opportunities, medical resources) | Professional Knowledge and Training<br><br>• Are your dietary, exercise, and medication suggestions based on your knowledge or are they supported/guided by higher-level institutions or community resources?<br>• Have these trainings improved your ability to manage patients' physical activity? Why?<br>• In the past five years, have you attended any training related to diet, exercise, and medication management? If yes, please describe. If not, are you interested in such training?<br><br>Collaborative Models<br><br>• How do you collaborate with other levels of medical institutions and doctors in managing elderly patients with comorbidities?<br>• What is the status of referral systems? How do you ensure stable follow-up visits after referrals?<br>• How effective do you think current collaborative models are?<br>• What challenges have you faced in collaboration?<br>• What areas can be improved? (Information sharing, referral procedures, communication mechanisms)<br><br>Family physician Management Model<br><br>• In your work, are there requirements and supervision regarding salt reduction education for hypertensive and chronic disease patients? (Is information recorded in routine checkups?)<br>• We understand that there are performance assessments for family physicians. Please share your experience. How can you earn more points? Does one extra point matter?<br>• Do you think current performance assessments are reasonable? How can they |

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| | | be reformed to better promote patient management?<br><br>Incentive Mechanisms<br><br>• Are there incentive policies or special care/subsidies for managing comorbid patients provided by the government, hospitals, or communities? (Bonuses, etc.) If yes, which incentives do you think are effective?<br>• Which incentives or subsidies motivate you the most to manage patients daily? Please rank them and explain why. |
| Peer Leader Participation | Before becoming a family physician, have you participated in information-sharing or health behavior change activities? | • Have you participated in any activities aimed at educating patients on health knowledge? (Ask about interaction methods, identities of participants, etc.)<br>• In your observation, do patients actively exchange information with other patients? What kind of information?<br>• What potential reasons do you think hinder patients from sharing information with others?<br>• Do you think communication with others helps patients understand disease control or healthy behaviors, and improves emotional well-being (restoring confidence, connection, etc.)? |
| | Understanding and expectations of peer education. | • In your mind, what qualities should a peer supporter have? What do you think is most important? (Explore expectations for peer support education)<br>• What responsibilities should a peer supporter undertake?<br>• How many people should there be in a peer support group for it to be effective?<br>• How do you assess patients' willingness to participate in peer education activities? What concerns might they have? |

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| | Expectations for peer education content and methods. | • What information or help do patients and their families need most?<br>• If activities are organized, do you think patients prefer online (QQ groups, WeChat groups, calls) or offline participation? Or a combination?<br>• What frequency of activities do you think is appropriate? (Monthly, several times a week) |
| | Support for peer education. | • How willing are you to provide training and support for peer leaders?<br>• What training or education do peer leaders need to support peers? Do you have recommended training strategies?<br>• How can community residents be better encouraged to participate in peer support programs?<br>• What external support or resources do you need to better conduct training? |

# Appendix E

Outline of interviews with municipal leaders

*(Introduce project content, sign informed consent, including audio recording)*

1. The project focuses on the elderly co-morbid patient population: 65+, hypertensive, at least one (diabetes, heart disease, stroke, chronic kidney disease). Do you think this group of patients warrants co-morbidity management? What is the priority given to managing patients with co-morbidities? How is this group of patients currently managed in the city (or in your organisation)? (If co-morbidities are not yet managed, find out the current status of management of related diseases/patients).

2. According to our preliminary understanding, there are 30-50,000 such patients in our city, and our project will be rolled out in batches across the city with the strong support of the school-local cooperation and the Municipal Health Commission. What are your suggestions for launching a city-wide co-morbidity management programme for tens of thousands of people? What are the challenges and coping strategies?

3. In the context of the city's promotion of the construction of medical communities, what do you think about strengthening the integrated medical management pathway for patients with co-morbidities (including timely treatment and the provision of reasonable treatment options, such as medication)?

4. In addition to medical management, we also target healthy lifestyle management, with programmes focusing on reducing sodium intake, appropriate and safe physical activity, and improving medication adherence. What do you see as the core staff, the key strategies for implementing such initiatives?

5. According to our preliminary research, the family physician team (community doctors) plays an important role in co-management. As the first phase of the project, we do not intend to cover patients who have not yet been documented or are not managed in the community, do you agree with this? Do you think that integrated management and health promotion of hypertensive co-morbid patients can be included in the daily work of the family physician team? What kind of support do they need (e.g., training, policies, support from immediate leadership, etc.)? How to promote their motivation and persistence?

6. Given the large number of patients managed by the family physician team and the time constraints, we plan to promote the 'Peer Leader' initiative (selection criteria and methodology, long-term interactive and mutual supportive activities, training and guidance from family physicians, focusing on three major categories of healthy lifestyles and information resource sharing), and we are also considering non-peer community health volunteers (knowledgeable, enthusiastic volunteers, etc.). volunteers (people who understand and are enthusiastic). What are your suggestions for this intervention? How can we avoid the problem that self-management groups tend to be unsustainable and a formality? No equipment is provided free of charge to

patients, but is it acceptable for citywide projects to recommend some products (e.g., low-sodium salt), energy testers, apps, etc., through family physicians and peer leaders, and voluntarily choose to purchase them?

7. Final query: feasibility of (randomised) cohort implementation? Suggestions and ideas for regularisation, sustainability of providing co-management in the long term? Any other sharing?

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