# Barriers to Physical Activity among Older Adults with Cardiometabolic Disease: A Convergent Parallel Mixed-Methods Study in Kunshan City, China

by

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Defense Date: March 21, 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

Physical activity (PA) offers numerous benefits for older adults with hypertension and diabetes, such as improved blood pressure and glucose levels and reduced risk of complications. However, due to various practical challenges, around 3 quarters of Chinese older adults fail to meet the World Health Organization (WHO)'s recommended PA levels. Therefore, this study aims to explore the barriers to PA among older adults with cardiometabolic disease in Kunshan City.

This study adopts a convergent parallel mixed-methods approach. Questionnaire (n=144) and interview (n=29) data from older adults (aged 65 years and older) were collected. Regression analysis was used to examine the association between PA level and various factors, including age, sex, education level, self-rated health status, physical ability, number of cardiometabolic diseases, smoking habit, alcohol habit, and family support score. Content analysis was applied to the interviews. The two forms of data were then integrated to provide greater insights.

This study identified that the most common barriers among the study population (most 65-75 years old) were “physical barriers,” “bad weather”, “lack of motivation”, “safety concern”, and “lack of time”. Future interventions should focus more on addressing these barriers.

# Dedication

I would like to extend my deepest gratitude to my advisors, Dr. Lijing Yan, Dr. Truls Østbye, and Dr. Marius Wamsiedel, for their unwavering support and invaluable guidance. Their constructive suggestions have been instrumental in the successful completion of this work.

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# 1. Introduction

China has become one of the fastest growing ageing populations in the world. By 2040, the population of people over 60 years old in China is estimated to reach 402 million, taking 28% of the total population [1]. Meanwhile, the prevalence of cardiometabolic disease increases with age, which poses significant threats to the national healthy aging goal [2, 3]. Elderly people with cardiometabolic disease are more vulnerable to infectious disease pandemics such as influenza. Moreover, they are facing a higher loss of functionality and quality of life and a higher risk of disability and death [4]. Cardiometabolic disease refers to "having at least one of three cardiometabolic disorders: hypertension, diabetes mellitus and cardiovascular disease (CVD)"[5]. With the rapid economic development in China, significant lifestyle changes among the elderly population have contributed to a sharp rise in the prevalence of cardiometabolic diseases over the past few decades [5, 6]. Most recent studies shows that about one-third of Chinese older adults have CVD [5, 7].

## *1.1 Physical Activity Level among Older Adults in China*

The current WHO *Guidelines on Physical Activity and Sedentary Behavior* recommend that older adults (65+) with (and without) chronic conditions engage in 150–300 minutes of moderate-intensity or 75–150 minutes of high-intensity PA per week [8]. Current studies well established that PA is related to numerous health benefits, particularly among older adults, such as preventing or managing chronic diseases, preventing falls, delaying the onset of dementia and Alzheimer's disease, maintaining independence, and improving quality of life [9-15]. Moreover, people who met the WHO-recommended PA level were associated with 20%-30% lower risk of life-long cardiovascular disease mortality compared with those who didn't meet it [16-18]. However, the current PA level in Chinese older adults is still insufficient [19, 20]. Based on the most up-to-date China National Fitness Survey Report, the proportion of older adults who regularly participate in physical exercise is only 26.1% [21, 22]. What's more, the

prevalence of insufficient PA even had an increasing trend in the past few decades [18]. In addition, the unique perspective of PA in Chinese culture “Yangsheng”, differ from Western Culture[23, 24]. It is necessary to investigate the reasons why a large proportion of Chinese older adults do not have sufficient physical activity, particularly focusing on the barriers that they face.

## *1.2 Previous Evidence*

Previous studies have limited evidence on barriers related physical activity in older adults within China. However, globally, it was widely investigated. I’ve reviewed 6 systematic reviews including 95 papers in investigating PA barriers in the older adults [25, 26]. They were published between 2012 to 2024. Most study define older adults as people who aged 65 and over. The most highly applied frameworks in investigate PA barriers in the older adults is Social Ecological Model (SEM) [27]. SEM was developed by Bronfenbrenner in 1977, aiming to comprehensively address the multiple levels of influence on health behaviors and outcomes. It was commonly used in interpreting healthy behavior barriers. Therefore, SEM framework was selected to present the study findings.

The current findings were summarized and reported by the SEM from intrapersonal, interpersonal, and environmental (including organizational, community, social level) aspects. At the intrapersonal level, physical limitations are the most reported barrier to PA among older adults. Studies highlight issues such as poor physical ability and fatigue, which are often exacerbated by age-related decline [25, 26, 28-30]. Additionally, negative attitudes towards PA, such as lack of motivation, having safety concerns, and having low self-rated health status further prevent older adults from PA participation [26, 28, 29, 31]. Safety concern especially focusses on fear of injury/fall [25, 26, 29, 30]. Half of the reviews mentioned lack of knowledge as an important barrier such as unaware of exercise benefits and lack of sport skill [26, 28, 31]. Other than that, one third shows that poor general health problem such as comorbidity can be considered as a barrier as well [28, 29]. The rest of the barriers include lack of time, lifestyles,

onset of depressing, sociodemographic factors (older age, lower education level, lower income, and sex as female) [26, 31-34]. Lack of time was common barrier that older adults reported because of their caring role [25, 26, 28, 30].

In the interpersonal level, lack of social support was the barrier reported the most [25, 26, 28, 29, 31, 32]. It can caused by lacking support from family/friends or healthcare professionals (e.g. lack of companionship) [26, 28]. In addition, half of the papers reported that social norm pressure, difficulty engaging with others and availability of social activities can significantly affect PA as well. Studies conducted in the UK and the US reveal that women, in particular, facing greater pressure to be active or to exercise alone.

In the environment level, barriers include lack of facilities and PA program, safety, community walkability, bad weather, transportation time to the PA facilities/park, "fit" PA environment, socio-cultural ageing stereotypes (e.g. older adults should not do much exercise) and inappropriateness PA class time [25, 26, 28-30]. Among all barriers, 2 third reviews reported lack of facilities and PA program, safety, and community walkability [25, 26, 28, 29]. Half of reviews reported barriers as weather, transportation, and "fit" PA environment [28-30].

There are few gaps in current studies. First, there is few studies specifically focus on older adults with cardiometabolic diseases, who face unique challenges due to their health conditions. Since older adults with cardiometabolic disease are more vulnerable. There is a need to explore PA barriers in older adults with cardiometabolic disease(s). Second, China has a notably low level of PA among older adults, with only 26.1% meeting the recommended PA levels. Moreover, the prevalence of insufficient PA has shown an increasing trend over the past few decades [18]. However, most existing research were conducted in developed countries, such as the United State, Canada, Australia, UK and South Korea. Few studies were conducted in China mainland [30]. The attitude towards PA between China and Western countries may vary due to a lot of reasons.

Kunshan is a city located in Jiangsu Province, close to Shanghai. It has a significant older adult population. According to the announcement of the results of the 7th National Population Census by the Kunshan City Bureau of Statistics, the population of people aged 65 and above in Kunshan City is 183,910, accounting for 8.79% of the total population of Kunshan [35]. At the same time, the Kunshan Municipal Government has vigorously developed older adult care services and is committed to building a multi-level, high-quality older adult care service system. Our research results can provide a solid foundation and reference for the high-quality development of the Kunshan Municipal Government in the field of older adult care service.

Currently, there are different study designs to investigate PA barriers in older adults, such as qualitative design (e.g., interview or focus groups), quantitative design (e.g., cross-sectional study or longitudinal study), or mixed method study design [26, 28-31]. Single qualitative design is the one that has been used the most, with strength in understanding the problem in-depth with personal experience [22, 26, 28-31, 36, 37]. Comparing to qualitative design, quantitative design could better indicate the level of associations between factors and outcomes and whether it is statistically significant. With strengths in both quantitative study and qualitative study, the mixed method study design is getting more and more popular in recent years [22, 29, 36-38]. Therefore, it would be beneficial to use a mixed-method design to investigate the study question.

## *1.3 Implications*

In conclusion, most mixed studies only included older adults in their qualitative research without muti-stakeholders, such as family members and community care staffs [39, 40]. A previous study highlighted the importance of engaging all related stakeholders in understanding older adults' PA because each context setting is individual [41]. Furthermore, engaging relevant stakeholders can also foster positive attitude changes and enhance their cooperation in future

physical activity (PA) interventions. Thus, multiple stakeholders, including older adults' family members and community family physicians (FPs) will be included in the qualitative research part.

By using mixed-method design to investigate the physical activity barriers in older adults with cardiometabolic disease in Kunshan city, this study aims to 1) identify risk factors that are significantly associated with PA level in cross-sectional analyses; 2) identify PA barriers reported by 1) older adults and their family members and 2) FPs through semi-structured interviews; 3) use SEM to integrate quantitative and qualitative findings, providing a comprehensive understanding of the local Kunshan context. By applying SEM, the factors were classified into multiple levels, allowing for a comprehensive and systematic analysis of the issues. Therefore, this study can provide strong evidence in future PA intervention/management programs for Kunshan older adults with cardiometabolic disease(s).

# 2. Method

This study is a convergent parallel mixed-methods design research [42, 43]. Based on Dr. Creswell's definition, convergent parallel mixed-methods design research refers to a kind of mixed method that" collecting both quantitative and qualitative data, analyzing them separately, and then comparing the results to see if the findings confirm or disconfirm each other" [43]. Thus, I combined two studies' results on older adults with chronic disease in Kunshan to provide a comprehensive understanding of the barriers to PA among older adults with cardiometabolic disease in Kunshan. The qualitative study is Pre-implementation Qualitative Research on Co-designing Evidence-Based and People-Centered Cardiometabolic Multimorbidity Management among Older Adults in Kunshan City (KS C4M), while the quantitative study is Mechanisms and Path Analyses for Health Management among Chronic Diseases Patients in Urban China: A Community Empowerment-Based Approach (CEBA). It is important to acknowledge that this study may not have been rigorously designed as a mixed-methods study from the outset. Both data types are collected concurrently from June to September 2024 and analyzed separately before integration (as seen in Figure 1) [44]. Cross-sectional study data was collected to identify factors associated with PA levels. Qualitative data from interviews was collected to understand barriers associated with PA from the perspective of 1) older adults and their family members and 2) FPs. Using a mixed-method design could bring insight understanding of the research question.


**Figure 1 A Convergent Parallel Mixed Method Study to Explore PA Barriers in Older Adults with Cardiometabolic Disease in Kunshan.**

## *2.1 Quantitative Study Design*

### 2.1.1 Research Question

The primary research question in this quantitative study is: "What are the risk factors significantly associated with physical activity (PA) levels?" This overarching question was further divided into the following two sub-questions:

a) What are factors significantly associated with activity level (high level/ low and moderate level)?

b) What are factors significantly associated with continuous variable IPAQ MET total?

### 2.1.2 Data collection

This study uses CEBA 2024 survey data. 144 samples were recruited from 6 Kunshan communities. CEBA is an observation longitudinal study started at 2019, focusing on older adult with chronic diseases. It was conducted by the Duke Kunshan University Global Health Research Center and Wuhan University.

Inclusion criteria were as follows: 1) Individual was diagnosed with at least one of cardiometabolic diseases (hypertension, diabetes, heart disease, stroke), and other chronic diseases can also be diagnosed. 2) Aged 65 and above. 3) People who participated in the CEBA surveyed in the Kunshan community in at least one of 2019, 2020, 2021, or 2022. Exclusion criteria were 1) having a serious illness, physical or mental disability, or other

condition that prevents participation in the survey or 2) not obtaining informed consent, withdrawal of informed consent, or request to withdraw from the research. In total, there were 144 adults aged 65 years and above in the CEBA 2024 data set. All of them were included in the analysis.

The data collection was conducted by the Duke Kunshan Global Health Center. 21 trained researchers, including me in Duke Kunshan University, use mobile devices to conduct surveys, including structured questionnaires and anthropometric assessments. The questionnaire was pretested in Chinese by researchers during training. Verbal and written informed consents were obtained prior to data collection. For illiterate participants, the participants' thumb print impressions were taken and witnessed by a literate person. Participants who were found to have medical problems were referred to the FPs.

Based on the literature review, factors were reported significantly related to PA level in CEBA study were selected as factors, including intrapersonal factors, interpersonal factors, details see Tab. 1. Intrapersonal factors include the sociodemographic information (age, sex, education), health problem (chronic disease number), Self-rated health status, lifestyle factors (smoke habit, alcohol habits). Interpersonal factors include family support. In conclusion, sex, smoking, and alcohol habits are binary variables. Factors other than that were quantified as scores, where a higher score indicates a less advantageous state, the quantified method shown in Table 1.

The 5 time chair stand test (5CST) was selected to be the physical ability test, which was recommended by WHO in the elderly physical capacity screening process [45]. To assess the 5CST result, the time to complete this test was recorded. A firm, straight-back chair was used to conduct the test. Therefore, there are minor differences in chair heights. For those who have visible impairment in walking, the researcher would opt out of testing them by choosing unable to complete the test. For the participants who do not have visible

impairment in walking, researchers will illustrate the process of chair stand and let participants try a single chair stand. After that, participants will be asked if they are able to participate in the test as quickly as possible. The time from when they were seated and asked to start until when they had stood up straight for the fifth time was recorded. Participants can choose to withdraw at any time if they feel uncomfortable. The test results of participants who withdraw will not be recorded.

PA levels and lower limb function were assessed using the International Physical Activity Questionnaire (IPAQ) and 5-time chair stand test.

The International Physical Activity Questionnaire (IPAQ) was used to assess PA level.[46] was transferred to 2 types of data: continuous and binary. The continuous data in PA level was calculated based on the International Physical Activity Questionnaire Scoring Protocol (Short Forms). The continuous score was expressed as MET-min per week. The calculation equation is MET level * minutes of activity/day * days per week. The three MET levels include walking (3.3 METs), moderate intensity (4.0 METs), and vigorous intensity (8.0 METs). Therefore, the total MET minutes/week of an individual is equal to walk (METs*min*days) moderate intensity (METs*min*days) + vigorous intensity (METs *min*days). After having a primary understanding of the data distribution, it was found that the results of IPAQ were not normally distributed. Since the data contained 0, the equation "log (x + 1)" was used to adjust the data. A new continuous data set was obtained. After using the box plot test, 4 outliers were deleted. The Shapiro-Wilk test shows that the adjusted variable was normally distributed.

Based on the IPAQ guidance, the result was first summarized to 3 categorical scores: low, moderate, and high. The lowest level of PA refers to individuals who did not meet the criteria for categories 2 or 3. Moderate refers to those individuals who met the following criteria. Individuals who have 5 or more days of any combination of walking, moderate-

intensity or vigorous-intensity activities achieving a minimum of at least 600 MET min/week. High refers to those who had 7 or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum of at least 3000 MET minutes/week. Then, the low and moderate levels were combined into one category based on the small sample size. Therefore, the two categories were high-intensity activities versus low and moderate-intensity level.

**Table 1: Factor and Outcome List**

| Factors | | |
|---|---|---|
| Intraper sonal | Socio demographic (age, gender, education level), | Age |
| | | Gender<br>• Women (0)<br>• Men (1) |
| | | Education level<br>• No formal school education (score 6)<br>• Primary school education (score 5)<br>• Primary school graduation (score 4)<br>• Junior high school graduation (score 3)<br>• Senior high school/secondary vocational school graduation (score 2)<br>• Bachelor's degree/post-secondary graduation (score 1)<br>Drop if the answer is missing |
| | Health problem | Chronic disease number |
| | | Physical ability (5-time chair stand result)<br>Time to complete the 5-time chair stand test |
| | Self-rated health status | Self-rated health status<br>• Very good (score 1)<br>• Good (score 2)<br>• Fair (score 3)<br>• Not so good (score 4)<br>• Not good at all (score 5)<br>Drop if the answer is missing |
| | Lifestyle factors | Smoke habit<br>• Non-smoker (0)<br>• Smoker (1) |
| | | Alcohol habit<br>• Not drink (0)<br>• Drink (1) |
| Interper sonal | Family support | When I encounter difficulties, my family offers me help, which makes me feel satisfied<br>• Always (score 1)<br>• Sometimes (score 2) |

| | | |
|---|---|---|
| | | • Almost never (score 3)<br>My family discusses issues related to our interests with me and solves problems together, which makes me feel satisfied.<br>• Always (score 1)<br>• Sometimes (score 2)<br>• Almost never (score 3)<br>I find that when I want to engage in new activities or change my lifestyle, my family respects my wishes.<br>• Always (score 1)<br>• Sometimes (score 2)<br>• Almost never (score 3)<br>The way my family expresses emotions and responds to my feelings (e.g., anger, sadness, and love) satisfies me.<br>• Always (score 1)<br>• Sometimes (score 2)<br>• Almost never (score 3)<br>The way my family spends time with me makes me feel satisfied.<br>• Always (score 1)<br>• Sometimes (score 2)<br>• Almost never (score 3)<br>Add the total score, drop the sample if any answer is missing |
| Outcomes | | |
| Physical activity | Continuous IPAQ-MET | Total IPAQ-MET=Walk (3.3 METs*min*days) + Moderate intensity (4.0 METs*min*days) + Vigorous intensity (8.0 METs *min*days) |
| | Binary (High vs. Low/moderate) | Low and moderate level: less than 1500 MET minutes/week<br>High level: at least 1500 MET-minutes/week |

### 2.1.3 Data Analysis

Descriptive statistics were used to summarize the characteristics of the study sample, including intrapersonal factors and interpersonal factors. Continuous variables were reported as means and standard deviations, while binary variables were presented as frequencies and percentages. Initially, we conducted univariate analyses using linear or logistic regression for each factor to assess its association with the outcome. Factors with a statistically significant association ($p \leq 0.05$) were then included in a multivariable regression for further analysis. To

ensure data integrity, the sample containing missing data was excluded from the analysis. All analyses were performed using STATA SE.

## *2.2 Qualitative Method*

### 2.2.1 Interview Aim

Semi-structured interviews were used to address the study aim 2: identify PA barriers perceived from 1) older adults and their family members and 2) FPs.

### 2.2.2 Terminology

Based on the WHO definition, PA refers to “any bodily movement produced by skeletal muscles that require energy expenditure” [8]. Considering the limited comprehension abilities of the older adults, the use of the abstract concept of PA in interviews is not suitable. Therefore, I have replaced "PA" with the concept of "exercise". Exercise is "a subcategory of physical activity that is planned, structured, repetitive, and purposefully focused on improvement or maintenance of one or more components of physical fitness" [47]. Since this study is a part of a planned intervention program aiming to promote community healthcare management service for older adults in Kunshan, this paper focuses on providing evidence basis for future practical exercise interventions program. Thus, instead of focusing on all bodily movement (including housework chores), “exercise” would be a more appropriate term to use in the interview.

### 2.2.3 Interview Guide

Interview guides were developed based on previous studies [38]. It includes age and cardiometabolic disease history, exercise habits, and barriers to exercise. Most of the questions are open-ended. Researchers could use probes to gain an in-depth understanding. The interview guide was pretested in 1 community center and then developed on the expressions. The English version of the interview guide is uploaded in Appendix A.

### 2.2.4 Data Collection

The interviews were conducted by the Duke Kunshan University research team, including 15 trained researchers (1 project manager, 1 doctoral student, 4 graduate students, and 9 undergraduate students). From June to August 2024, 15 researchers, including me, conducted interviews within 3 community health centers in Kunshan. Purposive convenience sampling was applied in 3 community healthcare centers. Within each community, 2 service stations will be chosen, differentiated by their work performance into good, average, and poor categories. There are 6 service stations in total. We recruited 3 older adults per station (for a total of 18 older adults), 1 family member per station (for a total of 6 family members), and 1 FP per station (for a total of 6 FPs). Even though we hope to involve perspectives from family members and FPs, the focus of this study was the older adult's perspective. Therefore, we chose more older adults than family members and FPs with the ratio about 3:1.

This study focuses on older adults with cardiometabolic disease. Thus, we were looking to recruit adults 1) aged 65 or above and 2) having at least one of the cardiometabolic diseases of hypertension, diabetes, stroke, and heart disease. It is fine to have other non-cardiovascular diseases; 3) Chinese citizens; 4) permanent residents in the community. We excluded people who were 1) unable to give informed consent or refused to participate due to physical or other reasons; 2) having severe mental illness. For family members, we recruited people who are family members of the cardiometabolic disease older adults and take care of them. They don't have to be the family members who participated in this study. For FPs, we chose the people who have at least one year of work experience in community healthcare centers and are familiar with older adults' exercise management.

Community healthcare centers are in charge of healthy lifestyle management among older adults, especially including seasonal follow-up visits. Therefore, they have the full

records on older adult's demographics, chronic disease condition, and lifestyle habit. Due to the time-consuming nature of the project, participants and related stakeholders were identified through referral from FPs in community healthcare centers. To better understand the barriers in both males and females, we expressed that we were looking for equal sex distribution. We stopped recruitment once we reached our target number. However, sometimes, more people were recruited on-site. In this circumstance, we also did the interviews with the extra participants. By the end, we conducted 23 interviews with older adults, 9 with family members, and 8 with FPs. Participants were engaged in one-on-one semi-structured interviews lasting about 45 minutes. 2 older adults, 1 family member didn't get the interview recorded because of technical issues. Therefore, they were dropped. I took the exercise-related parts to conduct further analysis. The qualitative data came from an interview part of a planned program, which had limited time. 7 older adults and 1 family member with interviews shorter than 5 minutes were excluded from the analysis. In total, 14 older adults, 7 family members, and 8 FPs were included in the data analysis. The time range is about 15-25 minutes

### 2.2.5 Data Analysis

Initially, A researcher, WH, and I independently reviewed the transcripts to become acquainted with the data. Following this, we conducted the initial coding separately using NVivo 12 software, employing an inductive approach using the SEM framework. Next, we developed preliminary themes by clustering related codes and analyzing their interconnections. Subsequently, I evaluated the emerging themes against the entire dataset, refining them and identifying subthemes. Then, I defined and labeled the themes again and compiled the findings. All themes were fitted into the SEM framework.

## *2.3 Data Integration*

Quantitative and qualitative data were analyzed separately before integration. Quantitative results were transformed into qualitative themes to facilitate comparison with qualitative findings. The integration process involved mapping quantitative and qualitative results onto the SEM framework and identifying consistencies and discrepancies.

## *2.4 Ethical Consideration*

Ethical approval was granted by the DKU Research Ethics Committee and the Wuhan University Research Ethics Committee.

# 3. Results

## *3.1 Quantitative Findings*

A total of 144 people (sex ratio 1:1) aged ≥65 years were included in this study. Factors include age, sex, education level, CMD number, self-rated health status, smoking habit, and alcohol habit, covering both the intrapersonal and interpersonal levels. The average age was 72.31±4.42. The average education score was 4.22±1.40, while the mean of chronic CMD number was 2.23±1.04. The average self-rated health status score was 2.60±1.0. 38 (26.39%) participants reported having a smoking habit, and 37 (25.69%) have an alcohol habit. The family support score was 6.52±1.99.

Outcomes include PA in both binary and continuous form. 8 (5.56%) participants have a low PA level. 92 (63.89%) participants have a moderate PA level. 44 (30.56%) participants have a high PA level. Due to the very small sample size in the low PA level group, PA level was classified into two types (high level vs. low/moderate level). Thus, 100 (69.4%) participants have a low/moderate PA level. 44 (30.56%) participants have a high PA level. As a continuous variable, the IPAQ-MET mean is 3297.16, with a standard deviation of 4275.89. The minimal data is 0, while the maximal data is 24528. The data IPAQ-MET is right-skewed. Therefore, the variable was standardized by the equation log(x+1) [48]. 3 outliers were identified through box plot check and dropped. All details are shown in Table 3.

**Table 2 Characteristics of Study Population and Individual Association Between Factors and Outcomes.**

| Socio-Ecological Level | Factors variable | N | Total Mean (SD)/Frequency (percentage) | Range | Binary Outcome IPAQ-MET: OR (p) N=139 | Continuous Outcome β (p) N=136 |
|---|---|---|---|---|---|---|
| **Intrapersonal** | Age | 144 | 72.31 (4.42) | (65, 86) | 0.98(0.57) | -0.013 (0.50) |
| | Sex: male | 144 | 72 (50%) | (0,1) | 0.71 (0.35) | 0.023 (0.89) |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Education level score | 144 | 4.22 (1.40) | (1, 6) | 0.67 (0.005)* | 0.12(0.044)* |
| | Diseases number | 144 | 2.23 (1.04) | (1,6) | 0.82 (0.28) | -0.016 (0.85) |
| | Physical ability | 122 | 12.09 (3.33) | (6.49, 27.31) | 0.96 (0.55) | -.019 (0.47) |
| | Self-rated health status score | 144 | 2.60 (1.0) | (1, 5) | 1.24 (0.272) | -0.16(0.07) |
| | Smoke: yes | 144 | 38 (26.39%) | (0,1) | 0.65 (0.30) | 0.38 (0.055) |
| | Alcohol drinking: yes | 144 | 37 (25.69%) | (0,1) | 0.65 (0.30) | 0.45(0.021)* |
| **Interpersonal** | Family support score | 139 | 6.52 (1.99) | (5,15) | 1.08 (0.42) | -.045(0.30) |

| | **Outcome variable** | **N** | **Total Mean (SD)/Frequency (percentage)** | **Range** |
|---|---|---|---|---|
| **Physical activity** | Binary (High vs. Low/Moderate) | 144 | Low/Moderate: 100 (69.40%) | (0,1) |
| | Continuous IPAQ-MET | 144 | 3297.16 (4275.89) | (0,24528) |
| **Physical ability (5TCS)** | Binary: Low risks vs. High risks/Unable to complete | 144 | High risks/Unable to complete: 52 (36.11%) | (0,1) |

In individual regression with PA categories, education level was identified as the only statistically significant factor with PA level in the simple logistic regression. The result indicates that a one-unit increase in education level score is associated with a 33% decrease in the odds of being in the low/moderate PA category (OR=0.67, p=0.005, 95% CI [0.50, 0.89]). In this study, a higher education level score indicates less education experience. For example, the highest education level score "6" stands for having no education experience. For the binary PA levels outcome, positive is having low/moderate PA levels. Therefore, the results suggest that older adults with lower education levels are less likely to engage in low/moderate PA levels.

**Table 3 Linear Regression for Association Between Significant Factors and IPAQ MET (Continuous: Log-Transformed)**

| Continuous Outcome: β (p) N=136 | Analysis 1: β (p) Alcohol drinking | Analysis 2: β (p) Analysis 1+Education level |
|---|---|---|

| | | |
|---|---|---|
| Alcohol drinking | 0.45(0.021)* | 0.53 (0.007)* |
| Education Level | | 0.15 (0.015)* |

In a univariable linear regression test, alcohol drinking and educational level scores were identified as significant and included in the regression analysis. Table 4 presents the linear regression results for the IPAQ MET. Analysis 1 indicates that having an alcohol habit is significantly associated with an average increase of 45% in log-transformed IPAQ MET (β=0.45, p=0.021, 95% CI [0.07, 0.84]). After adding education level to the analysis, having an alcohol habit is significantly associated with an average increase of 53% in log-transformed IPAQ MET (β=0.53, p=0.007, 95% CI [0.14, 0.91]). For education, each unit increase is associated with a 15% increase in log-transformed IPAQ MET (β=0.15, p=0.015, 95% CI [0.03,0.26]). In other words, people who have an alcohol habit and lower education level are associated with a higher PA level.

## *3.2 Qualitative Interview Themes*

29 participants' interview data was analyzed, including 14 older adults, 7 family members, and 8 community FPs. The sex ratio of older adults is 1:1. The mean age of older adults is 72.57. In general, walking, housework, running, and calisthenics are the most common physical activities in participants. Several themes were identified on the barriers to PA for the target population. They were discussed from two perspectives in detail below (older adults / older adults' family members vs. FPs)

**Table 4: Barriers reported by older adults /family members and FPs**

| **Older adults and their family members** | | **Reasons** |
|---|---|---|
| Intrapersonal | Physical Barriers | Limited physical ability; CMD; age-related tiredness |
| | Lack of motivation | No previous PA habit; personality |
| | Safety concern | Fear of injury |
| | Lack of time | Housework; taking care of grandkids (female) |
| Environmental | Bad weather | Raining; high temperature |
| **FPs** | | |

| | | |
|---|---|---|
| Intrapersonal | Lack motivation | Lack of awareness and knowledge; unable to persist |
| | Physical Barriers | Limited physical ability; CMD |
| | Safety concern | Afraid of exercise-induced medical emergencies (CMD-related) |
| | Lack of time | Housework; taking care of grandkids (female) |
| Environmental | Bad weather | Raining; high temperature |

### 3.2.1 Barriers to Older adults /Family Members

From the perspective of older adults and their family members, 6 most common barriers were identified, including “physical barriers,” “bad weather”, “lack of motivation”, “safety concern”, and “lack of time”.

#### 3.2.1.1 Intrapersonal Level

***Physical barriers***

Physical barriers have been mentioned the most. 15 out of 18 older adults or family members had reported that. The three major triggers are joint/muscle problems, cardiometabolic disease complications, and age-related tiredness/fatigue.

A lot of participants complain about having joint/muscle problems. For example, 1PL2 (male,67) reported “Because my knee is not in good condition. I used to play Tai Chi ball, but that sport is not good for my knees. I don't play it anymore now. It's mainly because I felt uncomfortable, not that I can't play." Even though the participant is still willing to have an active PA lifestyle, this knee problem caused discomfort and further prevented him from doing the Tai Chi ball. In addition to that, having cardiometabolic disease complications is a major barrier. 3PT1(male,77) reported, “Half (of my body) is a bit numb (after having a stroke), so I am not able to grip the exercise equipment.” It was also stated by family members. 2PF1 stated, “After having several stents implanted, he (the heart disease older adult) felt very tired and strained”. These clearly illustrate how cardiometabolic disease brought challenges to their PA. Third, age-related tiredness/fatigue is another important problem: “Oh dear, at my age, I can't handle it

(exercise) anymore. I get too tired. Even a little bit of movement is too much for me now.", said 2PT3 (female, 68). We observed that expressing physical ability declined with aging is a typical phenomenon. This age-related tiredness often prevents individuals from engaging in physical activities as they used to.

***Safety concern***

There was another theme highly related to the aging problem, which is the safety concern. 1PT7 (male,72) reported that "When I was young, I could walk fast. Now, I'm old, I walk slowly. I'm afraid I might fall and hurt myself." As she aged, she became more afraid of falling. "In the evening, I don't walk far... because I'm 81 years old, it wouldn't be good if I fall by any chance. If I did fall, the cost (from all aspects) would be great," said 1PT6 (female, 81). This also indicates that falls are considered extremely serious for older adults. They believe doing more exercise is related to higher risks of getting injured. Therefore, they don't want to take the risk of getting injured by doing more exercise. For some participants, previous injury experience could prevent them from keeping their regular physical habits. 1PL1(male, 68) said, "When I was almost 60, I could still run. But one day, I fell (while running) during the daytime. Fortunately, my blood pressure was stable; otherwise, it could have been serious. After that fall, I had to change and couldn't run anymore." The previous exercise-related injuries increased their safety concern on PA.

***Previous exercise habit***

The absence of regular exercise can also be a major obstacle. 2PF1 reported, "He (the older adult) doesn't enjoy exercising or going outside. He prefers to stay at home all the time. Back in the day, he used to just hold books in his hands. Now, with mobile phones, computers, and televisions, that's how our time is arranged." The older adult's family mentioned that her spouse had a sedentary lifestyle in the past. Nowadays, the widespread use of mobile phones,

computers, and televisions provides more opportunities for older adults to maintain a sedentary lifestyle.

***Lack of time***

Lack of time is a barrier highly related to participants' family responsibilities. This phenomenon occurs especially in female participants. 1PT5 (female, 65) said, "When my grandchildren were young, I didn't have time (doing exercise) because I had to take care of them." This is also shown in another female participant "I don't have time (to do exercise). After doing the housework, I have to wait for my son-in-law get off work (and cook dinner). He gets off work too late...so I don't have time to go out for a walk." said by 2PT3 (female, 68). Lack of time in this circumstance might be related to cultural background.

#### 3.2.1.2 Environmental Barriers

***Bad Weather***

Bad weather conditions can also pose significant obstacles to physical activities, especially outdoor activities. This study was conducted in mid-summer. Extreme heat and rain are reported by more than half of the older adults. 1PT7 (male, 72) made a joke about walking in the rain: "I don't go out for walk when it rains, If I walk in the rain, I will be an idiot, haha!". Others also agreed, "If it's hot, I won't go out. If it's cool, I'll go for a walk." It shows that bad weather can prevent older adults from doing outdoor physical activities, particularly when outdoor walking is the exercise they participated in the most.

### 3.2.2 Barrier reported from FPs

From the perspective of FPs, 7 barriers were identified. The most common barriers were mainly focused on the intrapersonal level, including "limited physical ability" and "lack of time".

#### 3.2.2.1 Intrapersonal Barriers

***Physical barriers***

FPs also highlighted the barrier of having limited physical ability. Joint/muscle problems, cardiometabolic disease complications, and age-related tiredness are still the major reasons. 2FP3 said, “It’s quite common among older adults to have joint pain. They can’t do intense exercises, and they can only walk. Even if you ask them to walk faster, they may feel uncomfortable. So, there are differences in what they can do. People with asthma or heart disease should exercise according to their physical capacity because this group of people can’t overexert themselves.” This comprehensive study explains how different limited physical problems affect older adults’ PA.

***Lack of Motivation***

Most FPs agree that some older adults lack motivation in engaging in regular exercise. 1FP3 mentioned, “They (older adults) are definitely better at taking medication because they all know that it is important. They are also okay with diet, but may be a little worse at exercise, in terms of the degree of attention they pay to it.” Compared to other healthy lifestyles (medication adherence and diet management), older adults pay less attention to exercise. There are different reasons, such as a lack of awareness. “They (older adults) may not fully understand the necessity of exercise.”, said 2FP3. Other perceived reasons include laziness. 1FP1 indicated, “Most people (older adults) are too lazy to move.”

***Safety concern***

FPs expressed their concerns in PA safety. 2FP3 said, “It's definitely impossible to ask them (older adults) exercise like young people... We (FPs) honestly wouldn't really recommend them (older adults) to do strength training. Honestly, We (FPs) ’re not comfortable with that (for safety reason).” Older adult is fragile, FPs have to be more cautious when providing exercise recommendations. Older adult with cardiometabolic disease “there is many different situations, for example, some people with high blood pressure cannot exercise.”

***Lack of Time***

Busy schedules and family responsibilities often prevent older adults from participating in a PA program, particularly in female older adults. It was confirmed by the FPs as well. 2FP3 reported, “Many older adults are busy and feel that they need to take care of the children, so they have to do housework, especially women.” Some older adults do not do PA because they have to take care of the grandkids and do housework. FP also mentioned that this phenomenon was related to females particularly.

## *3.3 Integration*

To better integrate the result, the quantitative result was transferred to qualitative data. The significant association between education level and PA levels was interpreted as the theme “education levels”. The positive association between alcohol consumption and PA levels was interpreted as the theme “alcohol habit”. The remaining factors without significant relationships were interpreted as “no significant association was observed”.

Below, we discuss the integrated themes that have been mapped to the SEM. The quantitative and qualitative results were both convergent and divergent. See Table 5.

**Table 5: Integration of Quantitative Result and Qualitative Result.**

| **SEM** | **Barriers** | | **Quantitative result** | **Qualitative result** |
|---|---|---|---|---|
| Intrapersonal | Age | | | x |
| | Sex | | | x |
| | Education levels | | x | |
| | Limited physical capacity | Disease number | | x |
| | | Self-rated health status | | |
| | | Physical ability | | x |
| | Smoke habit | | | |
| | Alcohol habit | | x | |
| | Safety concern | | N/A | x |
| | Previous exercise habit | | | x |
| | Lack motivation | | N/A | x |
| Interpersonal | Family support | | | |

| | | | |
|---|---|---|---|
| | Lack of time (female family responsibility) | N/A | x |
| Environment | Bad weather | N/A | x |

Note: “x” means this theme was reported

**Intrapersonal**

Interestingly, while quantitative findings showed no significant association between PA levels with age and sex, qualitative data revealed that both age and sex were perceived as barrier factors affecting PA participation. For example, age-related tiredness was one of the most reported barriers in qualitative study. Qualitative result shows that it is related to safety concerns. Both older adults and FPs expressed worries about the age-related injury while exercising.

Regarding physical ability, there is some inconsistency between the quantitative analysis and qualitative findings. The quantitative result shows that there is no significant relation between disease numbers, self-rated health status, PA ability and PA level. Qualitative interviews revealed that joint/muscle problems, cardio-metabolic disease complications, and age-related tiredness are the major barriers from both older adults and FPs perspective, preventing older adults from engaging in PA level.

Furthermore, quantitative analysis results indicated a significant positive association between and higher PA levels, education level, and alcohol consumption. However, qualitative data didn’t have further prove that.

**Interpersonal**

Quantitative data shows no significant association between family support and PA. Qualitative results show a lack of social interaction as an important barrier to their PA. For example, 2 participants mentioned that after Covid, they had fewer social interactions. This led to that they no longer went out for exercise as often.

The interview revealed that female participants may face more barriers in lacking time than males because of their family responsibilities.

**Environmental**

Qualitative results supplemented that bad weather posed significant barriers to outdoor physical activities. More than half of the participants reported that extreme weather would prevent older adults from doing exercise, especially when walking is the exercise they did the most.

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# 4. Discussion

This study employed a convergent parallel mixed methods design to explore the barriers to PA among older adults with cardiometabolic disease in Kunshan. The quantitative and qualitative findings provide a comprehensive understanding of the barriers influencing PA levels and physical ability.

The result shows that the safety concern is a barrier. Both older adults and FPs expressed worries about age-related injuries while exercising. This concern has been widely documented in previous research [25, 26, 29-32, 36, 49].

Particularly, female participants frequently reported gender-specific barriers, which is consistent with previous studies [28, 50]. The main reason for that is lack of time. Their caregiving responsibilities restrict their time. It was also indicated by FPs. This finding reflects how cultural background impacts older adults' PA. The family caregivers of grandparents was more likely to be women, married, living in rural areas, and having fewer years of education [51]. Female older adults often have to balance their family responsibilities with their personal health needs. In Chinese culture, three generations living together is a common phenomenon. The grandmother always takes the responsibility of taking care of the whole family and grandkids. This is consistent with findings from other studies [25]. This suggests that old female adults might face specific barriers to physical activity. Future interventions should be designed with a particular focus on the burden of family responsibilities.

Education level was proved to be significantly associated with PA level. However, the result in our study was inconsistent with the previous study [28, 52, 53]. In our research, older adults with a lower education level tend to have a high PA level. A previous study found that people with higher education levels tend to have a higher PA level [50]. People with low education levels relied on employment as the main source of PA. When they retired, their PA significantly declined. At the same time, people with high education levels tended to increase

their PA after they retired [52]. Even though this study didn't directly explain this phenomenon. However, an older adult mentioned her personal experience. This indicated that individual's previous farming experience facilitated her in keeping active. However, it is not solid.

The result shows that the number of chronic diseases has no significant association with PA level. This is inconsistent with current study findings [31]. Study shows that people with more comorbidities tend to have a lower PA level. The reason might be due to all participants being adults with cardiometabolic disease(s). Future quantitative studies may need to compare the differences between people with and without cardiometabolic disease(s). In addition, there is a bias in the sample characters. The quantitative sample has a relatively better PA level compared to other studies, with only 8 people in the low PA level.

Furthermore, quantitative analysis results indicate a significant positive association between alcohol consumption and higher PA levels. This finding is consistent with previous research [54-56]. A cross-sectional study in Cooper Institute includes 38,653 American adults and reveals that those engaging in PA are also more likely to have an alcohol drinking habit [55]. A previous study reveals that this phenomenon may be related to the "licensing effect" [54]. It refers to the idea that when a person did something healthy, they felt as if they had earned a license to do something unhealthy. Another study indicated that it might relate to social activities involvement as well [56]. A study suggests that individuals with extroverted personalities may be more likely to be in environments where alcohol is present and more likely to exercise with others [55].

This finding is consistent with previous research, suggesting that a lack of social interaction reduced older adults' PA opportunity [25]. Quantitative data didn't show a significant association between family support and older adults' participation in PA. On the other hand, most participants consider family support as a facilitator in their PA [30].

Qualitative results supplemented that bad weather could prevent older adults from doing outdoor physical activities. This is highly consistent with previous study[25, 26, 30].

## *4.1 Strengths*

The mixed methods design of this study is a major strength, as it provides a comprehensive assessment of factors influencing PA levels in older adults by integrating quantitative and qualitative data. For example, the quantitative analysis identified significant associations between education level, alcohol consumption, and PA levels, factors that were not emphasized in our qualitative findings or in previous research [37]. By using the SEM framework, we were able to systematically analyze barriers to PA at multiple levels (intrapersonal, interpersonal, and environmental), which is consistent with previous studies [27, 29]. Thus, the SEM framework highlights the importance of systemic interactions in understanding PA levels among older adults, provides a basis for dual interventions targeting multilevel factors, and facilitates cross-sectoral collaboration.

## *4.2 Limitations*

The biggest limitation of this study is that it has not been rigorously designed as a mixed-methods study. Two studies were conducted separately. The integration into a convergent parallel design was done retrospectively. This approach may limit the degree to which the qualitative and quantitative data were initially aligned, which may affect the coherence of the findings when compared and interpreted together. Future research should consider a more integrated mixed-methods design from the beginning to enhance the rigor and coherence of the results. In addition, although the qualitative and quantitative studies were conducted in populations with the same characteristics, the data were not collected from the same individuals. This also presented challenges for integrating and interpreting the findings. Future studies should aim to collect both qualitative and quantitative data from the same population, as this would enhance the validity of the results.

Second, the mean age of both the quantitative and qualitative samples skewed toward younger older adults primarily concentrated between 65 and 75 years old. This limited age range may affect the generalizability of the findings to frailer or older adult populations (e.g., individuals over 75 years) who may face distinct barriers to physical activity, such as more severe functional limitations and a higher prevalence of comorbidities. Previous studies show that PA patterns and barriers may differ between the young old (60-78 years) and the oldest old (79+ years) in the "fear" issue [49]. suggesting that the challenges faced by the oldest adults may not be fully captured in this study.

The cross-sectional design of this study limits our ability to establish causal relationships between factors and outcomes. Future research should consider longitudinal or randomized controlled designs to better interpret causal relationships. Furthermore, PA levels were assessed using self-reported measures, which may be subject to recall bias.

The convenient recruitment method used in our qualitative research introduced potential bias. Specifically, it may have limited the diversity of the participant population, as we were unable to reach individuals who were not involved in the family doctor management program. These individuals might face greater barriers. Future studies should consider including this population to provide a more comprehensive understanding.

At the same time, reported bias might rise because of the recruitment method and interview place. The participants were recruited by FPs who work in community healthcare centers. The interviews were conducted in the community healthcare centers. Participants might have potential concerns about reporting barriers that they encounter in community healthcare centers.

Additionally, the interviews were conducted by 15 different researchers, and the quality of the interview data varied. Close to one-third of the total qualitative samples mainly conducted by 2 researchers were dropped because of the very short time (<5mins). In future studies, all

researchers need to receive systematic professional training before data collection to minimize this bias. Also, it is a part of another lifestyle management study, which contributed to the very short time as well.

## *4.3 Implications*

By combining quantitative and qualitative data, the framework of the social ecological model was used to analyze the multiple factors that affect PA in the older adults. This study highlighted the importance of intrapersonal factors in PA. Future intervention strategies should comprehensively consider the multiple challenges faced by the older adults. Particular attention should be paid to addressing these intrapersonal barriers, as this can help improve older adults' physical health and quality of life.

# 5. Conclusion

This study employed a convergent parallel mixed methods design to investigate the barriers affecting the PA of older adults aged 65 and above with cardiometabolic diseases in Kunshan City. The convergent mixed methods approach provided a comprehensive understanding of this topic. The integrated results indicate that numerous barriers at various levels influence the PA levels of the older adults in complex ways. The most common barriers were "physical barriers," "bad weather", "lack of motivation", "safety concern", and "lack of time". It is crucial for future studies to pay more attention to these barriers when designing PA interventions for younger older adults (aged between 65-75 years old) with cardiometabolic diseases in Kunshan. Specifically, understanding their age-related physical capability issues, age-related safety concerns, disease-related physical barriers, and gender-related family support barriers can help with facilitating PA interventions. Second, addressing environmental-level barriers such as bad weather by improving the availability of indoor activity facilities and programs can enhance their participation in PA. Future study needs to focus on addressing these issues at different SEM levels to better assist older adults in Kunshan in engaging in activities.

# Appendix A

<table>
<tr><td colspan="2">Older adult Interview Guide</td></tr>
<tr><td colspan="2">Hello! We are the research team members of the Duke Kunshan University. Thank you for taking the time to participate in our interview. The interview will last about 15 minutes. In this interview, we mainly want to understand your views on chronic disease management. We will keep your information strictly confidential and will not disclose it to others; any reports on project results will not include your personal information, and all the contents of this interview will only be used for public welfare research. [Introduce the informed consent form and request to sign] In order to better summarize the information, we need to record this interview. Is it okay? Thank you for your support! Before the interview begins, do you have any questions? Then let's get started!</td></tr>
<tr><td>Disease History</td><td>1. How old are you?<br>2. Do you have high blood pressure, heart disease, diabetes, or stroke (make sure they report all diseases)? When did you know? How did you know?<br>3. What changes have been brought to your life by being diagnosed with these diseases?</td></tr>
<tr><td>Perception of exercise and exercise habits</td><td>4. What do you think about exercise?<br>5. What sports/exercises do you know? Where did you learn this information?<br>6. Do you do exercise?<br>(1) What type?<br>(2) How often?<br>(3) How intense is it (can talk while doing = low intensity, a little bit talk = moderate intensity, can’t speak at all = high intensity)?<br>(4) How long each day?<br>(5) Where?<br>(6) Alone or with someone? Who are them?<br>7. What are the effects of chronic diseases on your exercise habits<br>8. Do you have free exercise equipment or classes around you? If so, would you like to use them?</td></tr>
<tr><td>Challenges in exercise</td><td>9. What difficulties have you encountered during the exercise? (Personal physical limitations, lack of relevant knowledge, community facilities, safety risks, lack of personal motivation))<br>(1) What other reasons prevent you from doing exercise? (Personal physical limitations, lack of relevant knowledge, community facilities, safety risks, lack of personal motivation)<br>10. Have you tried to solve these obstacles/difficulties by yourself or sought help? What was the result?</td></tr>
<tr><td colspan="2">Family Member Interview Guide</td></tr>
</table>

| | |
|---|---|
| Hello! We are the research team members of the Duke Kunshan University. Thank you for taking the time to participate in our interview. The interview will last about 15 minutes. In this interview, we mainly want to understand your views on chronic disease management. We will keep your information strictly confidential and will not disclose it to others; any reports on project results will not include your personal information, and all the contents of this interview will only be used for public welfare research. [Introduce the informed consent form and request to sign] In order to better summarize the information, we need to record this interview. Is it okay? Thank you for your support! Before the interview begins, do you have any questions? Then let's get started! | |
| Disease History | 1. How old is the older adult you are caring for?<br>2. Does the older adult have hypertension, heart disease, diabetes, or stroke (please list all conditions)? When were they diagnosed, and how was it discovered?<br>3. What changes have occurred in their life since being diagnosed with these conditions? |
| Perception of exercise and exercise habits | 4. What are your thoughts on exercise for the elderly?<br>5. What types of exercise/physical activities do you know are suitable for the elderly? Where did you learn this information?<br>6. Does the older adult engage in exercise?<br>(1) What type of exercise do they do?<br>(2) How often do they exercise?<br>(3) What is the intensity of their exercise? (Can talk easily during exercise = low intensity, can talk with some difficulty = moderate intensity, cannot talk at all = high intensity)<br>(4) How long do they exercise each time?<br>(5) Where do they exercise?<br>(6) Do they exercise alone or with others? If with others, who are they?<br>7. How have the older adult's chronic conditions affected their exercise habits?<br>8. Are there free exercise equipment or classes available in their community? If so, are they willing to use them? |
| Challenges in exercise | 9. In your experience caring for the older adult, what difficulties have you observed them facing during exercise? (e.g., physical limitations, lack of knowledge, inadequate community facilities, safety concerns, lack of motivation, etc.)<br>(1) What other factors prevent the older adult from exercising?<br>10. Has the older adult tried to address these barriers/difficulties on their own or sought help? What were the outcomes?<br>11. As a family member, have you tried to help the older adult overcome these exercise barriers? What specific actions have you taken, and what were the results? |
| Family Physician Interview Guide | |

| | |
|---|---|
| Hello! We are the research team members of the Duke Kunshan University. Thank you for taking the time to participate in our interview. The interview will last about 15 minutes. In this interview, we mainly want to understand your views on chronic disease management. We will keep your information strictly confidential and will not disclose it to others; any reports on project results will not include your personal information, and all the contents of this interview will only be used for public welfare research. [Introduce the informed consent form and request to sign] In order to better summarize the information, we need to record this interview. Is it okay? Thank you for your support! Before the interview begins, do you have any questions? Then let's get started! | |
| Background | 1. Do you manage older adults' exercise in your daily work? What are the specific practices?<br>2. Did you receive any professional training or education on providing an exercise guide in the past?<br>3. Based on your knowledge, what are the impacts of exercise on old people with cardiometabolic disease?<br>4. Do you have personalized exercise interventions for different older adults? If so, what are the specific intervention methods? If not, why do you limit yourself to personalized exercise intervention? |
| Perception of exercise and exercise habits | 5. What are your thoughts on exercise for the elderly?<br>6. What types of exercise/physical activities do you know are suitable for the elderly? Where did you learn this information?<br>7. Do the elderly that you manage engage in exercise?<br>(1) What type of exercise do they usually do?<br>(2) How often do they exercise?<br>(3) What is the intensity of their exercise? (Can talk easily during exercise = low intensity, can talk with some difficulty = moderate intensity, cannot talk at all = high intensity)<br>(4) How long do they exercise each time?<br>(5) Where do they exercise?<br>(6) Do they exercise alone or with others? If with others, who are they?<br>(7) How does the older adult's chronic conditions affect their exercise habits?<br>8. Are there free exercise equipment or classes available in their community? If so, are they willing to use them? |
| Challenges in exercise | 9. What are the challenges older adults encountered in doing exercise?<br>(1) Do older adults who have hypertension, heart disease, diabetes, or stroke have specific barriers to exercise?<br>10. What are the main challenges you encounter when managing older adult exercise?<br>11. Have these challenges been solved? If so, how were they solved?<br>12. Have you ever had the experience of successfully promoting older adults exercise in the past? Can you talk about specific measures in detail?<br>13. Do you think community support (such as peer support, older adult family and community collaboration, and medical system collaboration) and technical support (such as wearing a sports bracelet, regular tracking of exercise data, and inputting information into the system) will help you manage your exercise? In what ways? |

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