Values and Preferences Regarding Medication-Taking Behaviors Among Patients in Primary and Secondary Prevention of Cardiovascular Disease: An Exploratory Mixed-Methods Study Postprint

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Abstract

Background Pharmacotherapy constitutes a crucial cornerstone in the primary and secondary prevention of cardiovascular disease; however, patients'values and preferences regarding pharmacotherapy remain inadequately understood. Objective To investigate the values and preferences of patients concerning medication-taking behaviors in the primary and secondary prevention of cardiovascular disease, thereby contributing to the reduction of pharmacotherapy burden and improvement of medication adherence. Methods This study employed an exploratory sequential mixed-methods design. Initially, stratified purposive sampling was utilized to recruit patients meeting criteria for primary and secondary cardiovascular disease prevention from West China Hospital of Sichuan University and Yulin Community Health Service Center of Wuhou District, Chengdu, between November 2021 and January 2022, as interview participants. Qualitative data were collected via focus group interviews to elucidate participants' medication-related behaviors, values, and preferences. Interview content was coded and categorized using MAXQDA 2020, and Colaizzi' s seven-step analysis method was applied for further organization, analysis, and thematic extraction. Following completion of the qualitative phase, a quantitative questionnaire was developed based on the identified themes. Subsequently, convenience sampling was employed to recruit patients meeting primary and secondary cardiovascular disease prevention criteria from the outpatient clinics of the Departments of Cardiology, Endocrinology, Nephrology, and Neurology at West China Hospital of Sichuan University, as well as Yulin Community Health Service Center of Wuhou District, Chengdu, between November 2022 and February 2023, as survey participants. After obtaining informed consent, further analysis was conducted

on the quantification of participants' values and preferences related to medication use. Results The qualitative study enrolled 21 participants for focus group interviews, yielding four themes: (1) perceptions and behaviors regarding medications; (2) barriers to medication use; (3) facilitators of medication use; and (4) needs for medical services. The quantitative study collected 186 valid questionnaires (response rate 93.5%). Results indicated that medication omission behavior was prevalent and further confirmed the presence of social stigma and medication burden identified in the qualitative study. Despite high heterogeneity in medication preferences, participants generally favored fewer medication types and dosing frequencies and expressed reluctance toward injectable formulations. Conclusion In clinical practice for primary and secondary prevention of cardiovascular disease, increasing the utilization of fixed-dose combination formulations may be considered, while integrating pharmacotherapy regimens with patients' daily life and work routines to reduce medication burden. Additionally, active intervention should be implemented to address patients' misconceptions and behaviors regarding disease and medications, thereby enhancing medication adherence.

Full Text

Preamble

Values and Preferences Regarding Medication Habits Among Patients Undergoing Primary and Secondary Prevention of Atherosclerotic Cardiovascular Disease: An Exploratory Mixed-Methods Study

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Abstract

Background: Pharmacotherapy is a cornerstone of primary and secondary prevention of atherosclerotic cardiovascular disease (ASCVD), yet patients' values and preferences regarding medication remain unclear. **Objective:** To explore the values and preferences of patients undergoing primary and secondary prevention of cardiovascular disease regarding their medication habits, with the aim of reducing treatment burden and improving medication adherence. **Methods:**

This study employed an exploratory sequential mixed-methods design. First, using stratified purposive sampling, we recruited eligible patients from West China Hospital of Sichuan University and Yulin Community Health Service Center in Wuhou District, Chengdu, between November 2021 and January 2022 as interview participants. Focus group interviews were conducted to collect qualitative data on medication-related behaviors, values, and preferences. MAXQDA 2020 was used to code and categorize interview content, which was further analyzed using Colaizzi' s seven-step method to identify key themes. Following completion of the qualitative phase, a quantitative questionnaire was designed based on the emergent themes. Second, using convenience sampling, we selected patients meeting criteria for primary and secondary cardiovascular disease prevention from outpatient clinics of Cardiology, Endocrinology, Nephrology, and Neurology at West China Hospital of Sichuan University, as well as Yulin Community Health Service Center in Wuhou District, Chengdu, between November 2022 and February 2023. After obtaining informed consent, we quantitatively analyzed participants' values and preferences regarding medication use. **Results:** The qualitative phase included 21 participants in focus group interviews, yielding four themes: (1) perceptions and behaviors regarding medications; (2) barriers to medication use; (3) facilitators of medication use; and (4) needs for medical services. The quantitative phase collected 186 valid questionnaires (response rate 93.5%), confirming the widespread occurrence of missed doses and validating the presence of social stigma and treatment burden identified in the qualitative phase. Although medication preferences were highly heterogeneous, participants generally preferred fewer medication types and lower dosing frequency, and were less inclined to use injectable formulations. **Conclusion:** In clinical practice for primary and secondary prevention of cardiovascular disease, increased use of fixed-dose combination preparations should be considered, and medication regimens should be integrated with patients' daily lives and work schedules to reduce treatment burden. Additionally, active intervention is needed to address misconceptions and inappropriate behaviors regarding disease and medication, thereby improving medication adherence.

[**Key words**] Cardiovascular diseases; Preventive medicine; Pharmacotherapy; Values; Preferences; Qualitative research; Mixed-methods study

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Atherosclerotic cardiovascular disease (ASCVD), including coronary atherosclerotic heart disease and peripheral atherosclerotic disease, is a common chronic non-communicable disease in China and a major cause of disability and life loss

among Chinese residents[1-2]. The tertiary prevention strategy is central to cardiovascular disease prevention and represents a core task for primary care physicians and public health practitioners in safeguarding community health. For general practitioners, primary prevention of cardiovascular disease involves comprehensive management of shared risk factors such as hypertension, dyslipidemia, diabetes, smoking, and obesity, while secondary prevention includes pharmacological and lifestyle interventions. In both primary and secondary prevention, pharmacotherapy serves as a crucial cornerstone[3].

The variety of medications used in primary and secondary prevention of cardiovascular disease is extensive, with substantial differences in formulation, dosing frequency, timing, preventive intensity, and types and probabilities of adverse reactions. This creates high heterogeneity in medication choices, which is closely related to patients' values and preferences[4-5]. The latter represents an essential determinant in clinical decision-making that cannot be overlooked[6-8]. For example, among diabetes treatments, there are oral medications like metformin and subcutaneous insulin injections. While these differ significantly in efficacy and safety, they have highly overlapping indications. When making choices, patients must balance risks, benefits, and costs, but the route of administration is also intimately connected to their daily lives. Ignoring patients'subjective preferences may reduce treatment adherence and satisfaction, and fails to demonstrate adequate respect for patients. Understanding patients' values and preferences helps clarify individualized treatment burden and enables patient-centered clinical practice, thereby improving medication adherence.

Current clinical practice guidelines and primary care manuals in China rarely systematically discuss patients' values and preferences, and related research has started later compared to international efforts. To better inform the development of Chinese clinical practice guidelines, this exploratory mixed-methods study employed both qualitative and quantitative methods to investigate the values and preferences of patients undergoing primary and secondary prevention of cardiovascular disease regarding their medication habits. This knowledge will facilitate patient-centered clinical decision-making, reduce treatment burden, and improve medication adherence.

1. Subjects and Methods

This study employed an exploratory sequential mixed-methods design. First, qualitative data were collected through focus group interviews to understand participants' medication-related behaviors, values, and preferences. Based on themes identified from the interviews, a quantitative questionnaire was then designed to further analyze participants' values and preferences regarding medication use quantitatively. The study was approved by the Ethics Committee of West China Hospital of Sichuan University (Approval No.: 2021 Review [1556]).

1.1 Qualitative Study

1.1.1 Interview Participants Using stratified purposive sampling, we screened patients meeting criteria for primary and secondary prevention of cardiovascular disease from the Cardiology, Endocrinology, Nephrology, and Neurology departments of West China Hospital of Sichuan University and Yulin Community Health Service Center in Wuhou District, Chengdu, between November 2021 and January 2022 as interview participants.

Inclusion criteria for primary prevention patients: (1) Significantly elevated single risk factor: total cholesterol >8 mmol/L, low-density lipoprotein cholesterol >4.9 mmol/L, or blood pressure >180/110 mmHg (1 mmHg=0.133 kPa); (2) Patients with type 2 diabetes without documented coronary heart disease or stroke history, regardless of target organ damage (microalbuminuria, retinopathy, or neuropathy); (3) Chronic kidney disease stage 3 or above [estimated glomerular filtration rate $ $59mL \cdot min^{\{-1\} \cdot (1.73m}\{2\})\hat{}\{-1\}$]; (4) Type 1 diabetes with early onset and duration $ $20 years.

Inclusion criteria for secondary prevention patients: Documented ASCVD, including acute coronary syndrome (acute myocardial infarction or unstable angina), stable angina, coronary revascularization, stroke, transient ischemic attack, or peripheral arterial disease.

Exclusion criteria: Individuals with cognitive impairment or inability to express their views normally, and minors.

1.1.2 Interview Guide The interview guide was developed based on literature review and expert opinion. Pilot interviews were conducted and the guide was refined accordingly. The final interview guide included: (1) What troubles have you experienced during long-term medication use? (2) Which formulation do you prefer? Why? (3) When efficacy and safety are equivalent, would you consider using fixed-dose combination medications? Why? (4) Do you prefer once-daily or multiple-daily dosing? Why? (5) Do you have any preferences regarding dosing intervals? (6) What aspects do you hope doctors will consider when prescribing medications?

1.1.3 Interview Methods Potential participants meeting inclusion and exclusion criteria were contacted by telephone to introduce the study' s purpose, significance, and format, inquire about their willingness to participate, and schedule interview times. Interviews were conducted by two researchers experienced in qualitative research: one endocrinologist from West China Hospital of Sichuan University and one doctoral student from the research team. Neither researcher had been involved in the clinical care or any other medical interactions with the participants, but both had clinical experience in inpatient settings and possessed strong doctor-patient communication skills. Interviews were held in quiet outpatient consultation rooms without scheduled clinic duties. Each focus group comprised 4-6 participants, with sessions lasting 90-120 minutes. At

the beginning of each interview, the moderator reintroduced the study purpose, assured participants that personal information would be de-identified, obtained permission for audio recording, and secured written informed consent. Demographic information (including name, age, gender, current diseases, medication use, etc.) was collected via questionnaire. During interviews, the moderator flexibly adjusted questioning order and style based on the interview guide and actual discussion flow, pursued valuable findings through in-depth follow-up questions, respected participants' language without guidance or intervention, and attended to non-verbal cues such as tone, facial expressions, and body language. The entire interview was audio-recorded, while another researcher observed and took notes. The qualitative phase aimed to include at least 16 participants (4 groups). Information saturation was considered achieved and qualitative data collection was terminated when no new information emerged from two consecutive focus groups.

1.1.4 Quality Control Audio recordings were transcribed into text within 24 hours after each interview, with data collection and analysis proceeding simultaneously. Two researchers verified the accuracy of the transcripts and independently coded the data using MAXQDA 2020 software. Coding results were compared, discrepancies discussed, and consensus reached. Colaizzi's seven-step method was used to organize and analyze the data and identify themes.

1.2 Quantitative Study

1.2.1 Study Participants Using convenience sampling, we selected outpatients from Cardiology, Endocrinology, Nephrology, and Neurology clinics at West China Hospital of Sichuan University and Yulin Community Health Service Center in Wuhou District, Chengdu, between November 2022 and February 2023 who met the same inclusion and exclusion criteria as the qualitative phase. After obtaining oral informed consent, participants completed an online questionnaire via the Wenjuanxing platform. Participants were required to read and click "agree" to the informed consent content before beginning the formal survey.

1.2.2 Questionnaire Survey The quantitative questionnaire was designed based on findings from the qualitative study. To further understand participants' medication behaviors, the second part of the questionnaire included questions about missed doses. Since disease stigma emerged during interviews, questions about feelings regarding taking medication in front of others were added. To elaborate on treatment burden identified in interviews, the questionnaire included items on values and preferences regarding carrying medication when going out, dosing frequency, formulation, timing, number of medication types, and relationship with meals. Before formal administration, the questionnaire was pilot-tested with 5 randomly selected eligible patients and refined based on results. The final questionnaire had a Cronbach' s α of 0.923.

The questionnaire comprised three sections: (1) Demographic information in-

cluding age, gender, occupation, education level, marital status, and residence; (2) Disease and treatment-related information including diagnosis, insurance coverage, medical expenses, and number and frequency of medications; (3) Information on patients' perspectives and preferences regarding medication frequency, formulation, type, and timing. Medication preference was rated on a 1-5 scale, where 1=very unwilling, 2=unwilling, 3=neutral, 4=willing, and 5=very willing to use the medication. Higher scores indicated stronger preference. Questionnaires were distributed to patients undergoing primary and secondary prevention of cardiovascular disease, with participants completing electronic questionnaires under researcher guidance. All investigators received unified training in questionnaire administration. After collection, data were exported from the online platform to Excel software, where two researchers independently checked data completeness and validity before finalizing the dataset.

1.3 Statistical Methods

Quantitative data were analyzed using IBM SPSS 25.0 software. Categorical data were presented as frequencies and percentages. Non-normally distributed continuous data were expressed as median (P25, P75), with between-group comparisons performed using the Kruskal-Wallis test. Statistical significance was set at $P<0.05$.

2. Results

2.1 Qualitative Study Results

2.1.1 Basic Information of Interview Participants The qualitative phase included 21 participants in focus group interviews, including 9 males (42.9%) and 12 females (57.1%). Most participants were aged $ $61 years (71.4%), 61.9% were primary prevention patients, and approximately half were currently taking 7 or more medications. Basic participant information is shown in Table 1 .

2.1.2 Interview Findings Four themes were identified from the qualitative data: perceptions and behaviors regarding medications, barriers to medication use, facilitators of medication use, and needs for medical services (Table 2).

Theme 1: Perceptions and Behaviors Regarding Medications

(1) Misconceptions and inappropriate behaviors. Participants commonly held misconceptions such as "all medicines have some toxicity," "Western medicines have more side effects than traditional Chinese medicines," "taking medicine after meals doesn' t harm the stomach," and "injections work better than oral medications." Participants also frequently adjusted their medication use—including dosage, frequency, timing, and duration—based on their own perceptions.

Participant 3: "I figured if my lipid levels were normal, I could stop taking this medicine."

Participant 4: "I always think all medicines have some toxicity; it' s best to adjust through diet."

Participant 6: "I think taking medicine for a long time hurts the stomach. I don' t think taking it on an empty stomach is right. So I take it about half an hour after meals."

Participant 14: "I think imported medicines have fewer side effects."

(2) Sources of medication information. Only a minority of participants obtained disease and medication information from books, hospital WeChat official accounts, health lectures, or doctors. Most preferred to get information from fellow patients, friends, family, or self-media, combining it with past experiences to form their understanding of diseases and medications.

Participant 6: "A WeChat official account said taking medicine after meals is the correct way."

Participant 7: "Because I saw online from some diabetic friends that type 2 diabetes just requires controlling diet and exercise, and basically it can be reversed."

Participant 9: "I actually prefer traditional Chinese medicine. Because they say it doesn' t hurt the stomach, and I think that' s possible."

Participant 12: "Later I saw in short videos that not just blood sugar, but lipids are also important."

(3) Dynamic changes in medication perceptions and behaviors. Participants' perceptions and behaviors were not static, but could change based on updated knowledge, disease severity, adverse reactions, or changes in symptoms and monitoring indicators.

Participant 7: "At first I was really worried whether these medicines would affect my organs, but now that I understand better, I know metformin doesn' t have any negative effects. In fact, today I saw a video about the benefits of metformin."

Participant 15: "Regarding side effects, I now have several examinations every year. Besides physical exams, I also check blood routine. It doesn' t seem to affect the liver; maybe only a very small number of people are affected. I' m doing pretty well, so now I don' t have much psychological burden about taking this medicine."

Theme 2: Barriers to Medication Use

(1) Concerns about adverse drug reactions. Participants widely worried about the impact of medications on liver and kidney function or other organs, especially when informed about long-term use or when they didn' t understand potential adverse reactions.

Participant 3: "Will there be any side effects from injections? Or any impact on the body?"

Participant 5: "I'm worried about long-term medication having some side effects on the body. I'm concerned about effects on other organs or parts."

(2) Negative patient identity. Some participants held negative illness identities, believing that medication use reinforced their patient status and affected self-identity.

Participant 2: "Actually, the reluctance to take medicine comes from a kind of fear. Many ordinary people, especially those without much education, are really scared of taking medicine."

Participant 3: "Taking medicine every day reminds me that I'm a patient."

Participant 9: "After my heart attack last February, taking all kinds of medicines made me feel bad."

Participant 15: "Psychologically speaking, it would be great if everything was normal without taking medicine. Having to take medicine several times a day, plus injections—it reminds you that you're a patient, which feels uncomfortable."

(3) Disease stigma. Some participants didn't want others to know their patient status and were unwilling to take medication in front of others, fearing that being seen taking medicine or injections would lead others to view them as "sick" or "not normal," affecting daily social interactions or work.

Participant 13: "Like tonight I'm going to dinner, I can't drink alcohol. I don't want to tell them I'm sick and can't drink. How do you explain to people that you can't drink? There's actually pressure, right?"

(4) Treatment burden. Most participants indicated that regular medication use itself was a burden, especially with multiple daily doses, injectable formulations, medication preparation, or frequent travel for work or other reasons. Higher complexity of medication regimens, longer time required, and greater impact on other life components resulted in weaker willingness to use medications.

Participant 3: "If there are many doses, you forget after a while, or you can't remember when you're older, or when you're out doing something and remember to take medicine but don't have it with you, it's inconvenient."

Participant 8: "Injections hurt, and they're troublesome. You have to prepare needles, disinfect, it's all very troublesome."

Participant 20: "Taking a big handful of medicine every morning is still a bit troublesome. And when traveling, you have to pack a full supply for more than ten days."

(5) Economic burden. Financial costs associated with medication also influenced participants' preferences, especially for long-term use.

Participant 3: "I wouldn' t choose this medicine. Because I can' t afford it financially—it' s higher than my pension. Even if other medicines don' t lower lipids as effectively, I wouldn' t use it. This medicine is too expensive."

(6) Lack of attention to disease and medication. Some participants didn' t pay enough attention to their disease or medication due to lack of understanding or concern.

Participant 4: "I didn' t really manage this disease myself, just didn' t take it seriously."

Participant 14: "Mainly because I don' t understand this disease, I don' t know the importance of medication."

Theme 3: Facilitators of Medication Use

(1) Concern about disease harm. Participants' concern about disease harm promoted active medication use.

Participant 13: "I should start using these medicines as soon as possible. Health is most important; medication is not a problem, injections are not a problem. Health is very important; without health, you have nothing."

Some patients were not fully informed about the necessity and value of medication when it was prescribed. For example, Participant 19 was prescribed statins and told they were for "lowering lipids," but didn' t understand the relationship between lipids and cardiovascular disease. When she realized the purpose was to reduce ASCVD risk by lowering lipids, her willingness to use the medication increased.

Participant 19: "Now I don't have much concern about taking medicine, because the harm from not taking it could be more serious."

(2) Perceivable medication effects. When patients experienced improvements in symptoms or monitoring indicators after taking medication, this positive reinforcement strengthened their medication behavior.

Participant 3: "Because after taking medicine, my lipids have lowered quite well. I think I should continue taking it."

(3) Family support. Family members' support, supervision, and encouragement served as positive facilitators for some participants' medication use.

Participant 2: "(My family) puts all the medicine I need to take every day in a fixed place, next to the dining table, so I take it after meals."

Participant 6: "My son' s support is very important for my medication use."

(4) Authority (physician) opinions. Doctors, especially those from hospitals recognized by patients, represented medical authority. Participants were willing to follow authoritative recommendations, and the degree of authority (e.g., higher for hospitals or doctors more recognized by patients)

significantly influenced medication behavior. This influence likely existed even when the authority figure was not a physician.

Participant 2: "I decided to take statins long-term and not stop. The specialist said so, and I believed it."

Participant 5: "Only if the doctor requires me to inject would I consider injections."

The strength of authoritative recommendations also importantly influenced patients' medication behavior.

Theme 4: Needs for Medical Services

(1) Need for emotional support. Many participants hoped to receive understanding and attention from doctors during consultations, with more encouraging information.

Participant 8: "It' s about human psychology. You hope to be cared for and noticed by doctors, and also hope to hear from them 'my disease can be cured' or 'it' s much better now than before,' which would give me more confidence."

Participant 13: "Doctors' comforting role is also very important."

(2) Need for knowledge. Participants generally reported insufficient communication time with doctors during visits and hoped for more detailed guidance on their disease condition, medication choices, benefits and risks, and precautions.

Participant 5: "What to pay attention to when taking medicine, what to watch in diet—the doctor didn' t explain."

Participant 8: "I hope when seeing a doctor now, they can explain which are first-line medicines and which are second-line."

Participant 14: "Doctors need to explain (how to use medicine). Also, like they said, the instructions are incomprehensible."

(3) Need for a stable doctor-patient relationship. Many participants hoped to have a regular doctor for follow-up visits, facilitating better understanding of their condition and long-term guidance.

Participant 4: "I still think I should see a doctor in a fixed place, where the doctor understands my situation. If you see one doctor today and another tomorrow, no doctor understands your condition well."

2.2 Quantitative Study Results

2.2.1 Basic Information of Survey Participants A total of 199 questionnaires were distributed, and after excluding incomplete responses, 186 valid questionnaires were collected, yielding a valid response rate of 93.5%. Among the 186 participants, 99 were male (53.2%) and 87 were female (46.8%). Eighty-three

participants (44.6%) were aged $ $61 years. Most had education levels of college or below (68.8%). Primary prevention patients accounted for 143 cases (76.9%). Government medical insurance was the primary payment method (83.9%). Most participants were currently taking 1-3 types of medications (87.6%), with dosing frequency predominantly $ $3 times/day (51.6%). Fifty-eight participants (31.2%) reported forgetting to take medication in the past week. Basic participant information is shown in Table 3 .

2.2.2 Medication Values of Survey Participants Thirty-five point six percent (66/186) of patients believed that medication formulation or taste affected regular medication use, but more participants (44.6%) were neutral about this. Twenty-eight percent (52/186) felt uncomfortable taking medication in front of others, while 45.1% did not feel uncomfortable. Forty-four point six percent (83/186) found it inconvenient to carry medication when going out. Eighty-two point three percent (153/186) preferred fewer doses, with 37.1% fully endorsing this view (Table 4).

2.2.3 Medication Preferences of Survey Participants Statistically significant differences were found in preference scores across different medication formulations, frequencies, timing, relationship with meals, and number of medication types ($P<0.05$). Preference scores for tablets, capsules, and granules were higher than for injectable formulations. Lower dosing frequency showed a trend toward higher preference scores, with scores for once-daily or lower frequency (including once-weekly, once-monthly, or once/$ $2 months) being relatively similar. Preference scores for noon and mid-meal dosing were lower. Higher numbers of medication types correlated with lower preference scores (Table 5).

3. Discussion

This exploratory sequential mixed-methods study identified the values and preferences regarding medication use among patients undergoing primary and secondary prevention of cardiovascular disease. Both qualitative and quantitative phases found that misconceptions about medications and missed doses were common. Barriers to medication use included concerns about adverse reactions, negative illness identity, social stigma, treatment burden, economic burden, and lack of attention. Facilitators included awareness of disease harm, perceivable treatment effects, family support, and physician recommendations. The quantitative phase further validated the presence of social stigma and treatment burden. Although medication preferences were highly heterogeneous, patients generally preferred fewer medication types and lower frequency, and were less inclined toward injectable formulations. These findings have reference value for community general practitioners and specialists when developing pharmacotherapy plans for patients undergoing primary and secondary prevention of cardiovascular disease.

The study revealed that misconceptions and inappropriate behaviors regarding disease and medications are widespread in primary and secondary prevention of cardiovascular disease. These misconceptions—including exaggerating or downplaying adverse drug reactions, insufficient recognition of the severity of asymptomatic conditions, and substituting lifestyle interventions or herbal medicines for standard treatment—are often related to inadequate patient education and doctor-patient communication. Unreliable information sources, such as folk rumors and low-quality online resources[10-11], may contribute to these inappropriate perceptions. These misconceptions often lead to inappropriate medication behaviors, such as stopping medication when symptoms improve. These phenomena are not unique to China. For example, a study in India on medication adherence among patients with cardiovascular disease and diabetes found that patients preferred herbal medicines over guideline-recommended treatments[12]. These beliefs often have some factual basis, but patients' interpretations for justifying their behaviors often show substantial deviation. For instance, participants repeatedly mentioned the belief that "all medicines have some toxicity," a concept from classical traditional medicine with strong scientific validity. However, when participants cited this, they overemphasized the "toxicity" while ignoring the cardiovascular benefits. Especially when patients lacked specific perception of potential adverse reactions and their likelihood of occurrence, the unspecified "toxicity" in this saying more easily became a motivation for discontinuing medication. Notably, this study found that patients' perceptions and medication behaviors are malleable and dynamically changeable, with knowledge updates and improvements in symptoms and signs after medication capable of altering previous perceptions and behaviors. This suggests that clinicians managing such patients long-term should proactively understand their perceptions and behaviors, explain the significance of pharmacotherapy, potential risks, and possible preventive measures in ways that patients can easily understand, and ensure patients' comprehension to improve medication adherence. It is particularly important to note that patients' habits of accepting and adopting knowledge are highly heterogeneous; one-way communication from clinicians may cause both parties to overlook patients' actual acceptance of information.

Barriers to medication behavior identified in this study included lack of knowledge about disease and medications, treatment burden, economic burden, concerns about adverse reactions, and disease stigma. Although corresponding research is limited in cardiovascular disease patients, studies of other chronic diseases (such as diabetes and inflammatory bowel disease) have found that negative illness identity reduces self-management levels and medication adherence[13-14]. Compared with previous research, this study did not identify negative factors such as medication unavailability or lack of trust in physicians[15], likely due to regional and institutional representativeness limitations. Therefore, studies in more regions of China may provide additional insights. This study and previous research consistently indicate that awareness of disease harm, family support, authoritative recommendations, medication reminder systems, integration of medication with daily life, positive peer influence, and fixed-dose combi-

nations are facilitators for medication use in primary and secondary prevention of cardiovascular disease. This study also found that patients' perception of medication effects, such as improvements in symptoms and monitoring indicators, creates positive feedback that can significantly enhance medication adherence.

This study found that patients undergoing primary and secondary prevention of cardiovascular disease have highly heterogeneous preferences for medications, with formulation, dosing frequency, timing, relationship with meals, and number of medication types all being considerations. Participants generally preferred fewer medication types and lower frequency, with low acceptance of injectable formulations, consistent with previous research[16]. Numerous studies have confirmed that fixed-dose combination preparations, which reduce regimen complexity, significantly improve medication adherence, increase long-term persistence, and thereby enhance control rates of multiple cardiovascular risk factors[17]. The 2023 Chinese Expert Consensus on the Application of Single-Pill Fixed-Dose Combination Preparations in Cardiovascular Disease Prevention and Control[18] proposed that combination preparations could become an optimized strategy for cardiovascular disease prevention in broader Chinese populations. Therefore, in managing medication for primary and secondary prevention patients, especially those using multiple medications, priority should be given to using fixed-dose combinations to reduce the number and frequency of medications and improve adherence. Patients' acceptance of oral medications was generally higher than injectable formulations. However, this study did not capture preferences for oral versus lower-frequency injectable formulations (such as weekly injections) in the qualitative phase. Previous research on type 2 diabetes pharmacotherapy found that patients still preferred oral medications over weekly glucagon-like peptide-1 (GLP-1) receptor agonist injections, consistent with our findings[19].

Preference scores for noon and mid-meal dosing were lower and more heterogeneous, possibly related to some patients needing to work outside during the day and disease stigma. The quantitative survey also confirmed that displaying medication behavior to others and carrying medication when going out could be concerns. Midday social occasions with work-related characteristics provide more opportunities for displaying medication behavior and carrying medication to workplaces. Therefore, clinicians should consider whether midday dosing poses barriers for patients, especially working patients, when developing treatment plans. Mid-meal dosing increases the visibility of medication behavior during social meals and may interrupt eating. Thus, clinicians should consider the potential burden of mid-meal dosing when prescribing and discuss this with patients promptly.

In summary, the qualitative and quantitative results of this study indicate that patients undergoing primary and secondary prevention of cardiovascular disease have highly heterogeneous medication preferences but generally prefer fewer medication types and lower frequency, with low acceptance of injectable formulations. In clinical practice, increased use of fixed-dose combination prepara-

tions and integration of medication regimens with patients' daily lives and work schedules should be considered to reduce treatment burden. Additionally, active intervention is needed to address misconceptions and inappropriate behaviors regarding disease and medication to improve medication adherence.

This study provides guidance for clinicians to select medication regimens based on individualized treatment burden and practice patient-centered clinical decision-making, thereby improving medication adherence and treatment satisfaction. This study has several limitations. It was conducted at a single center. Due to cultural and economic differences across regions, patients may have different values and preferences regarding pharmacotherapy, so the generalizability of this study requires further validation. However, this precisely demonstrates the importance of understanding patients' values and preferences and implementing patient-centered clinical decision-making. Additionally, the study used convenience sampling, which may limit representativeness of the surveyed population.

Author Contributions: LI Shenghan was responsible for study conception and design, implementation, and manuscript writing. DU Heyue and AN Kang collected and organized data and performed statistical analysis. HE Longtao, LI Jing, and LI Sheyu were responsible for study conception and design, manuscript revision, quality control and review, and overall supervision.

Conflict of Interest: The authors declare no conflict of interest.

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References

[1] Chinese Cardiovascular Health and Disease Report Writing Group, HU Shengshou. Summary of the China cardiovascular health and disease report 2020[J]. Chinese Circulation Journal, 2021, 36(6): 521-545. DOI: 10.3969/j.issn.1000-3614.2021.06.001.

[2] MA Liyuan, WANG Zengwu, FAN Jing, et al. Interpretation of key points of the "China Cardiovascular Health and Disease Report 2022"[J]. Chinese General Practice, 2023, 26(32): 3975-3994. DOI: 10.12114/j.issn.1007-9572.2023.0408.

[3] Chinese Cardiovascular Disease Prevention Guidelines (2017) Writing Group, Editorial Board of Chinese Journal of Cardiology. Chinese cardiovascular disease prevention guidelines (2017)[J]. Chinese Journal of Cardiology, 2018, 46(1): 10-25. DOI: 10.3760/cma.j.issn.0253-3758.2018.01.004.

[4] GONZÁLEZ-GONZÁLEZ J G, DÍAZ GONZÁLEZ-COLMENERO A, MILLÁN-ALANÍS J M, et al. Values, preferences and burden of treatment for the initiation of GLP-1 receptor agonists and SGLT-2 inhibitors in adult

patients with type 2 diabetes: a systematic review[J]. BMJ Open, 2021, 11(7): e049130. DOI: 10.1136/bmjopen-2021-049130.

[5] THIEU V T, ROBINSON S, KENNEDY-MARTIN T, et al. Patient preferences for glucagon-like peptide 1 receptor-agonist treatment attributes[J]. Patient Prefer Adherence, 2019, 13: 561-576. DOI: 10.2147/PPA.S187907.

[6] YANG Linning, ZHENG Hongying, ZHAO Dan, et al. A qualitative study of physicians' perceptions of shared decision-making[J]. Chinese General Practice, 2022, 25(10): 1213-1219. DOI: 10.12114/j.issn.1007-9572.2021.00.254.

[7] WANG Minghui, ZHANG Jing, ZENG Xiantao, et al. Methodology for developing clinical practice guidelines—patient values and preferences[J]. Chinese Journal of Evidence-Based Cardiovascular Medicine, 2018, 10(10): 1153-1156, 1161. DOI: 10.3969/j.issn.1674-4055.2018.10.01.

[8] WITTICKE D, SEIDLING H M, KLIMM H D, et al. Do we prescribe what patients prefer? Pilot study to assess patient preferences for medication regimen characteristics[J]. Patient Prefer Adherence, 2012, 6: 679-684. DOI: 10.2147/PPA.S35950.

[9] COLAIZZI P F. Psychological research as the phenomenologist views it[M]//VAILE R S, KING M. Existential phenomenological alternatives for psychology. New York: Oxford University Press, 1978: 48-71.

[10] WU Yuan, LÜ Hongjun, FU Jiao, et al. Analysis of accuracy and influencing factors of diabetes-related articles on WeChat platform[J]. Chinese Journal of Evidence-Based Medicine, 2022, 22(8): 876-881. DOI: 10.1097/CM9.0000000000002126.

[11] ZHOU Youlian, YUAN Xiang, YANG Xiaoling, et al. Quality evaluation of diabetes health information web pages in China[J]. Chinese General Practice, 2021, 24(16): 2103-2107. DOI: 10.12114/j.issn.1007-9572.2020.00.266.

[12] KRISHNAMOORTHY Y, RAJAA S, REHMAN T, et al. Patient and provider' s perspective on barriers and facilitators for medication adherence among adult patients with cardiovascular diseases and diabetes mellitus in India: a qualitative evidence synthesis[J]. BMJ Open, 2022, 12(2): e055226. DOI: 10.1136/bmjopen-2021-055226.

[13] ORIS L, RASSART J, PRIKKEN S, et al. Illness identity in adolescents and emerging adults with type 1 diabetes: introducing the illness identity questionnaire[J]. Diabetes Care, 2016, 39(5): 757-763. DOI: 10.2337/dc15-2559.

[14] PETERS L A, BROWN E M. The relationship between illness identity and the self-management of Inflammatory Bowel Disease[J]. Br J Health Psychol, 2022, 27(3): 956-970. DOI: 10.1111/bjhp.12584.

[15] KALANTARZADEH M, YOUSEFI H, ALAVI M, et al. Adherence barriers to treatment of patients with cardiovascular diseases: a qualitative study[J]. Iran J Nurs Midwifery Res, 2022, 27(4): 317-324. DOI:

10.4103/ijnmr.ijnmr_{{{307}}}_{{21}}}.

[16] MURDAN S, WEI L, VAN RIET-NALES D A, et al. Association between culture and the preference for, and perceptions of, 11 routes of medicine administration: a survey in 21 countries and regions[J]. Explor Res Clin Soc Pharm, 2023, 12: 100378. DOI: 10.1016/j.rcsop.2023.100378.

[17] BAUMGARTNER A, DRAME K, GEUTJENS S, et al. Does the polypill improve patient adherence compared to its individual formulations? A systematic review[J]. Pharmaceutics, 2020, 12(2): 190. DOI: 10.3390/pharmaceutics12020190.

[18] Chinese Expert Consensus Working Group on Application of Single-Pill Fixed-Dose Combination Preparations in Cardiovascular Disease Prevention and Control, GE Junbo, HUO Yong, et al. Chinese expert consensus on the application of single-pill fixed-dose combination preparations in cardiovascular disease prevention and control[J]. Chinese Circulation Journal, 2023, 38(9): 901-910.

[19] DIBONAVENTURA M D, WAGNER J S, GIRMAN C J, et al. Multinational Internet-based survey of patient preference for newer oral or injectable Type 2 diabetes medication[J]. Patient Prefer Adherence, 2010, 4: 397-406. DOI: 10.2147/PPA.S14477.

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Note: Figure translations are in progress. See original paper for figures.