

Analysis of Medication-Related Burden and Associated Factors Among Elderly Patients with Coronary Heart Disease: A Cross-Sectional Study

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Purpose: This cross-sectional study sought to examine the current level of medication-related burden (MRB) in elderly individuals with coronary heart disease (CHD) and to explore its key determinants. The findings are intended to inform strategies for optimizing medication management, mitigating MRB, and enhancing treatment adherence.

Methods: A cross-sectional survey was conducted amongst 231 elderly patients diagnosed with CHD who were admitted to the cardiology ward of tertiary hospital in Hefei from January to March 2026. Data collection was performed using three assessment tools: the Chinese version of the Living with Medicines Questionnaire-3 (C-LMQ-3), the Chinese version of the Beliefs about Medicines Questionnaire (C-BMQ), and a reliable and valid Medication Literacy Scale. Statistical procedures included descriptive statistics, univariate tests, and multiple linear regression analyses.

Results: Mean overall scores from the C-LMQ-3 and Visual Analogue Scale (VAS) both indicated moderate MRB among participants. Regression analysis indicated that medication adverse reactions, utilization of medication assistance devices, acquisition of medication-related health education, medication beliefs, and medication literacy were independent predictors of MRB (all $P < 0.05$).

Conclusion: MRB levels among elderly CHD patients are moderate and are associated with various modifiable factors. Medical practitioners should implement holistic approaches to reduce MRB, with particular attention to enhancing medication literacy and addressing medication beliefs, alongside minimizing adverse drug events, encouraging the use of medication support tools, and reinforcing medication education.

Keywords: coronary heart disease in older adults, medication burden, medication literacy, influencing factors

Introduction

Coronary heart disease (CHD), or coronary atherosclerotic disease, is a highly prevalent chronic illness in older adults.¹ Its extended disease trajectory, coupled with the necessity of sustained pharmacological therapy,^{2,3} makes CHD a significant public health concern that undermines the health status and quality of life of aging populations.⁴ As reported in the *China Cardiovascular Health and Disease Report 2024*,⁵ the estimated prevalence of CHD among elderly Chinese individuals is 27.8 per 1000, and this rate continues to rise with advancing age.

Pharmacotherapy is the cornerstone of secondary prevention for CHD.⁶ Elderly patients require long-term treatment with a variety of medications, including antiplatelet agents, lipid-lowering drugs, antihypertensives and anti-ischaemic agents.⁷ These complex treatment regimens and the need for long-term medication place a heavy medication-related burden (MRB) on elderly patients with CHD.⁸ MRB not only directly affects patients' adherence to medication but may also lead to behaviours such as self-adjustment of doses, discontinuation of treatment and medication errors, thereby



increasing the risk of adverse cardiovascular events and readmission, and further exacerbating the burden on the healthcare system and society.^{9–11} A recent cross-sectional study among elderly cardiovascular patients in Iran reported that polypharmacy affected 60.1% of participants and was significantly associated with lower medication knowledge, multimorbidity, and hospitalization history, highlighting the close link between complex medication regimens and adverse clinical outcomes.¹² Higher medication burden not only impairs patients' adherence but also negatively affects their health-related quality of life, making it a critical issue in the management of elderly CHD patients. Therefore, assessing the current status of patients' medication-related behaviour and analysing its influencing factors can provide important strategies for promoting medication adherence and ensuring medication safety.

In recent years, the issue of MRB has gradually attracted attention in the field of clinical research, and studies have now been conducted in populations such as those with tuberculosis, type 2 diabetes and late-life depression.^{13–16} Most existing studies have used the LMQ-3 questionnaire to assess patients' subjective MRB across dimensions such as difficulties in adherence, adverse reactions, financial burden and autonomy in medication use, and have found that income, educational attainment, type of medication and frequency of dosing are key factors associated with MRB.¹⁷ However, existing studies have primarily focused on general demographic characteristics, with little attention paid to key modifiable factors such as medication-related variables and beliefs regarding medication adherence; furthermore, there is a lack of MRB research specifically targeting elderly patients with CHD.

Accordingly, this study aimed to analyze the level of MRB and its associated factors in elderly patients with CHD, with a specific emphasis on the impacts of medication literacy and medication beliefs. In order to provide empirical support for optimizing clinical medication management, delivering personalized health guidance, and enhancing the long-term safety and efficacy of medication use in this population.

Materials and Methods

Population and Design

This study employed a cross-sectional design, and participants were enrolled through convenience sampling among elderly CHD patients admitted to four cardiology wards at the Second Affiliated Hospital of Anhui Medical University from January to March 2026. The eligibility criteria for inclusion were defined as follows: (1) Meeting the established diagnostic criteria for CHD.¹⁸ (2) Aged 60 years or older. (3) Has been prescribed and has been taking coronary heart disease-related medication (such as antiplatelet agents, statins, beta-blockers, etc) for at least three months. (4) Is alert, has no severe visual or hearing impairments, and is able to communicate normally. (5) Being fully informed of their condition and having voluntarily provided signed informed consent. (6) With stable clinical condition, and attending the cardiology department for either acute cardiac events or routine follow-up. Exclusion criteria were defined as follows: (1) History of severe cognitive impairment or mental illness, rendering the participant unable to cooperate with the questionnaire. Cognitive status was assessed using the Mini-Cog screening tool, and patients scoring ≤ 2 (out of 5) were excluded from the study.¹⁹ (2) Presence of major physical illnesses such as malignant tumours or severe liver or kidney failure, or a life expectancy of less than one year due to other conditions; Ethical approval for this research was obtained from the Medical Ethics Committee of the Second Affiliated Hospital of Anhui Medical University (Approval No. YX2025-307). All participants provided written informed consent before taking part in the survey.

The sample size was calculated based on the empirical rule for multiple regression analysis, which suggests that the minimum sample size should be 5–10 times the number of independent variables included in the model.²⁰ Given that 18 independent variables were incorporated into the analysis, the initial minimum required sample size was estimated at 90 participants. To account for an expected 20% rate of invalid or incomplete questionnaires, the adjusted minimum sample size was set at 113 cases. A total of 244 questionnaires were distributed, and 13 were excluded due to missing data or obvious logical contradictions, resulting in a final valid sample of 231 participants.

Survey Tools

General Information Questionnaire

Compiled by the researchers, this included eight items of demographic and sociological data: gender, age, educational level, marital status, place of residence, Living conditions, average monthly household income and payment types; as well as eight items of data relating to medication for the condition, including the number of other chronic conditions, types of medication, occurrence of adverse drug reactions, whether medication has been adjusted, whether Percutaneous Coronary Intervention (PCI) or coronary artery bypass grafting (CABG) has been performed, duration of medication use, use of medication aids, and receipt of medication-related health education.

Chinese Version of the Living with Medicines Questionnaire Version 3 (C-LMQ-3)

MRB was measured with the Chinese version of the Living with Medicines Questionnaire Version 3 (C-LMQ-3), which has been culturally adapted and psychometrically validated for elderly Chinese individuals by Wang et al²¹. The C-LMQ-3 includes 8 subscales addressing different dimensions of MRB, consisting of 39 items in total. Each item is rated on a 5-point Likert scale, with responses from 1 (strongly disagree) to 5 (strongly agree). The C-LMQ-3 contains both positively and negatively worded items. For negatively worded items, responses were reverse-coded prior to summation, so that higher scores consistently indicate higher MRB. A Visual Analogue Scale (VAS) from 0 (no burden) to 10 (extreme burden) was also employed to assess patients' subjective feelings of MRB. For this scale, the Cronbach's α was 0.855 for the total scale, with subscale α values ranging from 0.822 to 0.932. In our sample, the Cronbach's α for the total C-LMQ-3 was 0.892, and the α values for the eight subscales ranged from 0.792 to 0.931, indicating good internal consistency.

Beliefs About Medicines Questionnaire (Chinese Version, C-BMQ)

This tool was translated and culturally adapted into Chinese by Si et al²². This instrument consists of two dimensions: beliefs concerning medication necessity and beliefs concerning medication-related concerns, each containing five items. Each item is rated on a 5-point Likert scale, ranging from "strongly disagree" to "strongly agree", with scores assigned from 1 to 5. Elevated scores reflect stronger endorsement of the respective belief dimension. The overall score is calculated by subtracting the total score of the concerns subscale from the total score of the necessity subscale, which reflects the patient's perceived balance between the benefits of treatment and potential risks. A C-BMQ total score > 0 indicates that the perceived necessity of pharmacotherapy outweighs associated worries, whereas a score ≤ 0 suggests that concerns regarding medication risks predominate over perceived clinical advantages. For this scale, The Cronbach's α was 0.77 for the total scale, 0.92 for the necessity subscale, and 0.67 for the concerns subscale. In our study, the Cronbach's α coefficient for the total C-BMQ was 0.893, with α values of 0.912 for the necessity subscale and 0.862 for the concerns subscale, indicating good internal consistency.

Chinese Version of Discharge Medication Literacy Questionnaire

This questionnaire was culturally adapted for use among Chinese residents by Zheng et al²³. The scale evaluates patients' capacity to comprehend, compute, and manage medication-related information, covering essential aspects such as medication name, dosage, administration frequency, therapeutic purpose, and major adverse effects. It consists of nine items in total, utilizing a binary scoring approach wherein a correct response receives 1 point and an incorrect response receives 0 points. Items 7 and 9 are excluded from scoring. The maximum attainable score is 7, with higher values reflecting superior medication literacy. The original validation study reported a Cronbach's α of 0.85 for this questionnaire. In our sample, the KR-20 coefficient was 0.815, confirming good internal consistency. Based on the stratification employed by Jiao et al²⁴, medication literacy scores were categorized into three levels: low (0–2 points), moderate (3–5 points), and high (6–7 points).

Data Collection and Quality Control

Data were collected via on-site questionnaire surveys, completed on the day of discharge for elderly patients with CHD. Prior to the survey, patients were informed of the study's objectives, completion requirements and confidentiality principles. The survey was conducted only after obtaining informed consent. For patients with poor eyesight, difficulty writing or who were unable to complete the form independently, a researcher who had undergone

standardised training read out each question and recorded the responses accurately; those unable to express themselves independently were excluded in accordance with the exclusion criteria. This study implemented standardised data management: following the return of questionnaires, their completeness was verified, and invalid questionnaires with more than three missing items or logical inconsistencies were excluded; Valid data were entered into EpiData 3.1 by two independent operators; the system performed automatic validation, with any inconsistencies verified and corrected by a third party; outliers and extreme values were addressed following discussion and verification against the original questionnaires; the entire process was documented to ensure data accuracy, reliability and traceability.

Statistical Analysis

SPSS version 27.0 was utilized for all data processing and statistical analyses in this study. Skewness and kurtosis tests were conducted to assess the normality of the distribution. Continuous data were considered to follow an approximately normal distribution if skewness ranged between -1 and 1 and kurtosis ranged between -2 and 2 , and all variables met these criteria. To characterize the distribution patterns of variables, descriptive statistics were applied: categorical data were summarized using frequency counts and respective percentages, and continuous data were reported as mean $\pm$ standard deviation (SD). Between-group differences in the total C-LMQ-3 scores for elderly CHD patients were evaluated using independent-samples t-tests and one-way analysis of variance (ANOVA) where applicable. For variables with more than two groups, one-way ANOVA was used, followed by Tukey's HSD post-hoc test for multiple pairwise comparisons. Following univariate analysis, variables with a P value less than 0.05 were entered simultaneously into a multiple linear regression model to identify factors independently associated with MRB and to adjust for potential confounding effects. Multicollinearity was assessed using variance inflation factor (VIF) and tolerance, and model assumptions (normality of residuals, homoscedasticity, and independence of residuals) were checked using residual plots and the Durbin-Watson test.

Result

Demographic and Medication-Related Characteristics

The demographic and clinical characteristics of the 231 participants included in this study are presented in Table 1. The age of the study population ranged from 60 to 84 years, with an average age of 70.31 ± 6.38 years. Male patients comprised the predominant group, representing 62.8% of the total sample, whilst those with an educational attainment of primary school or below were the largest group, accounting for 53.2%. Regarding income per month, 57.1% of patients

Table 1 Demographic Characteristics of Participants (n = 231)

Characteristic	N (%)	C-LMQ-3 Score ($\bar{x} \pm s$)	t/F	P
Gender				
Male	145 (62.8)	110.58 $\pm$ 17.45	-0.861 ^a	0.390
Female	86 (37.2)	112.58 $\pm$ 16.47		
Age (year)				
60–69	101 (43.7)	107.80 $\pm$ 16.10	4.972 ^b	0.008
70–79	117 (50.6)	113.36 $\pm$ 17.38		
80–89	13 (5.6)	120.38 $\pm$ 16.77		
Marital status				
Married	208 (90)	110.46 $\pm$ 16.87	-2.332 ^a	0.021
Other marital status (Unmarried, Divorced, Widowed)	23 (10)	119.13 $\pm$ 17.36		
Residence				
City	103 (44.6)	107.64 $\pm$ 15.93	-2.991 ^a	0.003
Rural	128 (55.4)	114.29 $\pm$ 17.45		

(Continued)

Table 1 (Continued).

Characteristic	N (%)	C-LMQ-3 Score ($\bar{x} \pm s$)	t/F	P
Education level				
Primary school or less	123 (53.2)	114.86 $\pm$ 17.24	4.883 ^b	0.003
Middle school	49 (21.2)	107.65 $\pm$ 15.99		
High school	34 (14.7)	110.09 $\pm$ 18.30		
College or above	25 (10.8)	102.80 $\pm$ 12.00		
Living conditions				
Lives with spouse only	134 (58.0)	111.64 $\pm$ 16.83	2.098 ^b	0.101
Lives with children only	37 (16.0)	114.32 $\pm$ 18.72		
Lives with both spouse and children	42 (18.2)	106.00 $\pm$ 15.20		
Other arrangements (living alone/nursing home)	18 (7.8)	115.20 $\pm$ 18.05		
Average Income per month (RMB)			24.227 ^b	<0.001
<2000	71 (30.7)	121.61 $\pm$ 16.72		
2000–4000	132 (57.1)	107.87 $\pm$ 15.52		
>4000	28 (12.1)	101.54 $\pm$ 12.53		
Payment types				
Employee Basic Medical Insurance (EBM)	79 (34.2)	106.19 $\pm$ 17.05	4.648 ^b	0.004
Urban Resident Basic Medical Insurance (URBMI)	128 (55.4)	114.53 $\pm$ 16.28*		
Other payment types (New Rural Cooperative Medical Scheme NCMS/Self-payment)	24 (10.4)	111.13 $\pm$ 17.88		
Number of comorbid chronic diseases				
0	31 (13.4)	113.26 $\pm$ 16.73	1.027 ^b	0.381
1	122 (52.8)	110.91 $\pm$ 16.84		
2	62 (26.8)	110.78 $\pm$ 17.28		
≥ 3	16 (6.9)	112.75 $\pm$ 17.64		
Number of drug types				
≤ 4	95 (41.1)	111.11 $\pm$ 16.75	0.218 ^b	0.805
5–7	88 (38.1)	112.75 $\pm$ 17.64		
≥ 8	48 (20.8)	111.32 $\pm$ 17.08		
Side effects				
Yes	66 (28.6)	127.48 $\pm$ 12.78	11.339 ^a	<0.001
No	165 (71.4)	104.86 $\pm$ 14.05		
Medication adjustment past year				
Yes	70 (30.3)	120.26 $\pm$ 15.70	5.645 ^a	<0.001
No	161 (69.7)	107.44 $\pm$ 16.22		
History of PCI or CABG				
Yes	131 (56.7)	111.88 $\pm$ 16.82	0.563 ^a	0.574
No	100 (43.3)	110.60 $\pm$ 17.48		
Duration of medication use				
<1years	69 (29.9)	113.65 $\pm$ 16.84	0.762 ^b	0.517
1–5years	97 (42.0)	110.78 $\pm$ 17.49		
6–10years	40 (17.3)	110.58 $\pm$ 17.54		
≥ 10 years	25 (10.8)	108.20 $\pm$ 15.51		
Use of medication aids				
Yes	35 (15.2)	98.54 $\pm$ 12.10	–5.056 ^a	<0.001
No	196 (84.8)	113.61 $\pm$ 16.86		
Medication-related health education				
Yes	113 (48.9)	99.80 $\pm$ 11.25	13.362 ^a	<0.001
No	118 (51.1)	122.36 $\pm$ 14.18		
C-BMQ score				
≤ 0	94 (40.7)	127.59 $\pm$ 11.02	19.514 ^a	<0.001
>0	137 (59.3)	100.17 $\pm$ 10.12		

(Continued)

Table 1 (Continued).

Characteristic	N (%)	C-LMQ-3 Score ($\bar{x} \pm s$)	t/F	P
Medication literacy				
Low medication literacy group	72 (31.2)	129.22 $\pm$ 11.89	143.671 ^b	<0.001
Moderate medication literacy group	104 (45.0)	106.83 $\pm$ 12.18		
High medication literacy group	55 (23.8)	96.40 $\pm$ 9.01		

Notes: ^aRepresents T value; ^bRepresents F value.

had an average monthly income of 2000–4000 yuan. In terms of Living conditions, 58.0% of patients lived solely with their spouse. Regarding medication or treatment, 56.7% of patients had a history of PCI or CABG surgery. The largest proportion of patients (52.8%) had one comorbid chronic condition. The largest group of patients (42%) had been taking medication for 1–5 years. 28.6% of patients reported experiencing adverse drug reactions, and 30.3% had had their medication adjusted within the past year. Only 15.2% of patients used medication management tools. 48.9% of patients had received specific health education on medication. Regarding medication beliefs, 59.3% had a C-BMQ score >0 , whilst 40.7% had a score ≤ 0 ; medication literacy was most commonly at a moderate level (45.0%), with 31.2% at a low level and 23.8% at a high level.

Assessing MRB Using the C-LMQ-3

[Supplementary Table 1](#) presents the responses to the statements in the C-LMQ-3 and the scores for the eight domains. The total and dimensional scores of the C-LMQ-3 are presented in [Table 2](#). The total C-LMQ-3 score follows an approximately normal distribution, with a mean of 111.32 (SD = 17.08) and a range of 75–153 (the maximum possible range being 39–195). VAS scores tended towards higher values, with a median (range) of 6 (0–10) and a mean of 5.58 (SD = 1.36). The top 10 items with the highest scores on the C-LMQ-3 are listed in [Table 3](#).

Factors Influencing the MRB

[Table 1](#) shows the results of differences in C-LMQ-3 scores between different groups of elderly CHD patients in relation to their demographic characteristics and medication-related practices. Analysis of the results revealed significant differences in the C-LMQ-3 total medication burden score across different age groups, marital status, place of residence, educational level, average monthly income, type of health insurance, medication side effects, whether medication had been adjusted in the past year, use of medication aids, receipt of medication health education, BMQ score and medication literacy (all P-values < 0.05). Post-hoc comparisons using Tukey's HSD test showed that patients aged 60–69 years had significantly lower MRB than those aged 70–79 years (mean difference = -5.56 , $P = 0.041$) and those aged 80–89 years (mean difference = -12.58 , $P = 0.031$). Patients with primary school education or less had significantly higher MRB than

Table 2 Total and Dimensional Scores of the C-LMQ-3 Among Elderly Patients with CHD

Category	Items	Score Range	Total Score ($\bar{x} \pm s$)
Concerns about medicine use	7	7–35	19.76 $\pm$ 3.14
Practical difficulties	6	6–30	17.91 $\pm$ 2.46
Communication/relationships with HCPs	5	5–25	14.76 $\pm$ 3.12
Lack of effectiveness	5	5–25	15.56 $\pm$ 3.40
Interference to day-to-day life	6	6–30	14.23 $\pm$ 3.67
Side-effect-burden	4	4–20	10.32 $\pm$ 2.38
Autonomy/control	3	3–15	9.63 $\pm$ 1.97
Cost-related burden	3	3–15	9.16 $\pm$ 2.47
Total C-LMQ-3	39	39–195	111.32 $\pm$ 17.08

Table 3 The Top 10 Items with the Highest Scores in C-LMQ-3

Item	Score (x ± s)	Sort
I worry about paying for my medicines	3.39 ± 1.07	1
My life revolves around using medicines	3.36 ± 1.01	2
The side effects are worth it for the benefits I get from my medicines	3.31 ± 0.96	3
My medicines allow me to live my life as I want	3.30 ± 0.920	4
I can vary the dose of the medicines I take	3.29 ± 0.789	5
I can choose whether or not to take my medicines	3.24 ± 0.839	6
I can vary the times I take my medicines	3.22 ± 0.907	7
I feel I need more information about my medicines	3.20 ± 0.950	8
I have to put a lot of planning and thought into taking my medicines	3.18 ± 0.940	9
I am concerned that I may forget to take my medicines	3.12 ± 0.720	10

those with college or above education (mean difference = 12.06, $P = 0.006$). Patients in the lowest income group (<2000 RMB) had significantly higher MRB than those in the middle (2000–4000 RMB) and highest (>4000 RMB) income groups (both $P < 0.001$). Patients with low medication literacy had significantly higher MRB than those with moderate or high literacy (both $P < 0.001$).

Taking the total C-LMQ-3 score as the dependent variable, only those variables that achieved a significance level of $P < 0.05$ in the univariate screening were incorporated into the multiple linear regression model. The coding scheme for all independent variables included in the regression model is presented in Table 4. The results of the multiple linear regression analysis are presented in Table 5. The multiple linear regression model was significant ($F = 62.230$, $P < 0.001$) and explained 77.6% of the variance in MRB (adjusted $R^2 = 0.776$). The Durbin-Watson statistic was 1.867, and all VIF values were below 3 (range: 1.109–2.237), indicating no multicollinearity and independence of residuals. The results showed that medication side effects, the use of medication support tools, whether medication health education was provided, medication beliefs, and medication literacy were independent factors associated with MRB in elderly CHD patients (all $P < 0.05$). Specifically, when compared to the reference group, patients experiencing medication side effects had a higher MRB, whereas patients using medication aids, having received medication health education, possessing stronger medication necessity beliefs, and having moderate or high levels of medication literacy had a lower MRB.

Table 4 Coding Scheme for Independent Variables

Independent Variable	Coding Rules
Age (year)	60–69 = 1; 70–79 = 2; 80–89 = 3
Education level	Primary school or below = 1; Middle school = 2; High school = 3; College or above = 4
Average Monthly income (RMB)	<2000 = 1; 2000–4000 = 2; >4000 = 3
Medication literacy	Low = 1; Moderate = 2; High = 3
Payment types	Employee Basic Medical Insurance (Ref): Z1=0, Z2=0 Urban Resident Basic Medical Insurance: Z1=1, Z2=0 Other payment types: Z1=0, Z2=1
Marital status	Married(Ref) = 0; Other marital status = 1
Residence	Rural (Ref) = 0; City = 1
Side effects	No (Ref) = 0; Yes = 1
Medication adjustment past year	No (Ref) = 0; Yes = 1
Use of medication aids	No (Ref) = 0; Yes = 1
Receiving medication education	No (Ref) = 0; Yes = 1
C-BMQ score	C-BMQ score ≤ 0 = 0(Ref), C-BMQ score > 0 = 1

Note: Ref represents the reference group.

Table 5 Multivariable Linear Model Analysis for the Association with the MRB Among Patients with CHD (n=231)

Characteristics	B (95% CI)	SE	β	t	P	VIF
Constant	143.815 (135.811, 151.819)	4.061		35.414	<0.001	
Age	-0.228 (-2.162, 1.705)	0.987	-0.008	-0.233	0.816	1.184
Education level	0.253 (-1.254, 1.760)	0.764	0.015	0.331	0.741	2.237
Average Monthly income (RMB)	1.009 (-1.310, 3.327)	1.176	0.037	0.857	0.392	1.925
Medication literacy	-6.832 (-8.874, -4.789)	1.036	-0.296	-6.592	<0.001	2.065
Payment types						
Employee Basic Medical Insurance (EBM)	Ref					
Urban Resident Basic Medical Insurance (URBMI)	2.773 (-0.203, 5.749)	1.510	0.081	1.837	0.068	1.989
Other payment types	-0.806 (-5.113, 3.502)	2.186	-0.014	-0.369	0.713	1.571
Marital status						
Married	Ref					
Other marital status	2.615 (-1.112, 6.343)	1.891	0.046	1.383	0.168	1.132
Residence						
Rural	Ref					
City	-0.832 (-3.214, 1.550)	1.209	-0.024	-0.688	0.492	1.275
Side effects						
No	Ref					
Yes	5.342 (2.401, 8.283)	1.492	0.142	3.580	<0.001	1.605
Medication adjustment past year						
No	Ref					
Yes	1.360 (-1.163, 3.884)	1.280	0.037	1.062	0.289	1.223
Use of medication aids						
No	Ref					
Yes	-4.269 (-7.349, -1.189)	1.563	-0.09	-2.731	0.007	1.109
Receiving medication education						
No	Ref					
Yes	-7.859 (-10.554, -5.164)	1.367	-0.230	-5.747	<0.001	1.650
C-BMQ score						
C-BMQ score $\leq$ 0	Ref					
C-BMQ score>0	-12.581 (-15.862, -9.300)	1.665	-0.363	-7.557	<0.001	2.362

Notes: Model summary: $R^2=0.788$, Adjusted $R^2=0.776$, $F=62.230$, $P<0.001$. All VIF<3, indicating no multicollinearity.

Abbreviations: B, unstandardized regression coefficient; 95% CI, 95% confidence interval; SE, standard error; β , standardized regression coefficient; t, t-test value; p, significance level; VIF, variance inflation factor; Ref, reference group.

Discussion

In this research, the C-LMQ-3 scale was employed to evaluate the MRB of 231 elderly CHD patients. The findings revealed that the overall C-LMQ-3 score was 111.32 ± 17.08 , which reflected a moderate level of medication burden in this cohort. These results were comparable to those reported in a previous Chinese study (112.9 ± 11.3)¹⁷ and elderly patients with chronic diseases in Kuwait [median 112 (interquartile range 21) in the LMQ-3],²⁵ but were higher than those reported in New Zealand (101.8 ± 21)²⁶ and among adults in South East England (99.7 ± 19.8).²⁷ These differences may be related to factors such as the type of disease, age structure, regional economic development, healthcare system and cultural background of the study population. Currently, research focusing on MRB in elderly CHD patients remains relatively limited, and the outcomes of this study offer an important reference for the assessment of MRB in this group.

Analysis of the scores for each item of the C-LMQ-3 revealed that items associated with a higher MRB were primarily concentrated in the areas of financial burden, disruption to daily life caused by medication, autonomy in medication use, need for medication information, and medication-related concerns. Among these, the item “concerns about medication costs” received the highest score (3.39 ± 1.07), suggesting that the financial burden of medication is the primary source of MRB for elderly patients with CHD. This result is in line with the findings reported by Wang et al on elderly patients with chronic diseases.¹⁷ This may be linked to the limited financial resources of elderly patients and

inadequate health insurance coverage.²⁸ Consequently, health authorities and healthcare providers can alleviate patients' out-of-pocket costs through measures such as prioritising the use of medicines listed in the National Reimbursement Drug List, implementing policies for long-term prescriptions for chronic conditions and high reimbursement rates, and providing advice on medication costs. This was followed by "Taking medication has become a major part of my life" (3.36 ± 1.01), reflecting the impact of long-term, regular medication on patients' daily routines and their dependence on medication. Furthermore, items such as "ability to adjust dosage independently", "ability to decide independently whether to take medication", and "ability to adjust the timing of medication" also scored highly, indicating that patients lack autonomy in their medication regimens; This finding is in accordance with the conclusions drawn by Liu et al in their investigation of older adults with depressive disorders.¹⁶ This suggests that in clinical practice, when formulating treatment regimens, due consideration should be given to patients' preferences, allowing them reasonable scope for self-adjustment. At the same time, items such as "need for more information about medication", "requires considerable effort to plan medication", and "concern about forgetting to take medication" also ranked highly, indicating that elderly patients with CHD commonly face issues such as insufficient information about their medication, difficulties in managing their medication, and concerns about forgetting to take it.

This study found that patients experiencing adverse drug reactions was associated with higher MRB, a finding that aligns closely with the results reported by Liu et al in their study of elderly patients with depression.¹⁶ Approximately 28.6% of patients reported adverse drug reactions, indicating that such reactions are relatively common among elderly patients with CHD. This patient population often requires long-term treatment with antiplatelet agents, lipid-lowering drugs and antihypertensive agents. Among these, aspirin may increase the risk of bleeding and cause gastrointestinal discomfort, whilst statins may lead to abnormal liver function and muscle pain,²⁹ these adverse reactions may be associated with a greater MRB and affect treatment adherence.^{30,31} It is possible that adverse reactions are related to increased fear and anxiety regarding medication, thereby undermining their confidence in treatment.³² Healthcare professionals should therefore conduct a comprehensive assessment of patients' liver and kidney function, bleeding risk and concomitant medication prior to prescribing; select the type and dose of medication on an individual basis; inform patients of the potential adverse reactions; and strengthen the monitoring and management of adverse drug reactions, with a view to reducing the MRB on patients.

Research also indicates that patients who use medication aids such as pill boxes tend to experience milder medication-related behavioural problems. This may be because these tools help standardise medication routines, reduce missed and incorrect doses, and relieve memory pressure, thereby easing the overall medication management burden. This may also be because the use of medication aids may be associated with better medication management and lower MRB. Previous studies have found that simple medication aids can alleviate medication-related behavioural problems in patients.^{33,34} In this study, only 15.2% of patients used medication management aids, suggesting that the uptake of such tools in clinical practice remains low. In future clinical practice, both traditional and smart medication management aids should be promoted, taking into account the cognitive and practical abilities of elderly patients, and personalised guidance should be provided to simplify the medication process and reduce the administrative burden.

Furthermore, patients who have received medication education and possess a higher level of medication literacy tend to experience milder MRB. Proper medication education is associated with better understanding of patients' condition and treatment plan, while higher medication literacy is associated with knowledge of medication efficacy, adverse reactions, and precautions. Both may be related to lower burdens caused by lack of information.³⁵⁻³⁷ Consequently, clinicians should prioritise and enhance medication support and interventions for elderly patients with CHD. They should provide standardised, personalised medication education during the initial consultation and follow-up appointments, and utilise digital tools to assist patients in acquiring medication knowledge, broaden their access to information, and clarify drug administration, dosages and therapeutic effects, thereby improving their medication literacy.

At the same time, this study also found that stronger medication necessity beliefs are associated with lower MRB. This is primarily because stronger medication necessity beliefs make patients more receptive to long-term medication regimens and more proactive in adhering to medication management, thereby reducing the subjective burden and management pressure caused by psychological resistance, cognitive biases and excessive anxiety.^{38,39} A meta-analysis found⁴⁰ that the stronger a patient's positive belief in the necessity of drug treatment and the fewer their concerns about

taking medication, the higher their long-term adherence to the treatment. Clinical healthcare professionals should therefore provide more positive guidance to help patients form a positive attitude towards medication. By thoroughly discussing the benefits of treatment with patients and promptly clarifying misconceptions about medication, they can help patients develop a rational and positive understanding of medication, thereby reducing unnecessary concerns and resistance, and consequently alleviating the psychological and management burdens associated with medication.

The present study investigated the level of MRB and its associated factors among older patients with CHD. Amid the global population ageing trend, the prevalence of CHD in the elderly is continuously increasing, and long-term polypharmacy has become a common clinical practice. Nevertheless, systematic studies focusing on MRB in this specific patient group are still relatively limited. Through evaluating patients' MRB and its influencing factors, this study enhances our in-depth understanding of the real-world experiences and challenges encountered by elderly CHD patients during long-term pharmacotherapy, and provides a reference for clinical healthcare professionals and health policy-makers. Against the backdrop of China's accelerating population ageing, addressing and improving MRB among elderly patients with CHD is of great significance for optimising medication management, enhancing treatment adherence and improving patient health outcomes.

Based on our findings, clinicians should consider routine MRB assessment, personalized medication education, promotion of medication aids, active monitoring of adverse drug reactions, and enhancement of medication literacy to reduce MRB in elderly CHD patients. However, these suggestions are based on associational findings and require further validation in future interventional studies. Given the cross-sectional design, we cannot fully exclude the possibility of confounding by these or other unmeasured variables.

The current study possesses certain inherent limitations. To elaborate, the cross-sectional research design precludes the establishment of causal relationships among the investigated variables. Despite adjusting for all variables that reached statistical significance in univariate analysis, we cannot exclude the possibility of residual confounding by unmeasured factors, such as social support, disease severity, cognitive function, or health literacy. Secondly, the study sample was drawn from a relatively concentrated source and the sample size was limited, which may limit the external validity of the findings, making it difficult to apply them to populations of elderly CHD patients in different geographical areas or with varying levels of healthcare resources. Additionally, the evaluation of MRB and its associated determinants was based exclusively on patient self-reporting, which is potentially prone to recall bias or subjective reporting biases. Fourth, data were collected on the day of discharge, when patients may experience stress that could affect self-reported MRB. Future studies could enhance the representativeness of the findings by increasing the sample size and conducting multicentre studies, thereby providing a more reliable basis for optimising intervention strategies for MRB in elderly patients with CHD.

Conclusion

In this study, the MRB among elderly patients with CHD was found to be moderate, primarily reflected in dimensions such as financial burden and disruption to daily life. The MRB experienced by elderly patients with CHD is associated with a range of different factors, including drug side effects, the use of medication support tools, medication health education, medication beliefs and medication literacy. Notably, our findings highlight the novel and clinically relevant roles of medication beliefs and medication literacy as key modifiable factors associated with MRB in elderly CHD patients. Healthcare professionals should consider implementing targeted, standardised medication education to enhance patients' medication knowledge and self-management skills, whilst providing positive guidance on medication beliefs to alleviate unnecessary concerns. Furthermore, strategies such as promoting the use of medication aids, reducing the incidence of adverse drug reactions, and optimising individualised medication regimens can further alleviate patients' MRB.

Ethical Approval

All procedures performed in studies involving human participants were in accordance with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This study was approved by Second Affiliated Hospital of Anhui Medical University (Approval No. YX2025-307). Written informed consent was obtained.

Acknowledgments

We would like to thank all the faculty members in the Nursing Department of the Cardiovascular Medicine Division at the Second Affiliated Hospital of Anhui Medical University for their support of our work.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

Anhui Medical University School Clinical Science Fund Project [grant number 2020xkj197]; Nursing Project of Anhui Institute of Translational Medicine [grant number 2025zhxy-hl-A20]; 2026 Anhui Medical University School of Nursing Postgraduate Youth Training Project [grant number Hlqm22025101].

Disclosure

The authors report no conflicts of interest in this work.

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