

REVIEW ARTICLE

Self-reported questionnaires for assessing medication adherence in coronary heart disease patients: A systematic review

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ABSTRACT

Medication adherence is essential for assessing the effectiveness of treatment in people with coronary heart disease (CHD). It is evaluated through self-report, which is the most economical and straightforward method. This systematic review aimed to identify validated self-report questionnaires that measure medication adherence in patients with CHD. The study adhered to the PRISMA guidelines for carrying out systematic reviews. A total of 23 articles were selected according to the inclusion criteria, from three databases, namely PubMed, ScienceDirect, and Scopus. The Joanna Briggs Institute (JBI) Critical Appraisal Instrument was used to independently evaluate the quality of the included articles.

The most generally used self-report questionnaires for assessing medication adherence in patients with CHD were the MMAS-4 and MMAS-8, each applied in 22% of the studies. These were followed by the MARS-5, MGLS, and ACDS, each used in 13% of the studies. The results showed that most questionnaires had acceptable reliability (Cronbach's $\alpha = 0.739$ – 0.898) and validity (content and construct). However, few articles evaluated questionnaires across diverse cultural contexts or assessed their sensitivity to partial or intermittent medication adherence.

The MMAS-4 and MMAS-8 were the most commonly used validated self-report adherence questionnaires. Despite presenting acceptable psychometric properties, questionnaires had limited cultural adaptation and sensitivity to partial or intermittent adherence. This emphasized the need for further validation and the development of tools better tailored to diverse clinical settings and study contexts.

Keywords:

coronary heart disease; medication adherence; compliance; self-report scale; questionnaire

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INTRODUCTION

Coronary Heart Disease (CHD) remains a primary cause of death worldwide. The Global Burden of Disease study indicates that coronary heart disease results in the highest loss of healthy life years, with approximately 2,276 years lost per 100,000 people between 1990 and 2022.¹ By 2050, CHD is projected to remain the greatest cause of cardiovascular mortality, contributing to an estimated 20 million deaths.² Based on observations, achieving therapeutic benefit requires adherence to the prescribed treatment regimen.^{3–5}

Although treatment adherence is essential, it remains a major challenge in patients with CHD, as many fail to follow prescribed regimens.⁶ Advanced age contributes to nonadherence by increasing the potential of forgetfulness. Other factors include polypharmacy, the burden of lifelong medication use, mental health conditions (e.g., depression and anxiety), and concerns about potential medication side impacts.^{7,8} Nonadherence is linked to poor control of risk factors, delayed or inappropriate therapy adjustments, worse clinical outcomes, increased hospital readmissions, higher healthcare costs, and a 50%–80% relative gain in mortality.^{9,10}

Clinicians' ability to detect medication nonadherence is limited. Although screening is conducted by directly asking about missed doses, self-reported verbal assessments have limited accuracy.¹¹ Both direct and indirect methods exist for evaluating adherence, but none is clearly superior.^{12,13} Among the generally utilized indirect methods is the self-reported questionnaires.^{13,14}

Self-reported questionnaires offer several advantages for assessing medication adherence, including low cost, noninvasiveness, minimal patient burden, ease of use, as well as flexibility in timing and format. These questionnaires are practical for routine clinical care and can provide early insight into nonadherence

before adverse outcomes arise.^{3,10,15–18} In addition to medication-taking behavior, key determinants of adherence, such as patients' regimen understanding, reasons for nonadherence, medication beliefs, and other psychosocial factors, are captured.¹⁹

Despite the advantages, questionnaires present challenges due to the limited validity of self-reported adherence and the potential costs of additional data verification.²⁰ Although some systematic reviews examined adherence rates or interventions,^{21,22} few focused on self-reported adherence questionnaires and the psychometric properties in CHD patients.

A systematic review was carried out following PRISMA guidelines, searching multiple databases for pertinent studies to fill this gap. Data from questionnaires were extracted and used to evaluate medication adherence in CHD and the psychometric properties, including validity and reliability. This systematic review aims to identify and provide information on self-reported and validated medication adherence questionnaires. It provides researchers, clinicians, and policymakers with an overview of available instruments to guide the appropriate use in clinical practice and study.

METHODS

Study Selection

Mendeley Reference Manager (version 1.19.8, Windows 10) was used to import and manage the search results, while duplicate records were found and eliminated. Titles and abstracts were independently screened by MA and TMA, followed by full-text screening of potentially eligible studies. Any discrepancies were addressed by consulting a third reviewer (AWW) at each step. Studies were considered eligible when the predefined inclusion and exclusion criteria were met, as described in Table 1. This review was directed by the PICO framework, where Population (P) comprised adult patients with CHD and Intervention (I)

Table 1. Inclusion and exclusion criteria of the article

Inclusion Criteria	Exclusion Criteria
Articles measuring medication adherence with CHD treatment	Articles are not the original article
Articles published in English	Articles using unvalidated questionnaires
Articles published in the period 2014-2024	
Articles presented in full-text	

was the use of self-report scales. Furthermore, Comparator (C) was not applicable, and Outcome (O) was the psychometric properties of questionnaires, specifically validity and reliability. Despite being predefined in the protocol, the outcomes were omitted from the search string to maximize sensitivity, and the criteria were applied during screening and eligibility. Screening was carried out in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines²³. The PRISMA flow diagram, shown in Figure 1, illustrates the study selection process.

Data Sources and Searches

The literature search started in April 2024 and was conducted in three databases, namely PubMed, ScienceDirect, and

Scopus. BOOLEAN operators 'AND' and 'OR' were utilized in the search strategy to further refine the terms. The search terms applied were ("coronary heart disease" OR "coronary artery disease") AND ("compliance" OR "medication adherence" OR "medication compliance") AND ("self-report scale" OR "questionnaire").

Quality Assessment

The quality of articles that met the inclusion criteria was independently assessed by MA and TMA. Any discrepancies were addressed through discussion with a third reviewer (AWW). Quality of study was assessed utilizing the Joanna Briggs Institute (JBI) critical assessment instrument²⁴. JBI was selected because of its validation of the methodological

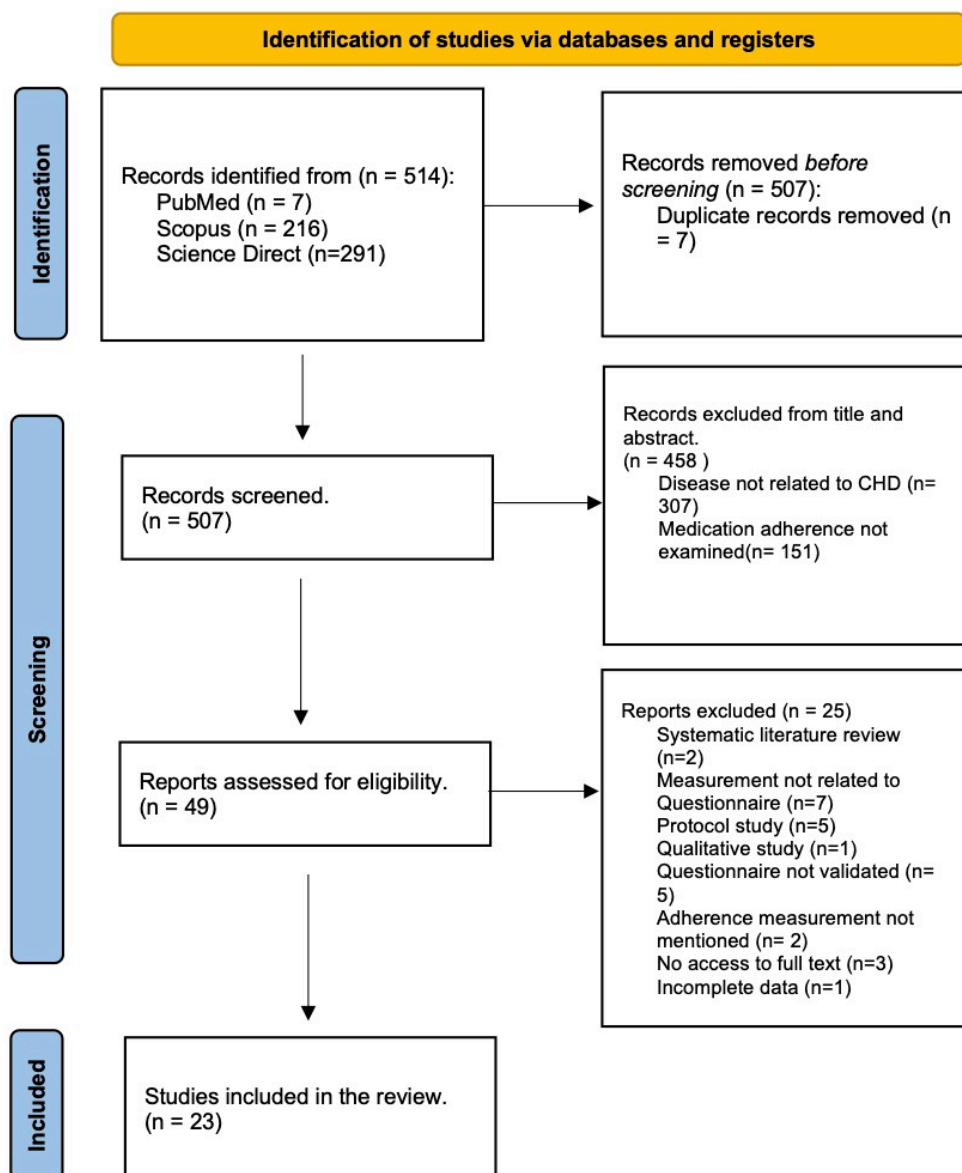


Figure 1. PRISMA Flow Diagram

quality across several study types, including cross-sectional, case-control, cohort, randomized controlled trials (RCTs), systematic reviews, and quasi-experimental. The evaluation informs the synthesis and interpretation of the results. According to the JBI critical appraisal scores, articles are categorized as high (70% and above), medium (50%-70%), or low (below 50%)²⁵.

Search Strategy and Extraction

MA and TMA independently conducted data extraction using a Microsoft Excel form. The information extracted comprised the author, publication year, country, study design, setting, and study duration, limitations of adherence scale, type of adherence questionnaire, and psychometric properties assessed (validity and reliability). Any discrepancies were resolved by discussing with a third reviewer

(AWW). The data collection form was pilot-tested on three studies to ensure clarity and consistency before complete extraction. The extracted details were synthesized narratively to address the study objectives. Data extracted from included articles were manually synthesized to summarize study characteristics and questionnaire psychometric properties. Two reviewers performed synthesis independently to ensure accuracy and minimize bias, with disagreements resolved through discussion or, when necessary, adjudication by a third reviewer.

RESULTS

Study Selection

This study reviewed articles published between 2014 and 2024 that applied questionnaires to evaluate medication adherence in CHD. A total of 514 articles were identified, including 7, 216, and 291 from PubMed, Scopus, and ScienceDirect, respectively. After duplicates were released, 507 studies were filtered based on titles, abstracts, and results, with 23 studies meeting the inclusion criteria after full-text review. The database distribution and selection process are displayed in Figure 1.

Study characteristics

Table 2 explains the characteristics of the articles that met the inclusion criteria. The 23 included articles were conducted across 26 countries, including one, four, and 20 in Africa, Asia, and Europe, reflecting geographical diversity. Results showed that the country with the highest total of studies was China ($n = 4$). Various designs were adopted, including cross-sectional ($n = 12$; 21-29), cohort ($n = 5$; 30-

34), and randomized controlled trials (RCTs; $n = 6$; 340), while study durations ranged from three to 36 months. Some entries were marked as NR, signifying information that was not reported in the original publications. This information was the study country, setting, and limitations related to adherence scales.

Quality assessment

The quality of the included articles was assessed using the JBI Critical Appraisal Instrument, producing scores ranging from 55% to 100%, which signified medium to high methodological quality. Two reviewers independently conducted the quality assessment, and any disagreements were settled through discussion with a third reviewer. Detailed results of the quality evaluation are offered in Table 3.

The Common Self-Reported Adherence Scale for Patients with CHD

Nine self-reported scales were used across 23 studies published between 2014 and 2024 to assess medication adherence in patients with CHD, as detailed in Tables 2 and 4.

Morisky Medication Adherence Scale (MMAS-4 and MMAS-8).

From 2014 to 2024, self-reported scales assessing medication adherence were dominated by MMAS-4 and MMAS-8 (44%). Most studies were conducted in hospitals, with a duration ranging from 5-36 months, as shown in Table 2.^{18,26-32} In the present systematic review, six articles were identified, where three used the MMAS-4 scale and the remaining three applied the MMAS-8 scale. All six scales were subjected to validation by the respective

Table 2. The characteristics of the included studies

Author	Year	Study Design			Country	Setting	Duration of Study (Month)	Limitations Related to the Adherence Scale
		Cross-sectional	Cohort	RCT				
Ali, et al.	2017	✓	-	-	Pakistan	Hospital	12 Month	Recall Bias
Jalal, et al.	2019	✓	-	-	UK	Hospital	6 Month	NR*
Casper, et al.	2019	-	-	✓	Egypt	Hospital	24 Month	Imbalance Score between two groups
Kristiansen, et al.	2021	✓	-	-	Norway	Hospital	36 Month	NR*
Dugunchi, et al.	2024	✓	-	-	Iran	Hospital	6 Month	Recall Bias
Ludt, et al.	2014	✓	-	-	10 European Countries	NR*	12 Month	NR*
Schwalm, et al.	2015	-	-	✓	Canada	Single Tertiary Care Center	12 Month	NR*
Cordero, et al.	2017	✓	-	-	Spain	Hospital	5 Month	NR*
Divchev	2019	✓	-	-	Germany	Hospital	12 Month	Indirect method of patient self-reporting
Zhang, et al.	2020	✓	-	-	China	Hospital	18 Month	NR*
Gaudel, et al.	2021	-	-	✓	Nepal	Hospital	3 Month	Recall Bias
Garcia, et al.	2022	-	-	✓	NR*	NR*	12 Month	NR*
Yin, et al.	2022	-	✓	-	China	Hospital	9 Month	NR*
Johnston, et al.	2016	-	-	✓	Sweden	Hospital	6 Month	NR*
Thomson, et al.	2020	-	✓	-	Scotland	Hospital	6 Month	Reporting Bias
Pettersen, et al.	2022	-	✓	-	Norway and Denmark	Hospital	6 Month	The utilization of both general and disease-specific instruments is essential to assess patient's adherence

Author	Year	Study Design			Country	Setting	Duration of Study (Month)	Limitations Related to the Adherence Scale
		Cross-sectional	Cohort	RCT				to medications accurately.
Kahkonen, et al.	2019	✓	-	-	Finland	Hospital	12 Month	NR*
Foldes-Busque, et al.	2021	-	✓	-	France	Hospital	24 Month	NR*
Kosobucka, et al.	2022	-	✓	-	Poland	Hospital	6 Month	NR*
Lee, et al.	2018	✓	-	-	Korea	Hospital	4 Month	NR*
Ni, et al.	2022	-	-	✓	China	Hospital	3 Month	NR*
Rad, et al.	2022	✓	-	-	Iran	Hospital	6 Month	NR*
Zhou, et al.	2022	✓	-	-	China	Hospital	4 Month	NR*

NR* shows information not reported in the original study.

authors and external analysts, ensuring reliability and relevance in evaluating medication adherence.

At least three versions of MMAS-4 and MMAS-8 have been adapted into different languages for patients with CHD. A study reported a construct validity of 0.6851 for the MMAS-4, while the content validity index of the MMAS-8 was 1. In another study, the construct validity of the MMAS-8 was evaluated utilizing known-group validity, based on the assumption that patients with lower medication adherence would result in lower blood pressure. The result showed a value of 0.03, consistent with the hypothesis and observations summarized in Table 4. Reliability testing presented that MMAS-4 featured acceptable internal consistency. Meanwhile, the

MMAS-8 demonstrated high internal consistency, as indicated by Cronbach's alpha values.^{33–36}

The MMAS-4 and MMAS-8 were designed to measure patients' medication adherence behaviors and do not capture the underlying reasons or determinants of non-adherence. Despite providing reliable estimates of medication-taking behavior, both scales functioned poorly as explanatory tools, which contributed to weak correlations with objective clinical outcomes. The scales are useful as screening and monitoring instruments for identifying patients at risk of non-adherence, but lack the depth required to guide the development of targeted strategies or interventions to enhance adherence.¹⁹

Table 3. Quality assessment results

Author	Year	Study Design			JBI Quality (%)	Conclusion		
		Cross-Sectional	Cohort	RCT		High	Moderate	Low
Ludt, et al.	2014	✓	-	-	75	✓	-	-
Ali, et al.	2017	✓	-	-	88	✓	-	-
Cordero, et al.	2017	✓	-	-	63	-	✓	-
Lee, et al.	2018	✓	-	-	88	✓	-	-
Divchev	2019	✓	-	-	63	-	✓	-
Jalal, et al.	2019	✓	-	-	75	✓	-	-
Kahkonen, et al.	2019	✓	-	-	88	✓	-	-
Zhang	2020	✓	-	-	75	✓	-	-
Kristiansen, et al.	2021	✓	-	-	88	✓	-	-
Rad, et al.	2022	✓	-	-	88	✓	-	-
Zhou, et al.	2022	✓	-	-	88	✓	-	-
Dugunchi	2024	✓	-	-	88	✓	-	-
Thomson, et al.	2020	-	✓	-	55	-	✓	-
Foldes-Busque, et al.	2021	-	✓	-	64	-	✓	-
Kosobucka, et al.	2022	-	✓	-	55	-	✓	-
Pettersen, et al.	2022	-	✓	-	55	-	✓	-
Yin, et al.	2022	-	✓	-	73	✓	-	-
Schwalm, et al.	2015	-	-	✓	100	✓	-	-
Johnston, et al.	2016	-	-	✓	69	-	✓	-
Casper, et al.	2019	-	-	✓	92	✓	-	-
Gaudel, et al.	2021	-	-	✓	85	✓	-	-
Garcia, et al.	2022	-	-	✓	69	-	✓	-
Ni, et al.	2022	-	-	✓	77	✓	-	-

Table 4. Self-reported scale for medication adherence in CHD patients

Self-Reported Adherence Scale	Country	Validity Value in CHD Patients			The Cronbach's α Value in CHD Patients
		Content Validity	Construct Validity	Criterion Validity	
MMAS-8	United States of America	NR	0.03	*	0.83
MMAS-8	Italy	NR	*	*	0.83
MMAS-8	Vietnam	1	*	*	0.898
MMAS-4	United States of America	NR	*	*	0.61
MMAS-4	Italy	NR	-	*	0.60
MMAS-4	China	NR	0.6851	*	0.61
MGLS	China	NR	*	*	0.61
MGLS	United States of America	NR	*	*	0.82
MARS-5	United States of America	NR	*	*	0.89
MARS-5	Norway	NR	*	*	0.87
ACDS	Poland	*	0.847	*	0.752
ACDS	Finland	*	*	*	0.91
ACDS	United States of America	NR	*	*	0.74
ACDS	Poland	NR	*	*	0.739
MMS	Korea	NR	*	*	*
Voil's Extent Scale	United States of America	NR	0.99	0.001	0.84
MAS-CAD	Iran	0.99	0.8	NR	0.81
Medication Adherence Questionnaires for Coronary Heart Disease	China	NR	NR	0.783	0.831

MMAS-8: Morisky Medication

Adherence Scale 8; MMAS-4: Morisky Medication Adherence Scale 4; MGLS: Morisky Green Levine Scale; MARS-5: Medication Adherence Rating Scale-5; ACDS: Adherence in Chronic Disease Scale; MMS: Modified Morisky Scale; MAS-CAD: Medication Adherence Scale Coronary Artery Disease; NR: not conducted in this study or no information available; *: Validity data using other study data.

The MMAS-4 and MMAS-8 were designed to measure patients' medication adherence behaviors and do not capture the underlying reasons or determinants of non-adherence. Despite providing reliable estimates of medication-taking behavior, both scales functioned poorly as explanatory tools, which contributed to weak correlations with objective clinical outcomes. The scales are useful as screening and monitoring instruments for identifying patients at risk of non-

adherence, but they lack the depth required to guide the development of targeted strategies or interventions to enhance medication adherence.¹⁹

MMAS-4 is a four-item questionnaire created to assess medication adherence. Each item was answered with “yes” or “no”, scored as 1 and 0, respectively. Since the items were negatively coded, lower total scores signified better adherence. Based on observations, 0, 1-2, and 3-4 reflected high, moderate, and low adherence.³⁷

MMAS-8 comprises eight items, including one Likert-type question with five response options (“never”, “rarely”, “sometimes”, “often”, and “always”) and seven dichotomous (yes/no) items.³⁸ To reduce social desirability bias, six items were negatively coded, where a “no” response signifies optimal adherence. Meanwhile, an item was positively coded, with “yes” reflecting adherence. Total score ranges from 0 to 8, classifying adherence as high (8), medium (6-7), or low (<6).³⁹

Morisky Green Levine Scale (MGLS).

MGLS was applied in three studies conducted in Nepal, China, and one unspecified location, with durations spanning from 3 to 12 months. Two of the articles were hospital-based, while the third did not report its setting, as detailed in Table 2.^{16,40,41} In two studies, the MGLS was utilized as a self-report measure to evaluate medication adherence, though validity was based on previous reports. The reported Cronbach’s alpha values varied from 0.6 to 0.8, reflecting acceptable reliability, as detailed in Table 4.^{15,42}

The four-item MGLS is a widely used instrument for assessing self-reported medication non-adherence.³⁷ Voils et al. stated that the MGLS primarily captured respondents’ reasons for non-adherence. Conceptually, it is more accurately categorized as a measure of the determinants of non-adherence, consistent with a causal indicator model, rather than as

a direct measure of medication-taking behaviour.⁴³

MGLS was developed in 1986 as a four-item generic medication adherence instrument, adapted from the original five-item version. It comprised questions such as (1) “Do you ever forget to take your medication?” (2) “Do you sometimes neglect to take your medication?” (3) “When you feel better, do you sometimes stop taking your medication?” and (4) “If you feel worse when taking your medication, do you sometimes stop taking it?” The scale was built on the idea that forgetfulness could be a reason for non-adherence, inattention, discontinuation after symptom improvement, or discontinuation due to adverse effects. Responses were scored “Yes” = 1 and “No” = 0, generating a total score from 0 to 4. Higher scores reflected greater non-adherence, with adherence levels categorized as high (0), moderate (1-2), and low (3-4).^{37,44}

Medication Adherence Rating Scale-5 (MARS-5).

In this systematic review, three studies conducted across Sweden, Norway, Denmark, and Scotland assessed medication adherence utilizing the MARS-5 scale. All were hospital-based and included a six-month follow-up (Table 2).^{17,45,46} At least two language versions of MARS-5 were applied in different countries. A study performed a validity test but did not report the results, while another relied on previously published validity data. The reported Cronbach’s alpha values of 0.89 and 0.87 showed high reliability, as detailed in Table 4.^{45,47} The MARS-5 has five items rated on a five-point Likert scale, where 1, 2, 3, 4, and 5 represent always, often, sometimes, rarely, and never, respectively. Scores were added up to create a total score ranging from 5 to 25, with greater scores indicating better adherence.⁴⁸

The MARS-5 scale addressed key limitations of earlier adherence assessments.⁴⁹ Its standardized instructions help minimize self-presentation bias, while the Likert-type response options provided a more nuanced assessment of non-adherent behavior than binary “yes/no” formats. Compared with MARS-10, the shorter MARS-5 was more practical for clinical use but retained strong reliability and validity. Additionally, it enabled the identification of important reasons for non-adherence without compromising data quality.⁵⁰

Adherence in Chronic Disease Scale (ACDS).

In this systematic review, three studies adopted ACDS across France, Finland, and Poland, all conducted in hospital settings with durations ranging from 6 to 24 months.^{51–53} Between 2014 and early 2024, ACDS was available in at least three languages, namely Polish, Finnish, and English. Two studies relied on previously reported validity data, while one assessed construct validity (0.847) and another evaluated criterion validity (0.848). The reliability values ranged from 0.74 to 0.91, reflecting acceptable internal consistency, as detailed in Table 4.^{51–54}

ACDS was developed to consider both the implementation of prescribed treatment regimens and the factors influencing adherence among patients with chronic diseases. The results supported strategies to enhance medication adherence in clinical practice.⁵⁵

ACDS consisted of seven items, each with five response options. Items 1-5 measured patients' behaviors related to treatment, while 6-7 evaluated aspects of the physician–patient relationship that may indirectly affect adherence. Each item was scored from 0 to 4, producing a total value that classified medication adherence as high (>26), moderate (21-26), or low (<21).^{4,54}

Modified Morisky Scale (MMS)

A study with a duration of four months adopted the MMS in a hospital setting in Korea. Validity and reliability data were referenced from previous reports, although specific values were not provided, as detailed in Tables 2 and 4. MMS was adapted from MMAS-4 to address certain limitations, particularly its inability to evaluate therapy persistence. To address this gap, the Case Management Society of America added two additional items. The resulting six-item scale measured two domains of adherence, namely knowledge and motivation. Scores for each domain ranged from 0 to 3, producing a total score of 0–6, with higher values reflecting better adherence.⁵⁶

Voil's Extent Scale.

This systematic review identified one study that applied the Voil's Extent Scale. Conducted in China in 2022, the hospital-based study lasted over three months (Table 2).⁵⁷ Validity and reliability were assessed using confirmatory factor analysis (CFA). Model fit was evaluated using the Comparative Fit Index (CFI) and Tucker–Lewis Index (TLI), both generating values of 0.99, which exceeded the 0.95 threshold and reflected excellent fit⁵⁸. The total non-adherence score was determined by summing responses from three items, with lower values reflecting better medication adherence.⁵⁷

Medication Adherence Scale-Coronary Artery Disease (MAS-CAD).

A study assessed adherence with the Medication Adherence Scale-Coronary Artery Disease (MAS-CAD). Conducted in Iran in 2022, the hospital-based study lasted over six months. Psychometric testing showed content and construct validity values of 0.99 and 0.80, respectively, alongside a reliability coefficient of 0.81,

reflecting good internal consistency, as presented in Tables 2 and 4.⁵⁹

MAS-CAD is a 25-item self-report questionnaire designed to evaluate medication adherence in patients with CHD. It evaluated four domains, namely participation in a treatment program (4 items), understanding of prescribed medication (7 items), adherence behavior (3 items), and self-regulation in medication use (11 items). Each item was rated on a 5-point Likert scale, which consisted of “False” = 1 to “True” = 5. Adherence levels were classified by mean scores as low (<2.34), moderate (2.34–3.67), or high (>3.67).⁶⁰

Medication Adherence Questionnaires for CHD.

A study applied Medication Adherence Questionnaires for CHD, a self-report scale administered in a Chinese hospital in 2022 over four months. Criterion validity testing produced a coefficient of 0.783, and reliability was strong at 0.831, as detailed in Tables 2 and 4.⁴⁴

The Medication Adherence Questionnaires for CHD assessed six key aspects of adherence, namely schedule, dose, frequency, type, regular review, as well as medication adjustment. It comprised six self-reported items, each rated from 0 (Never) to 3 (Always), producing a total score range of 0-18. Higher scores reflect better adherence to prescribed treatment.⁴⁴

DISCUSSION

Effective management of CHD requires appropriate medication alongside efforts to minimize risk factors for recurrent events. The attainment of therapeutic goals largely depends on patients' adherence to prescribed treatment.⁶⁰ Non-adherence, defined as the failure to follow medical recommendations, reduces treatment effectiveness, worsens outcomes,

accelerates complications, and increases hospitalizations.⁶¹ Conversely, adherence improves clinical outcomes, reduces avoidable healthcare costs, and prevents indirect economic losses.^{20,61,62}

Assessing adherence is crucial to designing effective interventions.⁶³ However, healthcare professionals, including physicians and pharmacists, often face challenges in detecting non-adherence. In this case, self-reported questionnaires provide a practical and widely used method for identifying patients who fail to comply with medication regimens.^{19,64,65}

Self-reported methods are mostly cost-effective and straightforward for assessing adherence to medication. Questionnaires may be distributed online, administered as organized interviews, or presented in the form of written surveys. This method is very popular in adherence studies and can be readily adapted to various patient groups.^{66,67} Due to their practicality, these tools are commonly employed in medication adherence studies.

The properties of self-report instruments should be briefness, reliability, and validity. When selecting a tool for clinical or study settings, it is important to consider key characteristics such as the total number of items, sample size, sensitivity, reliability, specificity, completion time, and criterion validity.^{64,65}

This review summarizes self-report scales used to evaluate medication adherence in patients with CHD. Most studies relied on validation data from previous reports rather than conducting comprehensive testing within the target populations, as detailed in Table 4. While established questionnaires provide practical frameworks, the accuracy may be limited across different cultural, healthcare, and demographic contexts, as each scale is generally validated for specific patient groups. Therefore, adapting or developing scales tailored to diverse populations is essential. These factors should be carefully

considered by study analysts and clinicians when evaluating medication adherence.⁶⁸

MMAS-8 and MMAS-4 were the most frequently used self-reported adherence scales in CHD patients. There were observations of acceptable psychometric properties with distinct strengths and limitations. MMAS-8 offers several advantages, serving as a consistent and quantitative tool that can be applied across diverse populations and clinical settings. By capturing both intentional and unintentional nonadherence, it identifies specific barriers to medication adherence.^{69,70} In contrast, the MMAS-4 is widely used for assessing medication-taking behavior. With only four straightforward items, it is quick to complete and easy for patients to understand.⁶⁸ However, the narrower focus may reduce the sensitivity, as the scale provides only a limited perspective on medication adherence behavior. MMAS-8 is more appropriate for study and targeted interventions due to its multidimensional assessment, while MMAS-4 is better suited for routine practice and large-scale screening, attributed to brevity. The study's objectives should guide the choice between the two scales, where depth and precision support the application of MMAS-8, while feasibility and efficiency support the use of MMAS-4. Careful selection is crucial to ensure correlation with specific clinical goals.⁷¹

This review includes only a limited number of studies that have explored the link between self-report adherence scales and clinical outcomes.^{18,27,33,54,56–58,70,72,73} Although self-report measures are susceptible to bias and may overestimate treatment outcomes,⁷⁴ correlation with clinical outcomes reflects predictive validity. This suggests that the tools can show reasonable sensitivity and specificity in assessing adherence across specific patient populations.^{75,76}

The results require confirmation through a high-quality methodological study. Out of the 23 included articles, 65 and 35% were rated high and moderate quality, respectively. It is important to acknowledge that methodological limitations vary by study design. Cross-sectional studies often lacked sufficient descriptions of participants and settings, failed to report or address confounding variables, and provided no strategies for control. Cohort designs were constrained by including a single participant group, inadequate consideration of confounders, and poor handling of incomplete follow-up. RCTs were limited by unblinded randomization, insufficient reporting of provider blinding, and lack of assessor blinding. These limitations highlight the necessity for cautious interpretation and emphasize the importance of adopting more rigorous methodologies in future investigations.

The review presents a significant limitation of self-reported adherence scales. Patients may experience difficulty in accurately recalling the medications taken, leading to recall bias and reduced reliability of the results. Disease-specific self-reported scales improve accuracy in assessing medication adherence.^{16,27,30,41,46,74,75} An ideal adherence measure should be simple, accurate, cost-effective, and capable of identifying barriers, beliefs, and fears that influence the behavior of patients. It should also balance patients' burden with practical applicability. No one method is universally superior, as each has context-specific strengths and limitations; hence, combining at least two is recommended. Objective methods provide reliable evidence of medication use, while subjective methods capture the underlying reasons, beliefs, or challenges associated with adherence.^{61,77–}

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Two key recommendations for a study on medication adherence were proposed. This includes the use of self-reported adherence scales validated for the target disease, sociodemographic group, and language.⁶³ At least two complementary methodologies should be applied, as no single measure can fully capture the complexity of adherence behavior. For example, combining the MMAS-8 questionnaires with pharmacy refill records provides subjective insights and objective evidence of medication adherence.^{61,80} Furthermore, this assessment underscores the need to validate self-reported scales using standardized testing protocols.

Several limitations should be considered. First, this review was not prospectively registered in PROSPERO, which is considered best practice to reduce bias and enhance methodological transparency. To mitigate this shortcoming, the protocol was retrospectively registered and made publicly accessible in the Open Science Framework (OSF; <https://doi.org/10.17605/OSF.IO/WMS4E>), and the review was conducted in accordance with PRISMA guidelines. Publication bias may also be present, as unpublished or non-recommended articles were excluded. Moreover, most studies did not examine the correlation between adherence scores and clinical outcomes, an essential step for establishing predictive validity and ensuring self-reported scales provide adequate specificity and sensitivity⁷¹. Although the articles comprised diverse cultural contexts, many relied on validation data from other populations. Short study durations limited the evaluation of long-term adherence patterns. Finally, self-reported measures remain susceptible to remembering and social desirability biases, potentially leading to overestimation of adherence.

The limitations identified in this review have significant implications for clinical practice, study, and policy. Clinicians should interpret self-reported

adherence data cautiously before supplementing with objective measures, such as pill counts. Researchers need to validate adherence instruments across diverse populations, establish predictive validity by correlating scores with clinical outcomes, and conduct longitudinal investigations to capture long-term patterns. Policymakers are encouraged to support standardized, culturally adapted adherence tools and promote the integration into routine care to guide interventions and improve outcomes.

RECOMMENDATION

In conclusion, this review identified MMAS-8 and MMAS-4 as the multiple widely validated self-report instruments for assessing medication adherence in patients with CHD. Although both showed comparable psychometric properties, MMAS-8 was better suited for study and intervention. MMAS-4 was more practical for routine clinical use and large-scale screening.

Based on the results of this review, clinicians should select validated adherence questionnaires appropriate for patients and complement the tools with objective measures. Future research should prioritize prospective protocol registration to enhance methodological rigor and reduce bias, as well as evaluate cross-cultural and predictive validity and track longitudinal adherence patterns. Policymakers should promote the usage of standardized, evidence-based tools and support the integration into routine care to enhance the monitoring and administration of patients' medication adherence.

AUTHORS' CONTRIBUTIONS

MA: Conceptualization, Data curation, Formal analysis, Funding acquisition, Methodology, Visualization, Writing - original draft. **TMA:** Conceptualization, Formal analysis,

Methodology, Project administration, Writing - review & editing. **AWW**: Conceptualization, Project administration, Writing - review & editing. **NT**: Conceptualization, Data curation, Visualization, Writing - review & editing.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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