

A Systematic Review of Patient Self-Reported Barriers of Adherence to Antihypertensive Medications Using the World Health Organization Multidimensional Adherence Model

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Multiple barriers can influence adherence to antihypertensive medications. The aim of this systematic review was to determine what adherence barriers were included in each instrument and to describe the psychometric properties of the identified surveys. Barriers were characterized using the World Health Organization (WHO) Multidimensional Adherence Model with patient, condition, therapy, socioeconomic, and health care system/team-related barriers. Five databases (Medline, Embase, Health and Psychological Instruments, CINAHL, and International Pharmaceutical Abstracts [IPA]) were searched from 1980 to September 2011. Our search identified 1712 citations; 74 articles met

inclusion criteria and 51 unique surveys were identified. The Morisky Medication Adherence Scale was the most commonly used survey. Only 20 surveys (39%) have established reliability and validity evidence. According to the WHO Adherence Model domains, patient-related barriers were most commonly addressed, while condition, therapy, and socioeconomic barriers were underrepresented. The complexity of adherence behavior requires robust self-report measurements and the inclusion of barriers relevant to each unique patient population and intervention. *J Clin Hypertens (Greenwich)*. 2012;14:877–886. ©2012 Wiley Periodicals, Inc.

Hypertension is the leading risk factor for mortality and the third cause of disability world-wide.¹ By the year 2025, it is estimated that there will be 1.56 billion patients with hypertension.² Poor medication adherence is a major cause of failure to achieve blood pressure (BP) control.³ Patients take only 50% to 70% of the prescribed doses of antihypertensive medications and up to 50% of patients discontinue their antihypertensive treatment within the first year. In addition, up to 75% of patients do not achieve target BP.⁴

Adherence is defined as “the extent to which a person’s behavior corresponds with agreed recommendations from a health care provider.”⁴ Oftentimes, nonadherence is attributed to patient-related barriers; however, medication taking is a complex phenomenon and responsibility for nonadherence should not be solely attributed to the patient.⁴ Nonadherence can also be caused by therapy, illness, health system/health care team, and socioeconomic-related barriers.⁴ Patient self-report is an efficient and practical method for assessing medication adherence and is the only method that can be used to explore patients’ perspective about adherence barriers.⁵ Research using patient self-report of adherence have focused on patient-related barriers (eg, forgetting doses); however, these barriers represent only part of the problem of nonadherence.⁶

Ecological or multilevel system models do not only focus on individual behavior but also on direct attention to environmental barriers.⁷ Ecological models encompass intrapersonal, interpersonal, organizational, policy, and community barriers such as patient-pharmacist interactions, access to health care, drug coverage, social support, and complexity of drug regimen.^{4,8} Examples of ecological models are Healthy People 2020,⁹ the Model of Health and Behavior by the Institute of Medicine,¹⁰ and the World Health Organization (WHO) Multidimensional Adherence Model.⁴

In 2003, the WHO described adherence to long-term therapies as a behavior that is influenced by multiple barriers. The WHO organized adherence barriers into 5 dimensions: health care team/health system, therapy, condition, patient, and socioeconomic-related barriers. These 5 dimensions represent the WHO Multidimensional Adherence Model.⁴ For instance, health care team barriers include the quality of the relationship between patient and health care provider and health care system-related barriers include quality of health care services, health insurance, and drug reimbursement. Therapy-related barriers (eg, side effects and complexity of drug regimen), condition-related barriers (eg, severity of symptoms, presence of comorbid conditions, and illness-related demands), and patient-related barriers (eg, forgetfulness to take medication, low self-efficacy, and inaccurate beliefs about diseases and medications) impact patients’ adherence. Although socioeconomic status has not been consistently determined as an independent predictor of adherence, barriers such as poverty, illiteracy, low social support, and unemployment have been found to

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impact adherence.⁴ This comprehensive model can be used to systematically study adherence barriers in hypertensive patients.^{11,12}

A comprehensive understanding of adherence barriers is necessary to determine strategies to improve medication adherence.¹³ Interventions that address multiple barriers are most effective to enhance medication adherence.¹⁴ Understanding the barriers affecting a patient's ability to adhere to antihypertensive therapy will allow researchers to design effective interventions. Moreover, a better understanding will help evaluate the impact of these interventions on perceived and actual barriers to medication use, adherence rates, and ultimately patient outcomes.¹³

The aim of this systematic review was to describe patient self-report instruments measuring barriers to antihypertensive medication adherence and to determine what dimensions of the WHO Adherence Model were included in each instrument.

METHODS

Data Sources

A computerized search was performed to identify patient self-reported studies published in English between 1980 and September 2011. The inception date was selected because the first articles examining patient use of medication—defined as “compliance” at that time—began to appear.¹⁵ The search was conducted by using 5 databases: Medline, Embase, Health and Psychological Instruments (HAPI), CINHAI, and International Pharmaceutical Abstracts (IPA). Two medical librarians (TC) and (DS) assisted in developing a list of appropriate database search terms and synonyms for adherence, hypertension, medication, and self-report to identify studies that measured patient self-reported adherence to antihypertensive medications. The following search words were used: drug, medication, pharmaceutical, prescription, patient, adherence, compliance, persistence, cooperation, self-report, belief, attitude, satisfaction, behavior, communication, concordance, Morisky, social support, knowledge, stress, complexity, interaction, acceptance, survey, scale, instrument, questionnaire, assess, screen, inventory, data collection, antihypertensive agents, hypertension, and high BP.

Study Selection

Two authors (SAG and LMG) identified citations by screening titles and abstracts for potential relevance. The full-text article for each potentially relevant citation was obtained for further evaluation. Studies eligible for inclusion were observational and experimental studies that measured patient-perceived barriers of adherence to antihypertensive medications, enrolled adults (18 years and older), and were published in English as a peer-reviewed full-text article. Studies were excluded if they measured adherence to other health behaviors such as diet, exercise, and smoking

cessation; measured adherence through patient diaries or open-ended questions; measured only adherence rates; or included patients with multiple chronic diseases (hypertension, dyslipidemia, asthma, diabetes). The full-text articles were examined to determine eligibility for inclusion; any discrepancies regarding inclusion were resolved by discussion.

Data Synthesis

A standardized data abstraction form was used to obtain information on the surveys used in each study. We identified the survey instrument used, number of items, adherence barriers, and evidence of reliability and validity testing.

One author (SAG) used the WHO Multidimensional Adherence Model to categorize adherence barriers examined in the identified surveys into 5 dimensions. Survey instruments that did not measure any adherence barriers were excluded from this review. Surveys were then compared according to the addressed component of the WHO Adherence Model and according to the reliability and validity evidence.

RESULTS

Search Results

The search identified 1712 citations from the 5 electronic databases. After removing duplicate citations, 1185 titles and abstracts were screened for potential relevance. Investigators disagreed on allocation of 44 articles, and discrepancies were resolved by discussion. In total, 199 citations were retained for full article review, of which 74 citations were included in this systematic review (Figure).

Surveys

The 74 selected studies included 51 unique survey instruments (Table II). The majority of studies (56 [76%]) used >1 survey to identify adherence barriers, while 18 (24%) studies used 1 survey to identify barriers.

The Morisky Medication Adherence Scale¹⁶ was the most commonly used survey instrument and was utilized in 42 (57%) studies. Other commonly used surveys were the Medication Adherence Self-Efficacy Scale (MASES) (used in 5 studies),¹⁷ the Medication Adherence Report Scale (MARS) (used in 4 studies),¹⁸ Beliefs about Medicine Questionnaire (BMQ) (used in 3 studies),¹⁹ and the Brief Medication Questionnaire (BMQ)²⁰ (used in 3 studies).

Of all the survey instruments identified from the included studies, 20 surveys (39%) had established reliability and validity evidence, 14 surveys (27%) had either reliability or validity evidence, and 17 surveys (33%) had neither reliability nor validity evidence (Table II).

Adherence Barriers Identified in the Included Studies

None of the identified surveys measured all dimensions of the WHO Multidimensional Adherence Model, only

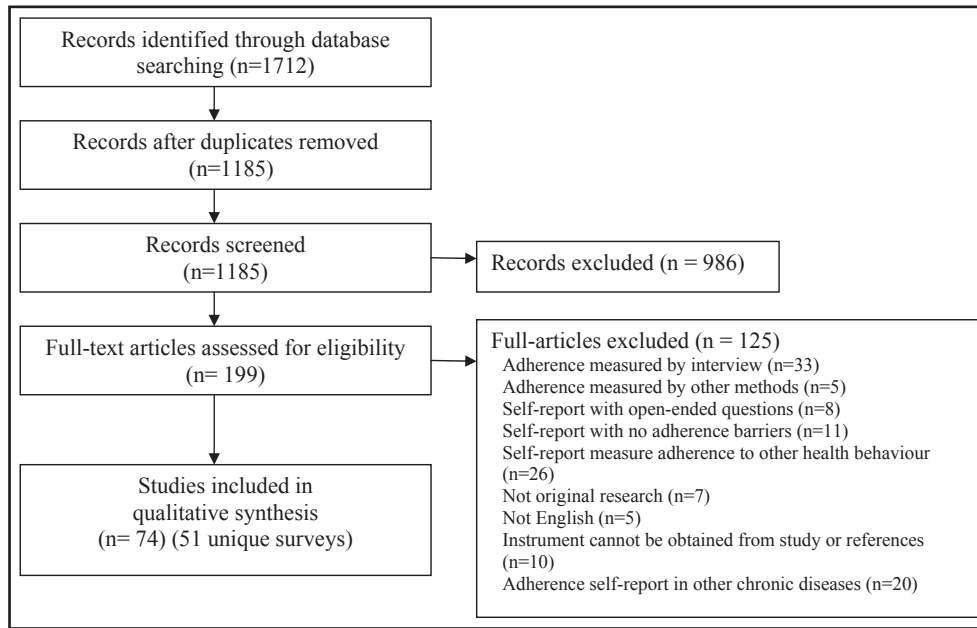


FIGURE. Flow diagram of study selection and studies included in this review.

5 surveys (10%)^{21–25} measured 4 WHO dimensions, 4 surveys (7.8%) measured 3 WHO dimensions,^{20,26–28} 6 surveys (11.8%)^{27,29–33} measured 2 dimensions, and the remaining 36 surveys (70%) measured 1 dimension (Table I and II). The average number of the WHO barrier domains examined in the surveys was 1.61 (median 2.5, and mode was 1).

Patient-Related Barriers

Thirty-nine surveys (76%) measured patient-related barriers associated with no-adherence (Table II). Twenty-four surveys (47%) solely identified these barriers and 15 (29%) combined these barriers and barriers from other dimensions. The most commonly studied patient-related barriers were remembering to take medication, patients' beliefs about hypertension or antihypertensive medications, and patient self-efficacy. Johnson and Rogers developed the purposeful action Medication Taking Questionnaire (MTQ), which measures 3 domains of patients' beliefs: perceived need, perceived effectiveness, and perceived safety of antihypertensive medications.³⁴ Likewise, the BMQ measures patients' perceptions about the specific necessity and concerns about medication use. In addition, it measures patients' perceptions about general harm and general overuse of medications.¹⁹

Another patient-related barrier is self-efficacy (ie, a person's perception about his or her ability to perform a specific behavior).³⁵ Self-efficacy influences the initiation and maintenance of health behaviors.³⁶ In addition, patients with higher self-efficacy scores were found to have better adherence than those with low self-efficacy.¹⁸ MASES measures patient self-efficacy

with respect to adherence to antihypertensive medications and this survey has evidence for its psychometric properties.^{18,37}

Health System/Health Care Team-Related Barriers

Fourteen surveys (27%) investigated reasons of non-adherence due to health care team/health system-related barriers. The components of health care team dimension identified from the different surveys in this review can be grouped into the following 3 domains: the patient-provider relationship, satisfaction with communication, and satisfaction with information. Moreover, the identified components of health system dimension were patients' perceptions about health care system, satisfaction with pharmacy services, and availability of drug reimbursement.

Therapy-Related Barriers

Twelve surveys (29%) studied poor adherence caused by therapy-related barriers. The most commonly identified barriers from this dimension were occurrence of side effects, complexity of drug regimens, and interference of medication taking with daily routines. Although the assessment of side effects in the identified surveys was common, the availability of health care provider support to deal with the side effects was not measured in any study.

Socioeconomic-Related Barriers

Eleven surveys (22%) investigated socioeconomic-related barriers. The identified barriers from this dimension were lack of social support, financial burden of medications, and health literacy. Three

TABLE I. World Health Organization Domains in the Surveys^a

Patient Barriers	Condition Barriers	Therapy Barriers	Socioeconomic Barriers	Health System/Health Care Team Barriers
Self-efficacy ^{17,20,21}	Patient depression ^{24,27,41}	Side effect occurrence ^{22,23,27–30,32,33}	Financial burden ^{22,24–26,67}	Difficulty in obtaining a refill ^{25,27}
Forget/remember medications ^{16,18–20,22,24,27,30,32,53–55}	Ability to open or close the medication bottle ²⁰	Medication efficacy ^{29,67}	Social support ^{23,28,39,66,68}	Health care system-related problems ⁶⁹
Remember to get refill ^{20,56}	Ability to read the print on the bottle ²⁰	Medication convenience ²⁹	Influence of social normatives ³¹	Lack of information ^{66,69,70}
Careless medication taking ¹⁶	The extent to which the disease influences patient's risk perception	Drug regimen complexity ^{20,24,25,30,32}	Cultural and language barriers ²³	Health care provider support ⁶⁹
Patient's beliefs about medications/hypertension ^{20,34,56–64}	Severity of symptoms	Frequent medication change ²⁴	<i>Health literacy</i>	Practical aspects of hypertension care ⁷¹
Self-efficacy ^{19,21,64}	Rate of progression of the disease	<i>Previous treatment failures</i>	<i>Distance from health care facilities</i>	Medication reimbursement ^{22,69}
Patient's attitude ^{52,65}		<i>The availability of medical support to deal with side effects of meds</i>		Quality of physicians' communication and patient participation ⁴⁷
Intentionally stop or modify the dosage ^{16,18,19,30,53,55}				Access to health care providers ²²
Use of herbal medicine or acupuncture to treat hypertension ²³				Relationship between patient and health care provider ^{23,54}
Awareness about drug insurance ²⁶				Difficulty in scheduling appointments ²⁶
Patient knowledge about hypertension and antihypertensive medications ^{26,66}				Satisfaction with pharmacy services ⁶⁷
<i>Patient's expectations about the consequences of poor adherence to medications</i>				Patient's perceptions about physician ⁷²
<i>Patient's awareness of adherence aids</i>				Patient's perceptions about pharmacist ⁷²

^aThe barriers in italics represent barriers that were not identified in this systematic review.

components of social support have been measured in the identified surveys: practical, informational, and affectionate. Practical support occurs when patients receive practical assistance with taking medication,³⁸ informational support means assisting patients with necessary information about medication,³⁹ and affectionate support means being empathic with patients, particularly from family and friends.³⁸ Maguire and colleagues³⁹ used the Modified Social Support Survey (MSSS) to measure tangible, informational, affectionate, and positive aspects of social interaction. They found that the high level of these components of social support were associated with adherence. On the other hand, Norman³¹ investigated the impact of practical social support on adherence to antihypertensive drugs and found a significant association with this component of social support and adherence to antihypertensive drugs. Likewise, DiMatteo³⁸ found that patients who received practical social support were 3.6 times more likely to adhere to medications than those who

did not. In another study, the practical and information support were more important for starting a medication, whereas emotional support was necessary for the maintenance of adherence.⁴⁰

Condition-Related Barriers

Surveys were least likely to assess condition-related barriers, with only 4 surveys (8%) used to investigate the influence of condition-related barriers. Three surveys assessed the presence of psychological disability, particularly depression.^{24,27,41} Only one survey assessed patients' physical demands on adherence (eg, ability to open a medication bottle and read the print on medication).²⁰

DISCUSSION

We identified 51 unique survey instruments that have been used to assess patient-reported barriers to adherence for antihypertensive medications. The 4-item Morisky Medication Adherence Scale was the most

TABLE II. Characteristics of Surveys and Use of the World Health Organization Dimensions in the Surveys

Instrument/References	Items	Reliability	Validity	Barriers				
				Patient	Condition	Therapy	Socioeconomic	Health System/Team
Patient Hypertension Beliefs Questionnaire ^{73,74}	30	Subscale Chronbach's $\alpha=0.39-0.59$		X				
Health Belief Questionnaire ^{75,76}	15	Subscale Chronbach's $\alpha=0.53-0.58$ Test-retest reliability=0.59-0.71	Content validity	X				
Perceived susceptibility to the sequelae of hypertension ²⁶	3	Cronbach's $\alpha=0.71$		X				
Perceived severity of hypertension ²⁶	1			X				
Benefits of antihypertensive therapy ²⁶	6	Cronbach's $\alpha=0.79$		X				
Barriers to treatment maintenance ²⁶	6			X			X	X
Knowledge about hypertension ²⁶	9			X				
Beliefs and Social Normative Influences Questionnaire ³¹	12			X			X	
Morisky Medication Adherence Scale ^{16,28,36,37,44,47-49,57-65,77-91}	4	Cronbach's $\alpha=0.61$	Concurrent and predictive validity	X				
Patient Satisfaction With Pharmacy Services ^{21,67}	44	Subscale Chronbach's $\alpha=0.36-0.80$	Convergent-discriminant validity	X		X	X	X
Epidemiologic Studies Depression Scale Short-Form ^{27,41}	10	Test-retest reliability=0.57	Criterion validity		X			
The Hypertension Patient's Perception of Physician Behavior Scale ^{73,92}	26	Cronbach's $\alpha=0.93$	Predictive validity					X
The Beliefs About Medicine Questionnaire ^{19,39,93-95}	34	Subscale Chronbach's $\alpha=0.51-0.86$	Criterion and discriminant validity	X				
Reported Adherence to Medication ^{19,39}	4	Chronbach's $\alpha=0.83$	Criterion and discriminant validity	X				
Brief Medication Questionnaire ^{20,68,96}	9		Criterion validity	X	X	X		
Antihypertensive Medication Adherence ^{44,68}	4		Concurrent validity	X				
Social Support Inventory ⁶⁸	9						X	
Perceived problems with hypertension treatment ³²	7			X		X		
Hill-Bone's Medication Compliance Scale ^{a, 23,56}	9	Cronbach's $\alpha=0.74$ Test-retest reliability=0.84	Predictive validity	X				
Perceived health care system-related problems/patient-related problems ⁶⁹	19							X
Medication Adherence Report Scale ^{18,63,70,97}	5	Cronbach's $\alpha=0.83$	Criterion and convergent validity	X				
Medication Taking Questionnaire ^{25,52}	16	Subscale Chronbach's $\alpha=0.60-0.77$	Content and construct validity	X		X	X	X
Compliance Survey ⁷²	6			X				

TABLE II. Characteristics of Surveys and Use of the World Health Organization Dimensions in the Surveys (Continued)

Instrument/References	Items	Reliability	Validity	Barriers				
				Patient	Condition	Therapy	Socioeconomic	Health System/Team
Patient Satisfaction Survey ⁷²	14							X
Patient Health Beliefs ⁶⁶	9			X				
Patient knowledge regarding hypertension and its treatment ⁶⁶	14			X				
Social Support with Blood Pressure Medications ⁶⁶	2						X	
Patient satisfaction ⁶⁶	5							X
Reasons for taking antihypertensives ³³	20	Test-retest reliability=0.5		X		X		
Medication Adherence Self-Efficacy Scale ^{17,37,48,70,98}	26	Cronbach's $\alpha=0.95$	Criterion validity	X				
Treatment Satisfaction Questionnaire for Medication ^{29,99}	14	Subscale Chronbach's $\alpha=0.85-0.87$	Construct validity	X		X		
Barriers to antihypertensive medication ²²	8			X		X	X	X
Self-confidence with hypertension treatment ⁷⁷	4	Chronbach's $\alpha=0.78$		X				
Perceptions of Western medications/social support ²⁸	5	Subscale Chronbach's $\alpha=0.57-0.91$	Face validity	X		X	X	
Medication Taking Questionnaire Purposeful Action ³⁴	20	Chronbach's $\alpha=0.88$	Content and construct validity	X				
Medication Compliance Questionnaire ³⁰	10	Subscale Chronbach's $\alpha=0.67$ and 0.84 Test-retest reliability=0.78 and 0.93	Validity of this survey has been established in a pilot study	X		X		
Self-efficacy Scale ^{36,39}	11	Chronbach's $\alpha=0.9$		X				
Patient's intention, attitude, subjective norms, and perceived behavioral control ³⁶	11	Subscale Chronbach's $\alpha=0.77$ and 0.61		X				
Morisky Medication Adherence Scale ^{29,42,54,70,100-105}	8	Cronbach's $\alpha=0.83$	Concurrent and predictive validity	X				
Visit-Specific Satisfaction Questionnaire ⁷¹	5	Chronbach's $\alpha=0.87$	Concurrent and predictive validity					X
Modified Social Support Survey ³⁹	18	Chronbach's $\alpha=0.88$	Convergent and discriminant validity				X	
Medication Adherence Inventory ⁵⁵	13	Subscale Chronbach's $\alpha=0.74-0.90$	Concurrent validity	X				
Patient perception about provider communication ⁴⁷	13	Chronbach's $\alpha=0.92$						X
Medication Adherence Factors Questionnaire ²³	10		Content validity	X		X	X	X
Self-Reported Medication Taking Behavior ²⁷	10	Cronbach's $\alpha=0.92$		X	X	X		
Barriers to medication adherence ²⁷	4			X				X
Patient-provider relationship ²⁷	8							X
Medication Adherence Scale ¹⁰⁶	15	Cronbach's $\alpha=0.82$		X				
Reasons for noncompliance with antihypertensive medication ²⁴	16			X	X	X	X	
Satisfaction with Information about Medicines Scale ⁷⁰	17	Chronbach's $\alpha=0.89$	Criterion validity					X
Drug Attitude Inventory ¹⁰⁷	10	Cronbach's $\alpha=0.65$		X				

^aModified version of Hill-Bone Compliance Scale that only measures adherence to medication.

commonly used instrument. This instrument is a generic survey that measures nonadherence to medications due to the following 4 reasons: forgetfulness, carelessness, feeling better, or feeling worse. These 4 reasons are not necessarily correlated with each other.⁶ Consequently, the 4-item Morisky Medication Adherence Scale has a low internal consistency (Cronbach's $\alpha=0.61$). Krousel-Wood and colleagues⁴² modified the 4-item Morisky Medication Adherence Scale to capture more adherence barriers. The new 8-item Morisky instrument measures a specific medication-taking behavior instead of a determinant of nonadherence; moreover, this scale has better internal consistency (Cronbach's $\alpha=0.83$). Volis and colleagues⁶ encouraged researchers to consider a two-step approach to measuring adherence where brief instruments such as the Morisky model are used to detect the presence of adherence and comprehensive models are used to measure barriers to hypertension.

The majority of survey instruments did not have established psychometric properties.

Self-report is the only way to gain insight into patient perceptions of barriers; thus, accurate self-report measurement is imperative. Researchers and clinicians should select tools with good evidence of reliability and validity.

In hypertension, it has been well recognized that adherence requires a multifactorial intervention.^{5,43,44} Current survey instruments are overwhelmingly focused on patient-related barriers and do not reflect the shift to a multifactorial paradigm. For example, surveys frequently measured forgetfulness but did not measure patients' awareness or use of adherence aids (eg, reminder packaging and drug calendars), which have been shown to improve adherence to medications.⁴⁵ Patients' use of adherence aids may be related to the communication strategies of the health care professional, the ability of the patient to afford these items, and/or availability in the health care system. All these barriers extend beyond the patient.

This focus on patient-related barriers reflects the common notion that these barriers are the principal determinants of nonadherence. For a given group of patients, we cannot say with certainty which barriers are prevalent or relevant. In a recent study of African American men who do not have regular health providers, patient factors (ie, age, self-efficacy, and depression) were predictive of adherence with antihypertensive medication; however, health care professional communication was not.⁴⁶ In a separate study, collaborative provider communication was associated with better adherence to antihypertensive medication in African American patients.⁴⁷ Relationships between barriers is complex. For example, the association between depressive symptoms and low adherence to antihypertensive medications was mediated by self-efficacy.⁴⁸

While, it is not realistic to have one instrument measure all barriers to medication adherence in

hypertension, clinicians and researchers may consider measuring barriers that are relevant to their unique patient population and interventions.⁴⁹ Indeed, the majority of studies in this sample elected to employ >1 survey. Social behavioral theory may be useful in helping clinicians and researchers determine which barriers may be most relevant to a given population.⁸

There are several barriers that require either survey development and/or integration from other disease areas. Patient participation in the treatment plan is a component of health care team-related dimension that enables patients to reveal their beliefs and concerns about medications; however, this component was measured in only one study.⁴⁷ The same can be said with patient physical demands that were not commonly measured, although they represent substantial barriers to adherence. Patients' health literacy was underrepresented, even though this barrier is correlated with nonadherence and poor health outcomes in patients with cardiovascular diseases.⁵⁰ Similarly, financial burden is an underrepresented socioeconomic barrier to adherence in cardiovascular diseases.⁵¹

Each individual barrier may require multiple questions to achieve a valid and reliable measurement. Several barriers such as patients' beliefs about medications and patients' satisfaction with health care provider were measured with a single item. For instance, the level of patient satisfaction may require measurement of underlying components of this construct (eg, patients' perceptions about provider behavior, patients' perceptions about provider technical skills, and patients' satisfaction about information provided). Likewise, measurement of patients' beliefs about medications requires assessment of patients' perceptions about the necessity and potential harms of medications.

There are various challenges to measurement of adherence barriers. First, specific barriers may not be stable over time and vary with individual medications. Second, the multifactorial nature of nonadherence barriers may lead to lengthy surveys and a significant burden to respondents. Third, different patient characteristics such as age, race, level of health literacy, and patients' beliefs may represent challenges to measurement. Furthermore, other characteristics associated with social norms, clinical settings, and the integrity of health care systems also represent a challenge to measurement. Fourth, measurement is influenced by the relationships between barriers from different dimensions (eg, self-efficacy and depression). Finally, longitudinal assessment may be required to distinguish between chronic and episodic nonadherence and related-barriers that may contribute to these types of nonadherence.

Since adherence is a common and dynamic process that affects patient health, it should be a priority for health care policy. Health care providers should consider measurement of adherence and barriers as

common health practices and use patient-specific information to guide the selection of the most relevant interventions to enhance adherence.

LIMITATIONS

There are several limitations of this systematic review. First, the search was limited to literature published in English, which may eliminate studies published in other languages. Second, we restricted this search to hypertension, but we believe that the focus on one disease will enhance the understanding of barriers that may affect adherence to medications of the targeted disease. Third, further validity and reliability testing may have been conducted in research that we did not identify in this review. Fourth, the development of measures of adherence barriers may be influenced by the time period in which the study was performed, as a typical patients' age and the number of antihypertensive medications may differ over the 3 decades of study. Fifth, we included studies published from 1980, despite the fact that the WHO Adherence Model was developed in 2003 for two reasons. We observed that many surveys were developed before 2000 and the WHO framework did not introduce new barriers but distributed the focus among multiple barriers. Finally, we did not perform a meta-analysis because of the heterogeneity of the identified surveys, which measured adherence barriers.

Implications for Research and Practice

Researchers and clinicians may consider using a combination of survey instruments with evidence for reliability and validity to measure adherence barriers specific to their context. The MTQ^{25,52} covers 4 domains (ie, patients, therapy, socioeconomic, and health systems) in 16 questions and could be paired with the Epidemiologic Studies Depression Scale Short-Form⁴¹ to measure the condition domain in 10 questions.

While it is important to consider the complete WHO Adherence Model, research in adherence should not use a one-size-fits-all approach.⁴⁹ A clinician or researcher may be interested in a specific construct and/or patient response burden may limit measurement of all 5 domains. For example, in an elderly population, the BMQ²⁰ can be used to identify the potential effect of patient's physical demands on adherence.

CONCLUSIONS

Patient-related barriers were the most commonly identified in this review, while condition, therapy, and socioeconomic barriers were underrepresented. The majority of surveys did not have evidence for reliability and validity. The complexity of adherence behavior requires robust self-report measurements and the inclusion of barriers relevant to each unique patient population and intervention. Future research should consider both the psychometric properties of self-report measures and the use of multidimensional adherence models to guide the measurement

of barriers to adherence to antihypertensive medications to help both clinicians and researchers understand how to optimize medication therapy and reduce the burden of uncontrolled hypertension.

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Supporting Information

Additional Supporting Information may be found in the online version of this article:

Table SI. Characteristics of surveys and use of the World Health Organization dimensions in the surveys.

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