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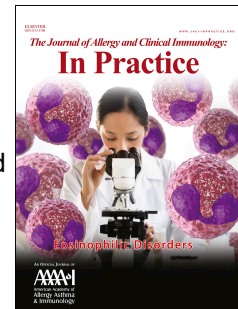
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International Barriers to Asthma Medication Adherence

**A Scoping Review of International Barriers to Asthma Medication Adherence
Mapped to the Theoretical Domains Framework**

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None of the authors have conflict of interests

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Abstract:

Background: Internationally, adult asthma medication adherence rates are low. Studies characterizing variations in barriers by country are lacking.

Objective: Conduct a scoping review to characterize international variations in barriers to asthma medication adherence among adults.

Methods: Searched MEDLINE, EMBASE, WOS, and CINAHL from inception to February 2017. Selected English-language studies employing qualitative methods (e.g., focus groups, interviews) to assess adult patient and/or caregiver-reported barriers to asthma medication adherence. Two investigators independently identified, extracted data, and collected study characteristics, methodologic approach, and barriers. Mapped barriers using Theoretical Domains Framework and categorized findings according to participant's country of residence, countries' gross national income and presence of universal health care (World Health Organization definitions).

Results: Among 2,942 unique abstracts, we reviewed 809 full-texts. Among these, we identified N=47 studies, conducted in 12 countries, meeting eligibility. Studies included a total of n=2,614 subjects, predominately female (67%), and mean age 19.1 to 70 years. Most commonly reported barriers were beliefs about consequences (e.g., medications not needed for asthma control, N=29, 61.7%) and knowledge (e.g., not knowing when to take medication, N=27, 57.4%); least common was goals (e.g., asthma not a priority, N=1, 2.1%). In N=27 studies conducted in countries classified as high income (HIC) with universal health care (UHC), the

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most reported barrier was participants' beliefs about consequences (N=17, 63.3%). However, environmental context and resources (N=12, 66.7%) were more common in HIC without UHC.

Conclusion: International adherence barriers are diverse and may vary with a country's sociopolitical context. Future adherence interventions should account for trends.

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Highlights box:

What is already known about this topic? Internationally, adult patients with asthma have poor asthma medication adherence.

What does this article add to our knowledge? This article describes the diverse reasons for asthma medication adherence reported by patients around the world and how they may change based on the sociopolitical context in which patients live.

How does this study impact current management guidelines? Based on the findings of this study, providers should inquire about a broad set of reasons for asthma medication nonadherence with focus on the most common barriers reported in a particular country.

Keywords: asthma; medication adherence; compliance; Black; African-American; qualitative research; behavioral research; behavior change; theoretical domains framework; world health organization; gross national income; universal health care.

Abbreviations:

UHC – Universal Health Care

HIC – High Income Country

WHO – World Health Organization

EMBASE – Excerpt Medical Database

WOS – Web of Science

CINAHL – Cumulative Index to Nursing and Allied Health Literature

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- 85 MeSH – Medical Subject Headings
- 86 TDF – Theoretical Domains Framework
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Introduction

Globally, asthma affects 339 million people and is associated with significant disability, health care utilization, impaired quality of life and mortality.(1-3) There are many contributors to asthma morbidity and mortality including gross national income, access to health care, air pollution, occupational exposures, and environmental tobacco smoke.(1) However, it is estimated that nonadherence to asthma medications affects 30-70% of adults with asthma and improving adherence is a key strategy to reducing the global burden of asthma.(4-7)

Barriers to asthma medication adherence include, but are not limited to, poor asthma knowledge, cost, and access to health insurance.(8) In research studies, these barriers are often the target of adherence interventions.(9, 10) However, evidence suggests some of these barriers, including medication costs and access to health care insurance, are influenced by the sociopolitical contexts within different countries.(8) In order to reduce the global burden of asthma, adherence interventions may need to be tailored to the sociopolitical contexts of individuals' countries of residence.

Little is known about how barriers to asthma medication adherence might differ around the globe based on various countries' gross national income and provision of universal health care coverage. Examining variation in barriers to adherence among countries with different sociopolitical contexts could inform the development of future interventions tailored to address individuals' contexts.

We sought to describe and characterize trends in patient-reported barriers to asthma medication adherence in countries of varied economic wealth and health care coverage.

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Methods

We conducted a scoping literature review to identify adult asthma patient-reported barriers to asthma medication adherence among countries with varied economic wealth and universal health care policies. We categorized barriers by domains in the Theoretical Domains Framework (TDF), a framework commonly used to characterize barriers to behavior change.⁽¹¹⁾

Literature Search Strategy

We designed our search strategy to be inclusive as possible of published and non-published investigations. An experienced librarian conducted searches in MEDLINE®, Excerpt Medical database (EMBASE), Web of Science and Cumulative Index to Nursing and Allied Health Literature (CINAHL) from inception to February 2017. Investigators performed quality checks to ensure that the search identified known (i.e., highly publicized or impactful) studies on asthma medication adherence. Our search strategy used a combination of Medical Subject Headings (MeSH) terms and key words focused on “asthma”, “medication adherence”, and “qualitative methods”. (See online repository text Table EI for full search strategy)

We identified unpublished studies and conference abstracts through Web of Science. For conference abstracts, we searched for full text articles and additional reported outcomes in MEDLINE, google scholar, and the clinicaltrials.gov database. We excluded conference abstracts if no associated peer-reviewed publications were identified. We searched the references of studies included in our analysis and the references of prior review articles to identify additional studies that may meet our eligibility criteria. We imported all citations into DistillerSR.

Inclusion and Exclusion Criteria

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We established a priori study eligibility criteria (Table I). We sought to identify studies that used qualitative methods (e.g., focus groups, interviews) to elicit the first-hand perspectives of adults with asthma and their caregivers' perspectives about asthma medications. We limited to studies on adults because the barriers to adherence in children are different due to children's rapid developmental transitions, limited input in treatment decisions, and larger dependence on caregivers.(12-15) If studies included adults and children, they were included if the adult patient perspectives were reported separately from children's perspectives. We limited to patients and their caregivers because we were interested in primary accounts of barriers to asthma medication adherence. Caregivers were included to give voice to adult patients that may not be able to adequately express their perspectives (e.g., disability, limited capacity). We limited to studies using qualitative methods including focus groups and interviews. We limited to qualitative approaches that used open-ended questions to obtain a broader range of barriers to asthma medication adherence. We excluded studies that exclusively assessed barriers exclusively using closed-ended questions (e.g., questionnaires) with pre-specified answers because we were interested in obtaining a comprehensive list of patient-reported barriers to asthma medication adherence with minimal restriction placed by the investigators. We excluded studies that did not separately report findings for our study population (e.g., adult asthma) and/or topic of interest (e.g., asthma, asthma medication (Table I).

Study Selection

Two members of the team independently reviewed each title and abstract for eligibility (SR/DC, IR/RP, IR/DC). Reviewers resolved conflicts by discussion, and the third reviewer (IR or SR) adjudicated disagreements, if needed, during all stages of the review. Two team members (SR/DC), independently reviewed the full text of articles and discrepancy in inclusion/exclusion were resolved by discussion. We recorded the main reason for exclusion at each stage of study selection. The reason for full text exclusion were assessed in hierarchical

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order. We first assessed for the correct approach, then population, then perspective, then topic (Table I).

Data Extraction & Analysis

Two independent reviewers (SR, DC) extracted data from each study meeting our inclusion criteria with a standardized and structured form. Reviewers resolved conflicts by discussion, and the third reviewer (IR) adjudicated disagreements.

Our primary outcome of interest was patient-reported barriers to asthma medication adherence. Barriers to asthma medication adherence were categorized using the Theoretical Domains Framework (TDF). TDF is a behavior change theory with 14 domains covering a wide range of potential barriers.(16, 17) Definitions for TDF domains are included in Table II.

Reviewers also extracted information on studies' population demographics (e.g., age, sex), approach (e.g., interview, focus group), study topic (e.g., asthma, asthma medications), participants' country of residence, the country's World Health Organization (WHO) and World Bank income level (i.e., high income, middle income, low income), and countries' presence of universal health care.(18, 19) Gross national income level was defined by WHO and World Bank definition.(19) We categorized studies by WHO gross national income and presence of universal health care because medication adherence is known to be associated with socioeconomic status and access to health care.(8) Descriptive statistics were used to analyze the included studies.

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Results

We identified 2,942 unique titles and abstracts and assessed 838 full text manuscripts for eligibility (Figure 1). Using our inclusion/exclusion criteria, we excluded 791 full text manuscripts. The full texts were excluded because N=690 did not meet our study approach criteria by not including open-ended questions as part of their qualitative approach or by not using qualitative methods. Thirty-four did not meet the population criteria, because they had pediatric or mixed pediatric and adult population without subgroup analysis of adults. Two studies did not report the perspectives of adults, or caregivers of adults, with asthma. While N=24 did not report barriers to asthma medication adherence. Forty-one studies were excluded because they did not have full texts associated with their abstracts (Figure 1).

For our analysis, we included 47 studies meeting our inclusion criteria that were conducted in 12 countries. Included studies had a total of n=2,614 subjects with mean age ranging 19.1 to 70 years and were predominately female (67%) subjects (Table III). Most studies exclusively used interviews (N=36) and focused on asthma medications (N=22) or asthma in general (N=21). Most studies were conducted in high income countries (N=45), few were conducted in middle income countries (N=2), and no studies were conducted in low income countries. Twenty-seven studies were conducted in countries with universal health care and N=20 in countries without universal health care. Of the studies (N=20) conducted in countries without universal health care, most (N=17) were conducted in the United States (Table III).

Eight countries were classified as high income with universal health care and included 27 studies with 1,127 subjects (Table III). Two countries were classified as high income without universal health care and included 18 studies with 1,327 subjects—most of the studies (N=17) were conducted in the United States. Two studies were classified as middle income without universal health care and included 320 subjects (Table III).

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Study Outcome

Internationally, patient-reported barriers to asthma medication adherence are diverse. The most commonly reported barriers to asthma medication adherence were categorized as beliefs about consequences (e.g., medications not needed for asthma control, N=29, 61.7%), knowledge (e.g., not knowing when to take medication, N=27, 57.4%) and environmental context and resources (e.g., costs, N=25, 53.2%). The least commonly reported barriers were goals (e.g., asthma not a priority, N=1, 2.1%), reinforcement (e.g., asthma not valued, N=3, 6.4%), and emotion (e.g., fear of dependence, stress, N=3, 6.4%) (Table IV). Table V includes examples of barriers categorized by domains in the Theoretical Domains Framework.

Analysis by WHO Gross National Income Level and Universal Health Care

In high income countries with universal health care, the three most commonly reported barriers were categorized as belief about consequences (N=17, 63.3%), knowledge (N=16, 59.3%), and social influence (N=12, 44.4%). In high income countries without universal health care the most commonly reported barriers were categorized as environmental context and resources (N=12, 66.7%), beliefs about consequences (N=11, 61.1%), and knowledge (N=10, 55.6%). In middle income countries without universal health care the most commonly reported barriers were categorized as memory, attention and decision (N=2, 100%), environmental context and resources (N=2, 100%), and emotion (N=2, 100%) (Table VI).

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DISCUSSION

In this scoping review of 47 studies conducted among 12 nations, we found study participants reported a wide range of barriers to asthma medications adherence, and that prevalence of barriers reported appeared to differ according to the presence of universal health care and gross national income. Lack of knowledge about asthma and belief about consequences were the most frequently reported barriers across all countries. Environmental context and resources, such as cost and access to health care, were more frequently reported among studies conducted in countries without universal health care; while barriers related to social influences were more commonly reported in countries with universal health care. Our study can inform future adherence interventions through its description of the unique distributions of global asthma medication adherence barriers.

Our findings are consistent with the literature. Lack of knowledge and environmental context and resources are commonly cited as barriers to general medication adherence(20) and specifically asthma medication adherence.(21, 22) Indeed, there are interventions targeting these barriers such as asthma self-management programs, motivational interviewing, and services that provide free or low cost access to asthma medications.(9, 10, 23) However, there has been less emphasis on barriers categorized in the other domains of the Theoretical Domains Framework (e.g., social identity, beliefs about consequences) despite their common occurrence in our study.

To our knowledge, this is the first international characterization of barriers to asthma medication adherence among qualitative studies in pulmonary disease. Our study is unique in that we categorized global barriers to adherence, and we used a comprehensive behavior change theory—the Theoretical Domains Framework—that can facilitate the development of future adherence interventions. There is increasing evidence that public health and health promotion interventions based on social and behavioral theory are more effective than those

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lacking a theoretical base.(11) Theory-based conceptual models 1. Identify the behavioral antecedents (i.e., barriers/enablers) and their relationship to the target behavior, 2. Select intervention methods to match targeted barrier/enablers, 3. Inform intervention evaluation, and 4. Identify “active ingredients” in interventions.(24) The Theoretical Domains Framework synthesizes elements of existing behavioral theories (e.g., health belief model, social cognitive theory, theory of planned behavior) most relevant to changing behavior and was developed using an expert consensus process and validation. Compared to any single behavioral theory, the theoretical domains framework covers a wider range of potential barriers and enablers and is therefore likely to identify more potential intervention strategies to improve asthma medication adherence. Our study provides the necessary foundation to describe and characterize barriers that can be used as future intervention targets.

There were a few limitations to this scoping review. The 47 included studies represent 12 countries, but there were only 2 middle income countries, no low income countries, and no studies conducted in Eastern Europe, Middle-East, Africa, Central America, or Asia. In addition, about 50% of study participants were from the US. We aimed for primary accounts of barriers to adherence so we may have missed some barriers by limiting to the perspectives of adult patients and their caregivers and excluding input from providers and health system staff. Our analysis was underpowered to statistically compare the relative prevalence of barriers. Lastly, our search was through 2017. Though the search yielded a comprehensive identification of barriers in all domains of our behavior theory, the included patient perspectives were collected before widespread use, and research of single maintenance and reliever therapy (SMART) in mild and moderate asthma and may not represent barriers to SMART.

Internationally, patient’s with asthma have a diverse set of barriers to asthma medication adherence. Lack of knowledge about asthma and belief about consequences were the most frequently reported barriers across all countries. The relative prevalence of barriers due to social

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influences were more commonly reported in high income countries with universal health care while environmental consequences and resources were more commonly reported in high income countries without universal health care. These findings highlight the diversity in barriers to adherence in various countries; the need for interventions targeting multiple barriers to adherence; and, the tailoring of intervention to the unique distribution of barriers based on the person's sociopolitical context.

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Table I: Inclusion and Exclusion Criteria

	Inclusion	Exclusion
Method/Approach	Qualitative Approach- study includes focus groups or interviews with open-ended questions	All other approaches
Population	Age 18 years or older or adult data reported separately Patients with asthma or asthma data reported separately	All other populations
Perspective	Reports the perspectives of adult asthma patients and/or the caregivers of adult asthma patients or reports adults/caregivers' perspectives separately	Sole perspectives of providers, children, health systems, or any other non-adult patient/caregiver perspectives.
Topic	Asthma medications	All other topics

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Table II: Definitions for Domains in the Theoretical Domains Framework for asthma studies	
Theoretical domain	Definition
Knowledge	Familiarity, awareness and understanding of asthma (e.g., know when to use inhalers)
Skills	An ability or proficiency to self-manage asthma acquired through practice (e.g., know how to use an asthma action plan, know how to use each inhaler)
Social/professional role and identity	A sense of self based on membership in a social or professional group (e.g., identifying as caretaker in their family)
Beliefs about capabilities	Belief in one's ability to manage their asthma
Optimism	Belief or confidence that asthma can be controlled; belief that taking asthma medication can decrease asthma symptoms
Beliefs about consequences	Acceptance of truth or belief that asthma behaviors (e.g., medication adherence, allergy avoidance) lead to a given outcome
Reinforcement	To encourage, strengthen or provide support for asthma management
Intentions	A conscious decision to perform asthma self-management skills such as asthma medication adherence and allergy avoidance.
Goals	Mental outcomes that a person wants to achieve (e.g., ability to play with their children, no asthma exacerbations)
Memory, attention and decision processes	The ability to remember, focus, and choose asthma self-management (e.g., remembering to take asthma medication, choosing to take heart medication and not asthma medication)
Environmental context and resources	Any circumstance of a person's environment (e.g., physical, social, political, financial) that affects asthma self-management. (e.g., cost, access to health insurance, social support)
Social influences	Changing ideas and actions in response to another person or social group.
Emotion	A state of mind or mental reaction determined by one's circumstances (e.g., fear, stressed, happy)

International Barriers to Asthma Medication Adherence

Table II: Definitions for Domains in the Theoretical Domains Framework for asthma studies	
Theoretical domain	Definition
Behavioral regulation	Resist using unhealthy behaviors to manage emotions and pursue a goal. (e.g., not smoking when stressed so asthma remains well controlled)
Definitions of the theoretical domains(25, 26). Definitions are based on definitions from the American Psychological Associations' Dictionary of Psychology(27).	

International Barriers to Asthma Medication Adherence

Table III: Study Characteristics by Country											
Study Characteristics	Australia N=8(28-35)	Brazil N=1(36)	Canada N=4(37-40)	Denmark N=1(41)	India N=1(42)	Ireland N=1(43)	Netherlands N=3(44-46)	Sweden N=2(47, 48)	United Kingdom N=8(49-56)	United States N=17(57-73)	Spain, France & United Kingdom N=1(74)
Publication Years (range)	2002-2016	2008	2008-2014	2014	2015	2016	2010-2015	2001-2013	1997-2010	2003-2016	2003
Subjects per study (#)	17-62	NA	13-29	NA	NA	NA	13-19	63-216	10-35	5-328	NA
Total Subjects (#)	n=317	n=160	n=79	n=10	n=160	n=31	n=51	n=279	n=185	n=1296	n=46
Age mean age range (y)	39-79 5NR	49	40.2-52.5 1NR	NR	51.5	43.1	NR	22-52	39.5-44 4NR	19.1-67.7 5NR	34
Female: Male	148F: 54M 3 NR	120F: 40M	48F: 31M	6F: 4M	73F: 87M	21F: 10M	33F: 18M	184F: 95M	73F: 56M 2NR	481F: 188 M 5NR	26F: 20M
Approach	6 Int; 2 FG/Int	1 Int	1 Int 3 FG	1 Int	1 Int	FG	2 Int 1 FG/Int	2 Int	8 Int	13 Int 5 FG	1 Int
Study Focus											
Asthma Medication	2	1	2	-	-	-	2	2	7	6	-

International Barriers to Asthma Medication Adherence

[illegible]

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Domains	Total N=47	Australia N=8(28-35)	Brazil N=1(36)	Canada N=4(37-40)	Denmark N=1(41)	India N=1(42)	Ireland N=1(43)	Netherlands N=3(44-46)	Sweden N=2(47, 48)	United Kingdom N=8(49-56)	United States N=17(57-73)	Spain, France & United Kingdom N=1(74)
Knowledge	27 (57.4)	5	1	3	1	-	1	2	1	4	9	-
Skills	14 (29.8)	3	-	3	-	1	-	1	-	2	4	-
Identity	9 (19.1)	1	-	2	-	-	1	1	1	3	-	-
Beliefs about capability	15 (31.9)	4	-	2	-	-	1	1	2	2	3	-
Optimism	3 (6.4%)	-	-	2	-	-	-	-	-	1	-	-
Beliefs about consequences	29 (61.7)	4	-	4	1	1	1	1	1	5	10	1
Reinforcement	3 (6.4)	-	-	-	-	1	-	1	-	1	-	-
Intentions	10 (21.3)	1	-	3	-	-	-	-	1	1	3	1
Goals	1 (2.1)	-	-	-	-	-	-	1	-	-	-	-
Memory, Attention, and decision	17 (36.2)	3	1	2	-	1	-	1	-	-	8	1

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processes												
Environment al Context and Resources	25 (53.2)	3	1	3	-	1	1	2	1	2	11	-
Social Influences	19 (40.4)	3	-	4	-	1	1	2	1	2	5	-
Emotion	17 (36.2)	2	1	1	-	1	1	1	1	2	7	-
Behavioral Regulation	16 (34.0)	4	-	3	1	-	-	-	1	2	5	-

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Table V: Patient-Reported Barriers to Asthma Medication Adherence Categorized by Domains in the Theoretical Domains Framework

Theoretical domain	Paraphrased Statements
Knowledge	The most important thing is to ensure our understanding.(50) I do not like to take medicine without asking questions.(53) I like to know what provider do. They never tell you things. You have to find it out for yourself.(53)
Skills	It's important to learn how to use medication properly.(34)
Social/professional role and identity	When you are responsible for other people you forget about yourself. It's a man's nature to think about themselves first, but women think about others first. I take care of my family with medical problems so asthma is not always my priority.”(72)
Beliefs about capabilities	It is very difficult to accept that you have asthma. You have to accept you are taking your asthma medication and everything is fine.(37)
Beliefs about consequences	I frequently do not take my inhalers because when I do not have symptoms, I tell myself that I do not need it.(39) I just take medications when I need them because I'm anti-drug and pill.(55)
Memory, attention and decision processes	Taking medication is something you add to an already busy schedule.(39) I work and I have a small child. I'm so busy that it's hard to remember to take my asthma medication.(72)
Environmental context and resources	I cannot afford my steroid inhaler. I try to compensate by using my rescue inhaler more.(28) I knew I was going to have a gap in insurance coverage, so I stockpiled my medication for me and my kids. I made sure I filled prescriptions even if I didn't use them.(71)
Emotion	I'm afraid of becoming addicted to my asthma medication.(40) I hate taking my asthma medication. The doctor said there are no long-term concerns, but I was scared that I would get immune to them.(28)
<i>Quotes may be categorized in more than one domain in the theoretical domains framework.</i>	

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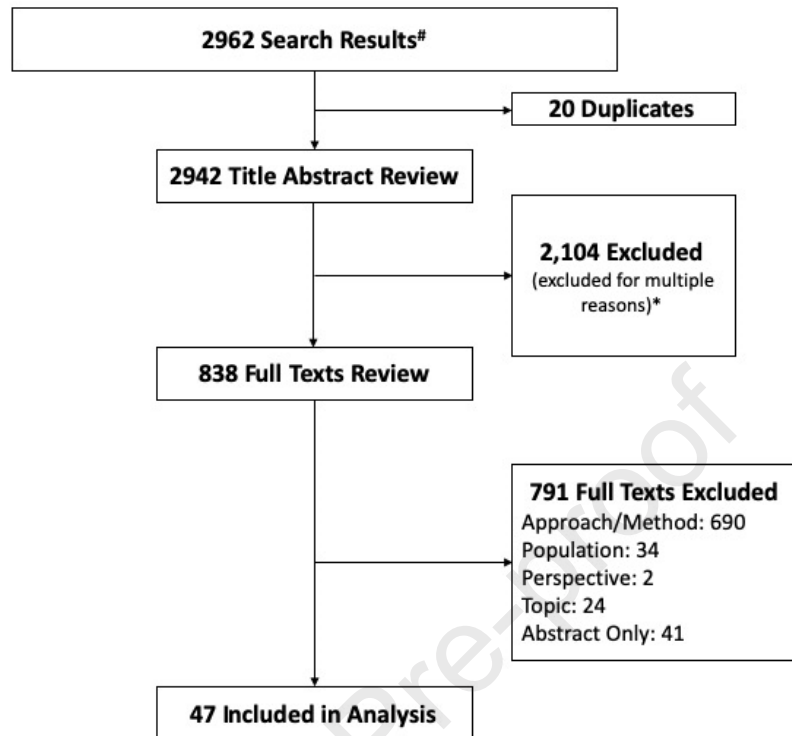
Table VI: Patient-Reported Barriers to Asthma Medication Adherence by WHO Gross National Income Level and Universal Health Care			
Theoretical Domains Framework Domains	High Income With Universal Health Care(28-35, 37-41, 44-56, 74)	High Income Without Universal Health Care(57-74)	Middle Income Without Universal Health Care(36, 42)
	N=27 studies (%) 1127 subjects	N=18 studies (%) 1327 subjects	N=2 studies (%) 320 subjects
Knowledge	16 (59.3)	10 (55.6)	1 (50.0)
Skills	9 (33.3)	4 (22.2)	1 (50.0)
Identity	8 (29.6)	1 (5.6)	0
Beliefs about capability	11 (40.7)	4 (22.2)	0
Optimism	3 (11.1)	0	0
Beliefs about consequences	17 (63.0)	11 (61.1)	1 (50.0)
Reinforcement	2 (7.4)	0	1 (50.0)
Intentions	7 (25.9)	3 (16.7)	0
Goals	1 (3.7)	0	0
Memory, Attention, and decision processes	7 (25.9)	8 (44.4)	2 (100)
Environmental Context and Resources	11 (40.7)	12 (66.7)	2 (100)
Social Influences	12 (44.4)	6 (33.3)	1 (50.0)
Emotion	7 (25.9)	8 (44.4)	2 (100)
Behavioral Regulation	11 (40.7)	5 (27.8)	0
<u>High income countries with universal health care:</u> Australia, Canada, Denmark, Netherlands, Sweden, United Kingdom, France, Spain <u>High income countries without universal health care:</u> United States, Republic of Ireland <u>Middle income countries without universal health care:</u> Brazil, India WHO- World Health Organization			

International Barriers to Asthma Medication Adherence

Figure 1: Scoping Literature Review Flow Diagram

#Sources: EMBASE- Excerpta Medica dataBASE, WOS- Web of Science, CINAHL-Cumulative Index to Nursing and Allied Health Literature, MEDLINE;

*Excluded for multiple reasons including: non-qualitative study (e.g., epidemiologic, intervention, exclusive quantitative methods), exclusively conducted in children, exclusively a non-asthma condition, or exclusively from a non-patient/caregiver perspective.



International Barriers to Asthma Medication Adherence

**A Scoping Review of International Barriers to Asthma Medication Adherence
Mapped to the Theoretical Domains Framework: Role of Gross National Income
and Universal Health Care**

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None of the authors have conflict of interests

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Online Repository Text

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Table E1: Search Strategy

PubMed:

#1	("asthma"[MeSH Terms] OR asthma[tiab] OR asthmatic[tiab]) NOT (("Adolescent"[Mesh] OR "Child"[Mesh] OR "Infant"[Mesh]) NOT "Adult"[Mesh])	124,059
#2	"Patient Compliance"[Mesh] OR "Medication Adherence"[tiab] OR "Medication Compliance"[tiab] OR "Medication nonadherence"[tiab] OR "Medication non adherence"[tiab] OR "Medication Noncompliance"[tiab] OR "Medication non compliance"[tiab] OR "Medication Compliance"[tiab] OR "Medication Persistence"[tiab] OR "Health Knowledge, Attitudes, Practice"[Mesh]	149,914
#3	("Administration, Inhalation"[Mesh] OR "Nebulizers and Vaporizers"[Mesh] OR inhaler[tiab] OR inhalers[tiab] OR asthma treatment*[tiab] OR "asthma medication"[tiab] OR "asthma medications"[tiab] OR "controller medication"[tiab] OR "controller medications"[tiab] OR asthma control*[tiab] OR "asthma management"[tiab] OR antiasthmatic[tiab] OR antiasthmatics[tiab] OR "anti asthmatic"[tiab] OR "anti asthmatics"[tiab] OR "asthma drug"[tiab] OR "asthma drugs"[tiab] OR "controller drug"[tiab] OR "controller drugs"[tiab] OR "Anti-Asthmatic Agents"[Pharmacological Action] OR "Anti-Asthmatic Agents"[Mesh] OR "accolate"[tiab] OR "advair"[tiab] OR "aerobid"[tiab] OR "albuterol"[Mesh] OR "albuterol"[tiab] OR "aminophylline"[Mesh] OR "aminophylline"[tiab] OR "arformoterol"[tiab] OR "asmanex"[tiab] OR "azmacort"[tiab] OR "beclomethasone"[Mesh] OR "beclomethasone"[tiab] OR "benralizumab"[Supplementary Concept] OR "benralizumab"[tiab] OR "brethine"[tiab] OR "budesonide"[Mesh] OR "budesonide"[tiab] OR "budesonide, formoterol fumarate drug combination"[Mesh] OR "cromolyn sodium"[Mesh] OR "cromolyn"[tiab] OR "daliresp"[tiab] OR "deltasone"[tiab] OR "dexamethasone"[Mesh] OR "dexamethasone"[tiab] OR "dulera"[tiab] OR "dupilumab"[tiab] OR "elixophyllin"[tiab] OR "flovent"[tiab] OR "flunisolide"[Supplementary Concept] OR "flunisolide"[tiab] OR "fluticasone propionate, salmeterol xinafoate drug combination"[Mesh] OR "fluticasone"[Mesh] OR "fluticasone"[tiab] OR "foradil"[tiab] OR "formoterol fumarate"[Mesh] OR "formoterol"[tiab] OR "indacaterol"[Supplementary Concept] OR "indacaterol"[tiab] OR "intal"[tiab] OR "lebrikizumab"[Supplementary Concept] OR "lebrikizumab"[tiab] OR "levalbuterol"[Mesh] OR "levalbuterol"[tiab] OR "maxair"[tiab] OR "medrol"[tiab] OR "mepolizumab"[Supplementary Concept] OR "mepolizumab"[tiab] OR "methylprednisolone"[Mesh] OR "methylprednisolone"[tiab] OR "mometasone furoate"[Mesh] OR "mometasone furoate, formoterol fumarate drug combination"[Mesh] OR "mometasone"[tiab] OR "montelukast"[Supplementary Concept] OR "montelukast"[tiab] OR "nedocromil"[Mesh] OR "nedocromil"[tiab] OR "olodaterol"[Supplementary Concept] OR "olodaterol"[tiab] OR "omalizumab"[Mesh] OR "omalizumab"[tiab] OR "onbrez"[tiab] OR "pediapred"[tiab] OR "pirbuterol"[Supplementary Concept] OR "pirbuterol"[tiab] OR "prednisolone phosphate"[Supplementary Concept] OR "prednisolone"[Mesh] OR "prednisolone"[tiab] OR "prednisone"[Mesh] OR "prednisone"[tiab] OR "proair"[tiab] OR "procaterol"[Mesh] OR "procaterol"[tiab] OR "proventil"[tiab] OR	27,056

International Barriers to Asthma Medication Adherence

	"pulmicort"[tiab] OR "qvar"[tiab] OR "Roflumilast"[Supplementary Concept] OR "Roflumilast"[tiab] OR "salmeterol xinafoate"[Mesh] OR "salmeterol"[tiab] OR "SAR231893"[Supplementary Concept] OR "SAR231893"[tiab] OR "serevent"[tiab] OR "singulair"[tiab] OR "spiriva"[tiab] OR "symbicort"[tiab] OR "terbutaline"[Mesh] OR "terbutaline"[tiab] OR "theolair"[tiab] OR "theophylline"[Mesh] OR "theophylline"[tiab] OR "tilade"[tiab] OR "tiotropium bromide"[Mesh] OR "tiotropium"[tiab] OR "tralokinumab"[Supplementary Concept] OR "tralokinumab"[tiab] OR "triamcinolone acetonide"[Mesh] OR "triamcinolone"[Mesh] OR "triamcinolone"[tiab] OR "uniphyl"[tiab] OR "ventolin"[tiab] OR "vilanterol"[Supplementary Concept] OR "vilanterol"[tiab] OR "xolair"[tiab] OR "xopenex"[tiab] OR "zafirlukast"[Supplementary Concept] OR "zafirlukast"[tiab] OR "zileuton"[Supplementary Concept] OR "zileuton"[tiab] OR "zyflo"[tiab]) AND ("Patient Acceptance of Health Care"[Mesh] OR adhere*[tiab] OR nonadhere*[tiab] OR non adhere*[tiab] OR comply[tiab] OR complian*[tiab] OR noncomplian*[tiab] OR non complian*[tiab] OR satisfaction[tiab] OR participation[tiab] OR acceptance[tiab] OR preference*[tiab] OR attitude*[tiab] OR self-manage*[tiab] OR barrier[tiab] OR barriers[tiab] OR belief[tiab] OR beliefs[tiab] OR enable*[tiab] OR facilitate*[tiab] OR "Perception"[Mesh] OR perception[tiab] OR perceptions[tiab] OR perceive[tiab] OR perceived[tiab] OR misperception[tiab] OR misperceptions[tiab] OR misperceive[tiab] OR misperceived[tiab])	
#4	#1 AND (#2 OR #3)	5,196
#5	"Focus Groups"[Mesh] OR "Qualitative research"[Mesh] OR "Observational Study"[Publication Type] OR "Observational Studies as Topic"[Mesh] OR "Interview"[Publication Type] OR "personal narratives as topic"[Mesh] OR "interviews as topic"[Mesh] OR "Narration"[Mesh] OR "Nursing Research"[Mesh] OR "Anecdotes as Topic"[Mesh] OR "Tape Recording"[Mesh] OR "semi-structured"[tiab] OR semistructured[tiab] OR unstructured[tiab] OR informal[tiab] OR "in-depth"[tiab] OR indepth[tiab] OR "face-to-face"[tiab] OR structured[tiab] OR interview*[tiab] OR discussion[tiab] OR discussions[tiab] OR "focus group"[tiab] OR "focus groups"[tiab] OR qualitative[tiab] OR ethnography[tiab] OR ethnographic[tiab] OR fieldwork[tiab] OR "field work"[tiab] OR "key informant"[tiab] OR questionnaire[tiab] OR questionnaires[tiab] OR survey[tiab] OR surveys[tiab] OR surveyed[tiab] OR open-ended question*[tiab] OR "thematic analysis"[tiab] OR workshop[tiab] OR workshops[tiab]	1,517,082
#6	#4 AND #5	1,914
#7	#6 AND English[lang] NOT (animals[mh] NOT humans[mh]) NOT (Editorial[ptyp] OR Letter[ptyp] OR Case Reports[ptyp] OR Comment[ptyp])	1,757

Embase:

No.	Query	Results
#1	'asthma'/exp OR asthma:ti,ab OR asthmatic:ti,ab AND [adult]/lim	59,031
#2	'patient compliance'/exp OR 'medication adherence':ti,ab OR 'medication compliance':ti,ab OR 'medication nonadherence':ti,ab OR 'medication non adherence':ti,ab OR 'medication noncompliance':ti,ab OR 'medication non compliance':ti,ab OR 'medication compliance':ti,ab OR 'medication persistence':ti,ab OR 'adherence to therapy':ti,ab OR 'adherence to treatment':ti,ab OR 'compliance to therapy':ti,ab OR 'compliance to treatment':ti,ab OR 'patient adherence':ti,ab OR	222,254

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	'patients adherence':ti,ab OR 'therapy adherence':ti,ab OR 'therapy compliance':ti,ab OR 'treatment adherence':ti,ab OR 'treatment compliance' OR 'attitude to health'/exp	
#3	('inhaler'/exp OR inhaler:ti,ab OR inhalers:ti,ab OR 'asthma treatment':ti,ab OR 'asthma treatments':ti,ab OR 'asthma medication':ti,ab OR 'asthma medications':ti,ab OR 'controller medication':ti,ab OR 'controller medications':ti,ab OR asthma control*:ti,ab OR 'asthma management':ti,ab OR antiasthmatic:ti,ab OR antiasthmatics:ti,ab OR 'anti asthmatic':ti,ab OR 'anti asthmatics':ti,ab OR 'asthma drug':ti,ab OR 'asthma drugs':ti,ab OR 'controller drug':ti,ab OR 'controller drugs':ti,ab OR 'antiasthmatic agent'/exp OR 'accolate':ti,ab OR 'advair':ti,ab OR 'aerobid':ti,ab OR 'albuterol':ti,ab OR 'aminophylline':ti,ab OR 'arformoterol':ti,ab OR 'asmanex':ti,ab OR 'azmacort':ti,ab OR 'beclomethasone':ti,ab OR 'benralizumab':ti,ab OR 'brethine':ti,ab OR 'budesonide':ti,ab OR 'cromolyn':ti,ab OR 'daliresp':ti,ab OR 'deltasone':ti,ab OR 'dexamethasone':ti,ab OR 'dulera':ti,ab OR 'dupilumab':ti,ab OR 'elixophyllin':ti,ab OR 'flovent':ti,ab OR 'flunisolide':ti,ab OR 'fluticasone':ti,ab OR 'foradil':ti,ab OR 'formoterol':ti,ab OR 'indacaterol':ti,ab OR 'intal':ti,ab OR 'lebrizumab':ti,ab OR 'levalbuterol':ti,ab OR 'maxair':ti,ab OR 'medrol':ti,ab OR 'mepolizumab':ti,ab OR 'methylprednisolone':ti,ab OR 'mometasone':ti,ab OR 'montelukast':ti,ab OR 'nedocromil':ti,ab OR 'olodaterol':ti,ab OR 'omalizumab':ti,ab OR 'onbrez':ti,ab OR 'pediapred':ti,ab OR 'pirbuterol':ti,ab OR 'prednisolone':ti,ab OR 'prednisone':ti,ab OR 'proair':ti,ab OR 'procaterol':ti,ab OR 'proventil':ti,ab OR 'pulmicort':ti,ab OR 'qvar':ti,ab OR 'Roflumilast':ti,ab OR 'salmeterol':ti,ab OR 'SAR231893':ti,ab OR 'serevent':ti,ab OR 'singulair':ti,ab OR 'spiriva':ti,ab OR 'symbicort':ti,ab OR 'terbutaline':ti,ab OR 'theolair':ti,ab OR 'theophylline':ti,ab OR 'tilade':ti,ab OR 'tiotropium':ti,ab OR 'tralokinumab':ti,ab OR 'triamcinolone':ti,ab OR 'uniphyll':ti,ab OR 'ventolin':ti,ab OR 'vilanterol':ti,ab OR 'xolair':ti,ab OR 'xopenex':ti,ab OR 'zafirlukast':ti,ab OR 'zileuton':ti,ab OR 'zyflo':ti,ab) AND ('patient attitude'/exp OR adhere*:ti,ab OR nonadhere*:ti,ab OR 'non adhere*:ti,ab OR comply:ti,ab OR complian*:ti,ab OR noncompliance*:ti,ab OR 'non compliance*:ti,ab OR satisfaction:ti,ab OR participation:ti,ab OR acceptance:ti,ab OR preference*:ti,ab OR attitude*:ti,ab OR 'self-manage*:ti,ab OR barrier:ti,ab OR barriers:ti,ab OR belief:ti,ab OR beliefs:ti,ab OR enable*:ti,ab OR facilitate*:ti,ab OR 'perception'/exp OR perception:ti,ab OR perceptions:ti,ab OR perceive:ti,ab OR perceived:ti,ab OR misperception:ti,ab OR misperceptions:ti,ab OR misperceive:ti,ab OR misperceived:ti,ab)	32,798
#4	#1 AND (#2 OR #3)	4,320
#5	'qualitative research'/exp OR 'observational study'/exp OR 'observational method'/exp OR 'questionnaire'/exp OR 'interview'/exp OR 'verbal communication'/exp OR 'thematic analysis'/exp OR 'recording'/exp OR 'semi-structured':ti,ab OR semistructured:ti,ab OR unstructured:ti,ab OR informal:ti,ab OR 'in-depth':ti,ab OR indepth:ti,ab OR 'face-to-face':ti,ab OR structured:ti,ab OR interview*:ti,ab OR discussion:ti,ab OR discussions:ti,ab OR 'focus group':ti,ab OR 'focus groups':ti,ab OR qualitative:ti,ab OR ethnography:ti,ab OR ethnographic:ti,ab OR fieldwork:ti,ab OR 'field work':ti,ab OR 'key informant':ti,ab OR questionnaire:ti,ab OR questionnaires:ti,ab OR survey:ti,ab OR surveys:ti,ab OR surveyed:ti,ab OR 'open-ended question*:ti,ab OR 'thematic analysis':ti,ab OR workshop:ti,ab OR workshops:ti,ab	2,432,939
#5	#3 AND #4	2,076

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#6	#5 AND [english]/lim AND [humans]/lim	1,912
#7	#6 NOT ('case report'/exp OR 'a case report':ti OR ': case report':ti OR 'case study'/exp OR 'editorial'/exp OR 'letter'/exp OR 'note'/exp OR [editorial]/lim OR [letter]/lim OR [note]/lim)	1,871

Web of Science:

Set	Search	Results
#1	TS=(asthma OR asthmatic)	164,711
#2	TS=("patient compliance" OR "medication adherence" OR "medication compliance" OR "medication nonadherence" OR "medication non adherence" OR "medication noncompliance" OR "medication non compliance" OR "medication compliance" OR "medication persistence" OR "adherence to therapy" OR "adherence to treatment" OR "compliance to therapy" OR "compliance to treatment" OR "patient adherence" OR "patients adherence" OR "therapy adherence" OR "therapy compliance" OR "treatment adherence" OR "treatment compliance" OR "attitude to health")	31,306
#3	TS=(inhaler OR inhalers OR "asthma treatment" OR "asthma treatments" OR "asthma medication" OR "asthma medications" OR "asthma drug" OR "asthma drugs" OR "controller drug" OR "controller drugs" OR "controller medication" OR "controller medications" OR "asthma control" OR "asthma management" OR antiasthmatic OR antiasthmatics OR "anti asthmatic" OR "anti asthmatics" OR accolat OR advair OR aerobid OR albuterol OR aminophylline OR arformoterol OR asmanex OR azmacort OR beclomethasone OR benralizumab OR brethine OR budesonide OR cromolyn OR daliresp OR dexasone OR dexamethasone OR dulera OR dupilumab OR elixophyllin OR flovent OR flunisolide OR fluticasone OR foradil OR formoterol OR indacaterol OR intal OR lebrikizumab OR levalbuterol OR maxair OR medrol OR mepolizumab OR methylprednisolone OR mometasone OR montelukast OR nedocromil OR olodaterol OR omalizumab OR onbrez OR pediapred OR pirbuterol OR prednisolone OR prednisone OR proair OR procaterol OR proventil OR pulmicort OR qvar OR Roflumilast OR salmeterol OR SAR231893 OR serevent OR singulair OR spiriva OR symbicort OR terbutaline OR theolair OR theophylline OR tilade OR tiotropium OR tralokinumab OR triamcinolone OR uniphyll OR ventolin OR vilanterol OR xolair OR xopenex OR zafirlukast OR zileuton OR zyflo) AND TS=("patient attitude" OR adherence OR nonadherence OR "non adherence" OR comply OR compliance OR noncompliance OR "non compliance" OR satisfaction OR participation OR acceptance OR preference OR preferences OR attitude OR attitudes OR "self-management" OR barrier OR barriers OR belief OR beliefs OR enable OR enables OR enabler OR enablers OR facilitate OR facilitates OR facilitators OR perception OR perceptions OR perceive OR perceived OR misperception OR misperceptions OR misperceive OR misperceived)	12,458
#4	#1 AND (#2 OR #3)	5,283
#5	TS=(qualitative OR "observational study" OR "observational method" OR "thematic analysis" OR "semi-structured" OR semistructured OR unstructured OR informal OR "in-depth" OR indepth OR "face-to-face" OR structured OR interview OR interviews OR discussion OR discussions OR "focus group" OR "focus groups" OR ethnography OR ethnographic OR fieldwork OR "field work" OR "key informant" OR questionnaire OR questionnaires OR survey OR surveys OR surveyed OR workshop OR workshops)	6,671,901
#5	(#3 AND #4) AND TS=(Adult OR Adults)	1,331

International Barriers to Asthma Medication Adherence

#6	#5 AND LANGUAGE: (English) DOCUMENT TYPES: (Article OR Meeting Abstract OR Review)	600
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CINAHL:

No.	Query	Results
S1	(MH "Asthma+") OR TI (asthma OR asthmatic) OR AB (asthma OR asthmatic)	32,896
S2	(MH "Medication Compliance") OR TI ("medication adherence" OR "medication compliance" OR "medication nonadherence" OR "medication non adherence" OR "medication noncompliance" OR "medication non compliance" OR "medication compliance" OR "medication persistence" OR "adherence to therapy" OR "adherence to treatment" OR "compliance to therapy" OR "compliance to treatment" OR "patient adherence" OR "patients adherence" OR "therapy adherence" OR "therapy compliance" OR "treatment adherence" OR "treatment compliance") OR AB ("medication adherence" OR "medication compliance" OR "medication nonadherence" OR "medication non adherence" OR "medication noncompliance" OR "medication non compliance" OR "medication compliance" OR "medication persistence" OR "adherence to therapy" OR "adherence to treatment" OR "compliance to therapy" OR "compliance to treatment" OR "patient adherence" OR "patients adherence" OR "therapy adherence" OR "therapy compliance" OR "treatment adherence" OR "treatment compliance")	18,985
S3	(MH "Nebulizers and Vaporizers") OR TI (inhaler OR inhalers OR "asthma treatment" OR "asthma treatments" OR "asthma medication" OR "asthma medications" OR "asthma drug" OR "asthma drugs" OR "controller drug" OR "controller drugs" OR "controller medication" OR "controller medications" OR "asthma control" OR "asthma management" OR antiasthmatic OR antiasthmatics OR "anti asthmatic" OR "anti asthmatics" OR accolat OR advair OR aerobid OR albuterol OR aminophylline OR arformoterol OR asmanex OR azmacort OR beclomethasone OR benralizumab OR brethine OR budesonide OR cromolyn OR daliresp OR deltasone OR dexamethasone OR dulera OR dupilumab OR elixophyllin OR flovent OR flunisolide OR fluticasone OR foradil OR formoterol OR indacaterol OR intal OR lebrikizumab OR levalbuterol OR maxair OR medrol OR mepolizumab OR methylprednisolone OR mometasone OR montelukast OR nedocromil OR olodaterol OR omalizumab OR onbrez OR pediaped OR pirbuterol OR prednisolone OR prednisone OR proair OR procaterol OR proventil OR pulmicort OR qvar OR Roflumilast OR salmeterol OR SAR231893 OR serevent OR singulair OR spiriva OR symbicort OR terbutaline OR theolair OR theophylline OR tilade OR tiotropium OR tralokinumab OR triamcinolone OR uniphyll OR ventolin OR vilanterol OR xolair OR xopenex OR zafirlukast OR zileuton OR zyflo) OR AB (inhaler OR inhalers OR "asthma treatment" OR "asthma treatments" OR "asthma medication" OR "asthma medications" OR "asthma drug" OR "asthma drugs" OR "controller drug" OR "controller drugs" OR "controller medication" OR "controller medications" OR "asthma control" OR "asthma management" OR antiasthmatic OR antiasthmatics OR "anti asthmatic" OR "anti asthmatics" OR accolat OR advair OR aerobid OR albuterol OR aminophylline OR arformoterol OR asmanex OR azmacort OR beclomethasone OR benralizumab OR brethine OR budesonide OR cromolyn OR daliresp OR deltasone OR dexamethasone OR dulera OR dupilumab OR elixophyllin OR flovent OR flunisolide OR fluticasone OR foradil OR formoterol OR indacaterol OR intal OR lebrikizumab OR levalbuterol OR maxair OR medrol OR mepolizumab OR	19,265

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	methylprednisolone OR mometasone OR montelukast OR nedocromil OR olodaterol OR omalizumab OR onbrez OR pediaped OR pirbuterol OR prednisolone OR prednisone OR proair OR procaterol OR proventil OR pulmicort OR qvar OR Roflumilast OR salmeterol OR SAR231893 OR serevent OR singulair OR spiriva OR symbicort OR terbutaline OR theolair OR theophylline OR tilade OR tiotropium OR tralokinumab OR triamcinolone OR uniphyll OR ventolin OR vilanterol OR xolair OR xopenex OR zafirlukast OR zileuton OR zyflo)	
S4	(MH "Patient Attitudes") OR TI ("patient attitude" OR adherence OR nonadherence OR "non adherence" OR comply OR compliance OR noncompliance OR "non compliance" OR satisfaction OR participation OR acceptance OR preference OR preferences OR attitude OR attitudes OR "self-management" OR barrier OR barriers OR belief OR beliefs OR enable OR enables OR enabler OR enablers OR facilitate OR facilitates OR facilitators OR perception OR perceptions OR perceive OR perceived OR misperception OR misperceptions OR misperceive OR misperceived) OR AB ("patient attitude" OR adherence OR nonadherence OR "non adherence" OR comply OR compliance OR noncompliance OR "non compliance" OR satisfaction OR participation OR acceptance OR preference OR preferences OR attitude OR attitudes OR "self-management" OR barrier OR barriers OR belief OR beliefs OR enable OR enables OR enabler OR enablers OR facilitate OR facilitates OR facilitators OR perception OR perceptions OR perceive OR perceived OR misperception OR misperceptions OR misperceive OR misperceived)	403,689
S5	S3 AND S4	1,947
S6	S2 OR S5	20,570
S7	S1 AND S6	1,737
S8	(MH "Qualitative Studies+") OR (MH "Interviews+") OR (MH "Observational Methods+") OR (MH "Surveys") OR (MH "Focus Groups") OR (MH "AudioRecording") OR (MH "Questionnaires+") OR TI ("semi-structured" OR semistructured OR unstructured OR informal OR "in-depth" OR indepth OR "face-to-face" OR structured OR interview OR interviews OR discussion OR discussions OR "focus group" OR "focus groups" OR qualitative OR ethnography OR ethnographic OR fieldwork OR "field work" OR "key informant" OR questionnaire OR questionnaires OR survey OR surveys OR surveyed OR "open-ended question" OR "open-ended questions" OR "thematic analysis" OR workshop OR workshops) OR AB ("semi-structured" OR semistructured OR unstructured OR informal OR "in-depth" OR indepth OR "face-to- face" OR structured OR interview OR interviews OR discussion OR discussions OR "focus group" OR "focus groups" OR qualitative OR ethnography OR ethnographic OR fieldwork OR "field work" OR "key informant" OR questionnaire OR questionnaires OR survey OR surveys OR surveyed OR "open-ended question" OR "open-ended questions" OR "thematic analysis" OR workshop OR workshops)	714,799
S9	S7 AND S8 Limiters - English Language; Age Groups: All Adult	315