Physicians' Compliance with Asthma Management Guidelines: A Literature Review

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Abstract

Background: Asthma is a chronic disease that has a great burden on individual and community health. Institutions around the world have developed guidelines to standardize asthma management and improve asthmatic patients' quality of life.

Objective: The aim of this study is to review studies that assessed the physicians' knowledge, practice and attitude toward asthma guidelines and which aspects of asthma management are the most deficient.

Method: A narrative literature review of 25 studies done to assess the knowledge, attitudes, and compliance of physicians to asthma guidelines in the last 10 years from different countries around the world in different health care settings and specialties.

Results: Most of the physicians did not follow the guidelines for asthma with some variations observed in practices.

Conclusion: Lack of Knowledge of the guideline may be the most important barrier for guidelines adherence encountered in most of the studies reviewed resulting in poor asthma control.

Keywords: Asthma; Guidelines; Physicians; Barrier; Adherence; Compliance; Knowledge

Introduction

In 2015, Asthma was the most prevalent chronic respiratory disease worldwide and caused around 0.40 million deaths [1]. Asthma is defined as a heterogeneous disease of chronic airway inflammation, which presents with wheeze, cough, chest tightness and dyspnea. These symptoms vary over time and in their intensity with variation in expiratory airflow limitation [2].

In the year 2002, the global strategy for asthma management and prevention (GINA) committee was founded to review studies done on asthma. The GINA guidelines are updated with recent recommendations on asthma management. The British thoracic society BTS and the Scottish Intercollegiate Guidelines Network (SIGN) corporated together to release asthma guidelines in 1999. In 2015, The United Kingdom (UK) National Institute for Health and Care Excellence (NICE) produced a document for diagnosis and monitoring of asthma and for the management of chronic asthma in 2016 [3].

Global and national asthma guidelines were made to guarantee better asthma management and control according to the standards. The 2005 Global Asthma Physician and Patient (GAPP) study described a contrast between recommended GINA guidelines and actual management practice in 16 countries [4]. These guidelines ensure an effective and efficient treatment plan. They also enable the physicians to make the most appropriate therapy decision according to the patient own clinical situation. Noncompliance to guidelines remains a dilemma; in spite of all works to develop and expand them. It would strongly affect healthcare costs and the quality of patients' life [5].

The national review of asthma deaths (2014) identified the lack of knowledge of the UK asthma guidelines as a cause of 25% of asthma deaths in that year. Barriers to asthma guideline adherence can be related to the patient, the health care system, or health practitioners [6].

Mentioned that good asthma control is the main objective of asthma treatment [7]. This is achieved by symptoms reduction, improving quality of life and fewer complications. If good control is not reached, initiating or escalating treatment is required. Assessment of control should be done

at every visit. Failure to assess control can be attributed to the lack of knowledge in addition to a shortage of time and not remembering to do so. Providing patients with a written asthma action plan is another recommendation that physicians fail to do adequately and have a low perception of its importance. They referred to [8] who believed that knowledge, experience, skills, attitude, beliefs and values do influence the implementation of guidelines recommendations and that will be clearly noticed when we look into studies done to assess physicians' adherence to the guidelines later on.

Methodology

A literature review of studies done on physician attitude, perception, adherence and knowledge about asthma guidelines. The reasons why physicians did not follow these guidelines in their practice, consequences, and methods suggested for improving extracted from each study. PubMed, Google and Science Direct were the main search engines utilized with the University of Wales Subscription used to gain access. Literature from the last 10 years included in the search, from the year 2009 to 2019. Studies published more than 10 years were excluded. Studies written in languages other English or not translated to English were not considered as well.

References of the reviewed studies were also been used. The included studies were 22 cross-sectional surveys and 3 chart reviews. Cross-sectional studies were done in Nigeria (8), Saudi Arabia (4), Italy (2), Pakistan (1), Korea (1), Vietnam (1), Egypt (1), Lebanon (1) and Kuwait (1). One cross-sectional survey was done in Australia, Canada, China, France, Germany, and Japan. Three chart reviews were included from the United Kingdom, the United States and Canada.

Surveys give evidence on practice, attitudes, and knowledge. They should have clear and high-quality essential questions that concern the study population, using the least number of questions possible. The survey should be reliable and valid.

Answering the survey should take less than 10 min. Ethical approval is important before starting any survey. Pilot testing of the survey improves the efficacy of the survey. The sample should represent the target group to ensure generalizability.

Biases include Sampling bias, Researcher Bias: which result from the way the questions were asked, Non-response Bias: Surveyors must discuss the cause of non-responding and analyze it, Recall Bias and Self-report Bias when respondents hide negative characteristics [9]. Retrospective chart review requires a large sample size to be more powerful. The researcher should ensure a random selection of the records and should define the study variables. The data abstractors' role is to review and code each chart in an accurate and consistent manner. Coders should be trained before data abstraction. Abstractors should remain objective and be blinded to the study purpose. Abstraction form has to be simple and logical in consequence. Intra-rater and inter-rater reliabilities should be assured. Pilot tests to guarantee good quality of the review. Confidentiality and ethical issues should be addressed [10]. Retrospective chart reviews tend to be limited to one facility leading to lack of generalizability. They have advantages of understanding population characteristics, and reasons for adherence and non-adherence. Surveys reach a broader population but rely on accurate recall and self-reporting [11].

Results

In a questionnaire-based study including 811 general practitioners

and 230 specialists in Italy found that only 20% of General practitioners and 43% of specialists use the Asthma control test score [12]. Only 20% answered correctly to questions regarding the level of asthma control. A significantly higher number of specialists answered correctly to the question about control (P<0.0001).

They found that 40% did not think that there a need for long-term management although the majority of specialists and general practitioners had a good knowledge of asthma pathogenesis and were higher than knowledge in other included surveys. The self-management plan was not preferred by most respondents and was considered not applicable to most patients. There were significant differences between general practitioners and specialists regarding patient involvement in their management plan. A 28.6% of general practitioners and 21.3% of specialists use a cooperative approach which highly involves the patient in their treatment plan. General practitioners preferred to use a paternalistic approach while specialists preferred to use informative, consultative, and interpretative approaches toward asthma patients. They even mentioned that both general practitioners and specialists do not entirely trust that the asthma guidelines are applicable. The study looked into factors that affect asthma control. It suggested the majority of practitioners were not aware of asthma control tests and its appropriate use, which might explain the poor level of asthma control seen in the practice.

Majority of General practitioners and specialist preferred to use a fixed-dose regimen (57.69% and 54.2% respectively) with routine medical control.

29.48% of GPs and 30.84% of specialists chose a continuous fixed-dose regimen in addition to as-needed administration as the patient decision by 6.99% of GPs and 7.48% of specialists chose a continuous fixed-dose regimen with the option of dose modification without referring back to the physician.

This study had a big number of participants compared to other surveys with a good response rate. The study population was general practitioners attending a CME course and those who were teaching in the course, this might explain the good knowledge level and at the same could be a sampling bias as of all surveys; respondent's answers might not represent their actual practice. No information about pretesting of the questionnaire. Summary of the questionnaire (Tables 1-7) but not the actual one used was provided. The questionnaire did not contain demographic information of respondents.

Another Italian cross-sectional study by Baldacci et al. [13], 107 general practitioners filled questionnaires on 995 asthmatics taking into account GINA 2009 guidelines. They reported that in 7% of cases, the severity of asthma was not assessed and in 2.7%, no data about severity was available. A good/optimal asthma control was found in only 67.4% of all patients. Combination inhaled corticosteroids and long-acting beta-agonists were the most prescribed medication in around 54.7% of patients, irrespective of GINA guidelines. Inhaled corticosteroids monotherapy was the second used treatment in around 15.2% irrespective of GINA guidelines. Short-acting beta-agonist alone was prescribed for 8.8% of the patients. Guideline's adherence was significantly associated with good asthma control. The level of adherence was 28.8%. The number of physicians included in the study is low compared to survey [12]. This survey was a part of a study called (ARGA) Allergopatie Respiratory i.e., Respiratory allergies: Monitoring study of GINA and ARIA guidelines. Practitioners were selected randomly with an 89% response rate.

Table 1: Summary of findings.

Study	Knowledge about asthma pathogenesis	Knowledge about asthma guidelines	Asthma diagnosis	Knowledge assessment of control	Use of asthma control tools	Good asthma management practice	Use of self-asthma plan	Acute asthma management	acute severe asthma	Long term management	Guidelines adherence	Difference in performance	Asthma treatment accuracy	CME effect
Braido et al. [12]	91%	-	-	20%	20.15%GPs 42.92% specialists	-	3%	-		40% no need of long term TTT	-	Significant in knowledge and practice of asthma control and in guidelines applicability. SP>GP	fixed dose regimen with physician control is preferred	
Baldacci et al. [13]	-	-	-	-	around 90% of patients assessed	-				-	28.80%	-		
Bhulani et al. [17]	22.40%	-	99%	-	-	10.40%	-	14.1% (practice)	58.9% (practice)	-	-	>40 years old had less knowledge	9.9% knowledge of medication	no effect
Lingner et al. [19]	58% GPS 59% trainee	58% GPs 57% trainee	51% GPs 53% trainee			60%	35% GPs 23%trainee	36% appropriate systemic steroid use knowledge				Not significant between GPS and trainee <3 years better than >15 yrs. Practice	34% knowledge about leukotriene receptor agonists use	
Ayuk et al. [20]			34%				31% in TH 20% in non TH	40% use systemic steroids					<1% use inhaled corticosteroids	
Umoh and Ukpe et al. [21]		20%		55% of pt assessed correctly				73% (respiratory physicians)				Respiratory physicians better score		+
Osaretin et al. [22]			11.50%		0%			22% used inappropriate medication	19% used inappropriate medication			No significant difference in terms of diagnosis		

Table 2: Summary of findings.

Study	Knowledge about asthma pathogenesis	Knowledge about asthma guide lines	Asthma diagnosis	Knowledge assessment of control	Use of asthma control tools	Good asthma management practice	Use of self-asthma plan	Acute asthma management	acute severe asthma	Long term management	Guidelines adherence	Difference in performance	Asthma treatment accuracy	CME effect
Obumneme-Anyim et al. [23]	58.60%	47.30%	90% used lung function test	34.90%						87% used combination therapy		Significant between high and low cadre physicians		
Fawibe et al. [24]		16.40%							58.8% iv steroids 75% IV methylxanthines	ICS (6.6%) and ICS/ LABA -15%				
Desalu et al. [25]	-	-	-	30%	20%	-	-	-		-	-	Pulmonologist better in term of assessing control		+
Adeniyi et al. [26]	6%		32%use spirometr y				38%			29% use ICS/ LABA		Family physicians, <40, <20 y experience better knowledge.		
Ozoh et al.[27]	96.95	50%	30.6% use peak flow meter		24.5%ACT 28.6%GINA		35.70%			45.9% ICS 57.1% ICS/ LABA	33%	Poor knowledge significant with non- CME and work in NTH		+
Alotaibi et al. [31]			53.7–59.6%					37% use of oral steroids					41.5% and 90.7%	
Yousef et al. [32]		8%									33.70%	residents had better knowledge than physicians		
Alrabiah et al. [33]		5.40%			39.60%	94.30%						More experience better score		
Almakrami et al. [41]		21%										residency level didn't affect the knowledge		

The most important point about this study that information was gathered from asthmatic patients who were seen by the participating general practitioners, thus giving a better reflection on how patients are managed. This will not exclude a self-report bias. Ethical approval was obtained and statistical analysis explained. A copy of the questionnaire was not included.

The two Italian studies are 9 years apart but non-compliance to asthma guidelines still could be observed [12] concluded poor practice with lack of use of asthma control tools and lack of appropriate management. As well claimed that there was low adherence to asthma treatment guidelines [13].

Italy's health care system is based on national health services that deliver health coverage free of charge. Central government sets the basic principles and objectives of the health system and confirm benefit package of health services available to all citizens, the regions are in charge of organizing and providing primary, secondary,

Table 3: Summary of findings.

Study	Knowledge about asthma pathogenesis	Knowledge about asthma guidelines	Asthma diagnosis	Knowledge assessment of control	Use of asthma control tools	Good asthma management practice	Use of self-asthma plan	Acute asthma management	acute severe asthma	Long term management	Guidelines adherence	Difference in performance	Asthma treatment accuracy	CME effect
Al Mutwa et al.													37.20%	
Lababidi et al. [39]			47% spirometry							94.3% LABA 87.4% ICS	65%			
Salama et al. [40]			71.9% spirometry				58.20%			85.8% use steroids as controller		Higher qualification better knowledge and practice		
Sun et al. [44]		85.70%	21.5% peak flow meter 10.3% spirometry	85.7%.			5.2% of patients			low use of inhaled corticosteroids				
Nguyen et al. [46]			50% spirometry		24.40%					70%. Use LABA		Internists and GPS better than family physicians, more age better score		
Chapman et al. [4]					10% use ACT or ACQ		37%			72%				

Table 4: Summary of findings.

Study	control assessment	Use of self-asthma plan	SABA prescription	maintenance treatment prescription	allergy evaluation	inhaler technique	medication adherence assessment	Asthma treatment accuracy
Yawn et al. [48]	15%	3.10%	88%	70.40%	32.50%	7.60%	32.50%	
Levy et al. [50]			5% prescribed more than 12 SABA inhalers			< half of the patients mean 49.6%		
Price &Agarwal [51]	15.40%	0%	63.80%	17% ICS 14.9% ICS/LABA				Augmentation was done in 15%

and tertiary health care services as well as preventive and health promotion services [14]. In 1991-1993, the median prevalence of asthma documented by the ECRHS survey was 4.1%, range 3.3% to 5.0%. Twenty years later, the GEIRD study, recorded that the median prevalence was 6.6%, range 4.5% to 8.0% [15].

Health service delivery system in Pakistan was run by federal government then shifted to provincial government. It has public and private healthcare delivery system providing primary, secondary and tertiary healthcare services [16,17] surveyed 192 general practitioners from different areas who attended patients from diverse social and economic backgrounds in Karachi, Pakistan comparing their practice to the GINA guidelines 2009. Only 10.4% had appropriate asthma management practices. Management of acute asthma exacerbation was practiced appropriately by only 14.1%. Acute severe asthma management practice was much better by a percentage of almost 59%.

Ninety percent had insufficient knowledge of medications. In contrast to Braido et al. [12] study, only 22% had good knowledge about asthma pathogenesis. Bhulani et al. [17] concluded a poor level of knowledge and lack of consistency of practice among general practitioners in Karachi, Pakistan. Insufficient knowledge was noted more in those who are above 40 years old more than the younger general practitioners are. Surprisingly, reading medical journals and working in teaching hospitals seemed not to affect the level of adherence to the guidelines. Overall poor knowledge of asthma and poor practice of asthma exacerbation was outlined. This study had a good response rate of around 77%. This study was held in Karachi and participants were randomly selected and interviewed by 4th-year medical students this would have excluded missed questions but might lead to interviewer bias. The sample was small compared to other studies. The actual questionnaire was not included sociodemographic data of participants were included in the questionnaire and linked to other elements surveyed. According to the authors, ethical approval was obtained. Statistical analysis was done with the involvement of statistician. The questionnaire was pretested to assure good quality. No other studies from Pakistan were found but the results were much near to other surveys worldwide.

The health care system in Germany is based on national and state bodies which share decision making. It provides comprehensive coverage for extended range of services. Health insurance has been compulsory for all citizens and permanent residents since 2009 [18]. Poor knowledge of asthma and low adherence to asthma guidelines was stated by who has done a cross-sectional survey involving 55 General Practitioners (GPs) and 240 general practitioners trainees in Lower Saxony and Bavaria, Germany [19]. The result was consistent with other included studies. They reported that 58% general practitioners and 59% trainee defined asthma, as chronic inflammation. Knowledge of asthma guidelines was 58% and 57% in general practitioners and trainees respectively. The use of a written asthma plan was low but around the average of other studies. It was used by 23% and 35% of trainees and general practitioners respectively. Twenty two percent of respondents thought that the use of short-acting beta-agonist can reduce exacerbation. Only 36% knew that systemic steroids should be administered as quickly as possible in the treatment of acute asthma attacks.

General practitioners who were working for less than three years achieved a significantly better score than those who were practicing for more than 15 years. There were no questions regarding the knowledge and use of control assessment tools.

The general practitioners and trainees were selected from audit groups, continuous professional development events and regional Association of Statutory Health Insurance Physicians' lists that were assumed to have higher knowledge and so may limit the generalization of the results. The response rate was low with 46% in Lower Saxony and 45% in Bavaria. Pretesting of the questionnaire was done prior to the study. The surveyor claimed that they contacted those who did not answer and explored causes for non-response. The sample size was big relative to other studies. Ethical approval was obtained. No other studies from Germany were extracted.

In Nigeria, [20] conducted a descriptive cross-sectional multi-center study to evaluate asthma management practice in the southeast of the country and came upon variation in practice. The study included 285 respondents, 194 from tertiary hospitals and 91 from non-tertiary hospitals. The practice and knowledge of tertiary, non-tertiary physicians and physicians with different levels of experience were

Table 5: Summary of study design and objective.

	Author/Year	Country	Study design	Sample size	Setting/Specialty	Element Assessed
1	Braido et al.[12]	Italy	Descriptive survey based/ Multiple choice questionnaire	1010/1041	General practitioners -respiratory medicine specialists	• asthma pathogenesis knowledge • control, applicability guidelines • Doctor-patient relationship
2	Sun et al.[44]	Korea	Cross-sectional survey	81 of 131 Response rate 61.8%.	Primary care pediatricians	• Adherence to guidelines • Reasons for nonadherence.
3	Ayuk et al.[20]	Nigeria	A descriptive cross-sectional multi-centre study	275/285 Response rate 96%	Consultants, senior registrars, registrars, House officers, and medical officers -Pediatrics, Internal Medicine, and	• Epidemiology, diagnosis, management and medication
4	Salama et al.[40]	Egypt	Cross-sectional study. self-administered questionnaire	352 Response rate 55-60%	101 General practitioners, 131 pediatric specialists, 35 pediatric Consultants and 85 doctors (no report the qualification) 165 in governmental hospitals, 68 in private clinics and 119 clinicians work in both.	• attitude, knowledge of guidelines, diagnosis, management in pediatric
5	Bhulani et al.[17]	Pakistan	Cross-sectional survey/ Multiple-choice questions	192/250	General physicians	• Pathology, history points, risk factors, diagnosis, and management
6	Umoh and Ukpe et al.[21]	Nigeria	Cross-sectional survey/ Multiple-choice questions	104/115 Response rate of 90.4%.	74 Internists, 24 Family Physicians And six Respiratory Physicians at a teaching Hospital	• Understanding of the GINA guidelines.
7	Fawibe et al.[24]	Nigeria	Cross-sectional survey/Self-administered questionnaire	320 /334 Response rate 95.8%	General private and public practice in six states	• Drug prescribing pattern
8	Osaretin et al.[22]	Nigeria	Descriptive cross-sectional study/Semi-structured self-administered Questionnaire	131	Resident, medical officers, consultants Pediatrics, private practitioners, Anesthesia, family medicine, and internal Medicine (94 practices / 2 cities)	• Knowledge of asthma diagnosis and drug management
9	Alotaibi et al.[31]	Saudi Arabia	Cross-sectional study	80/206 Response rate 38%	Pediatricians And primary care physicians ,5 hospitals	• Level of adherence to SNAP recommendations and barriers
10	Obumneme-Anyim et al. [23]	Nigeria	Descriptive cross-sectional study/Structured, self-administered questionnaires	283 /1130	Trained/being trained in Internal Medicine, Pediatrics and Family Medicine from 3 hospitals	• epidemiology, pathology, diagnosis, classification, use of management tools and medication
11	Almutawa et al.[37]	Kuwait	Observational cross-sectional study	250/376 Response rate of 66.5%.	Primary health care physicians	• Adherence and attitude to the guidelines
12	Lababidi et al. [39]	Lebanon	descriptive cross-sectional study/questionnaire	330/2450 Response rate 91.5%	general Lebanese physicians from 4 regions	• diagnostic tools, pharmacotherapy patient education
13	Yousef et al.[32]	Saudi Arabia	cross-sectional study self-administrated questionnaire	74 Response rate 98.3%	8 PHC centers and the university FM clinic ,50 physicians and 24 (3rd and 4th year)family medicine residents)	• assess knowledge of asthma
14	Desalu et al. [25]	Nigeria	Descriptive cross-sectional study Self-administered questionnaire	194/250	Family and internal medicine practice in 4 public and 3 private hospitals	• Knowledge and use of asthma control measurement
15	Yawn et al. [48]	United States	Retrospective Chart Review	1176 patients data	16 family medicine and 6 pediatric practices	• Assess primary care adherence to 2007 US asthma guidelines in term of use of action plan, medication and inhaler technique education
16	Lingner et al. [19]	Germany	Cross-sectional survey Multiple-choice questions	240/530 Response rate 46% (Lower Saxony). 45 % (Bravia)	Gp\GP trainees In general practice	• Knowledge of guidelines , asthma definition, clinical findings, diagnostic tests, Differential diagnostics, treatment and prevention
17	Adeniyi et al. [26]	Nigeria	Cross-sectional survey Self-administered questionnaire	96/110 87% response rate	Physicians /various specialties/ attending a CME	• Level of asthma knowledge and quality of care
18	Nguyen et al. [46]	Vietnam	Cross-sectional study	201/327 response rate 61.5%	Primary care physician, urban and rural area,4 hospitals	• Assess the knowledge and practice of primary care physicians asthma management based on the Global Initiative for Asthma (GINA) guidelines (2015 update)
19	Chapman et al. [4]	Australia, Canada, China, France, Germany, and Japan	A cross-sectional survey/ standardized questionnaire Telephone, online or face-to-face.	1809,300 /each country	General practice or internal medicine physicians	• Physicians' perspectives and use of asthma control assessment tools and medication choice
20	Alrabiah et al. [33]	Saudi Arabia	Cross-sectional study/self-administrated questionnaire	246/281 Response rate 84.7%	18 Primary healthcare centers	• Knowledge and application of asthma guidelines
21	Almakrami et al. [41]	Saudi Arabia	cross-sectional study	153	Pediatric Residents	• evaluate knowledge and • the attitude of pediatric residents toward the Saudi • Initiative Asthma (SINA) guidelines
22	Levy et al. [50]	United kingdom	Audit	mean of 552 with code diagnosis of asthma	56 general practices in Bedfordshire	• assess asthma care
23	Price &Agarwal et al. [51]	Canada	prospective cohort study employing an electronic audit	884 patients data	Three family health teams	• assessment of asthma control, initiation/ Escalation of asthma controller therapy and the use of asthma action plans.
24	Baldacci et al. [2]	Italy	cross-sectional study ad hoc self-administered questionnaire	107 response rate 89%	general physicians	• Diagnosis, disease severity, level of control, drug prescriptions
25	Ozoh et al. [27]	Nigeria	Cross-sectional study Semi-structured Questionnaire	98/120 response rate 82%	General practitioners, fellows in Internal medicine, pediatrics, family medicine, and Public health	• awareness, adherence to GINA guideline • pathophysiology, diagnosis, and treatment, follow-up, asthma control test, peak flow meter

explored. Those who graduated more than 15 years and who graduated less than 5 years did not commonly follow asthma management guidelines. This observation can be compared to [19] when those working for more than 15 years had low knowledge scores but those less than three years scored better. Asthma diagnosis methods (signs, symptoms and lung function tests) were used in a ratio of 4:1 between tertiary to non-tertiary physicians, which were a significant difference (p<0.05). The use of asthma management tools (peak flow meter, spacers and written plan) was higher among tertiary physicians. Around 20% and 31% used a written asthma plan in non-tertiary and tertiary hospital respectively. The higher percentage in tertiary might be explained by higher confidence and experience of these physicians. These percentages are close to those from other studies. Consultants were the least to use peak flow meter and a written action plan. During

an acute exacerbation, the use of nebulized salbutamol was higher among tertiary doctors. Most doctors in tertiary and non-tertiary facilities did not prefer oral and parenteral steroids another matching result to finding [19]. Surprisingly older doctors and those who work in non-tertiary health facilities were still using aminophylline in acute asthma in spite of the newer recommendations. In the maintenance of asthma control, inhaled long-acting corticosteroid was used by less than 1% of doctors in tertiary health facilities, with no significant difference between physicians. The lack of utility of peak flow meter and spacer was attributed to their lack, especially in a non-tertiary hospital. The total number of practitioners in cities where the survey was conducted was 1,130 but only 285 were randomly selected, 275 physicians responded (96% response rate). The sample size was higher than in almost all other studies in Nigeria but around the average size

Table 6: Summary of study design and objective.

Study	Negative observations	Positive observations
Braido et al. [12]	low use of control assessment tool poor attitude toward guidelines	good knowledge about pathogenesis
Baldacci et al. [13]	inappropriate medication use	
Bhulani et al. [17]	low knowledge about asthma and poor acute exacerbation management	
Lingner et al. [19]	low knowledge on asthma treatment, low use of written asthma action plan	
Ayuk et al. [20]	Low use of diagnostic tools ,Low use of written asthma action plan ,inappropriate medication use	
Umoh and Ukpe [21]	Poor knowledge of control assessment, inappropriate management	Good knowledge about acute exacerbation
Osaretin et al. [22]	Lack of asthma control assessment tools, Low use of diagnostic tools, Inappropriate management	
Obumneme-Anyim et al. [23]	poor knowledge of asthma control test, poor knowledge of asthma guidelines	good knowledge about maintenance treatment
Fawibe et al. [24]	inappropriate medication use	
Desalu et al. [25]	poor knowledge and use of asthma control assessment tools	
Adeniyi et al. [26]	Low use of diagnostic tools, inappropriate management	good knowledge of asthma guidelines
Ozoh et al. [27]	poor knowledge of asthma and poor practice	
Alotaibi et al. [31]	inappropriate diagnosis and medication	
Yousef et al. [32]	poor knowledge of guidelines, poor knowledge of inhaler technique	
Alrabiah et al. [33]	Poor knowledge of guidelines, low use of written action plan and control assessment tool	
Almakrami et al. [41]	Poor knowledge of guidelines, low use of diagnostic tools	Good attitude toward guidelines
Almutawa et al. [37]	Poor knowledge of the guidelines	Good attitude toward guidelines
Lababidi et al. [39]	Low use of diagnostic tools, inappropriate medications	High awareness to the guidelines
Salama et al. [40]	poor knowledge of guidelines, diagnostic tools and medication	good attitude toward guidelines
Sun et al. [44]	Low use of diagnostic tools, Inappropriate medication	
Nguyen et al. [46]	Poor knowledge of asthma control assessment, inappropriate medication	
Chapman et al. [4]	Low use of asthma control assessment tool, low use of asthma action plan	High awareness of medication
Yawn et al. [48]		
Levy et al. [50]		
Price &Agarwal, [51]		

of samples in studies included. Statistical analysis was explained and the questionnaire was pretested but a copy of the questionnaire was not provided.

Evaluated the GINA guidelines understanding by surveying 104 physicians (GPS, internists, family physicians and respiratory physicians) at the University of Calabar Teaching Hospital in Nigeria as well [21]. Only 20% had a good understanding of these guidelines. Respiratory physicians scored better than other physicians did as well as those who attended CME programs. The overall score of the respiratory physicians was significantly better than internists while there was no significant difference between internists and family physicians. Respiratory physicians could assess the level of control accurately in 55% of patients. Respiratory physicians could correctly identify 73% of appropriate therapeutic options for managing acute exacerbation of asthma, when to initiate controller medications and how to modify therapy when control is not adequate. Overall, physicians could only correctly identify appropriate management strategies in 36% of the cases. Training and clinical experience were associated with a better understanding of asthma guidelines, comparing to [20] study where older practicing physicians were less using asthma management tools [17] who found that those who are above 40 years old scored less in terms of knowledge. This study outlined the importance of updating the knowledge through continuing medical education programs as a significant, good understanding of guidelines was found in those who attended continuous medical educational programs (P=0.017). The survey included physicians from the University of Calabar Teaching Hospital from different specialties and who regularly attend asthmatic patients. However, a low knowledge about the guidelines was observed and therefore explains poor asthma control. The sample size was small. The response rate was 90.4%. The questionnaire was pretested on physicians' sample.

Surveyed 131 medical practitioners including pediatricians, private practitioners, anesthesia specialists, family physicians, and internists [22]. Around 36% of respondents diagnosed asthma by symptoms only. Appropriate asthma diagnosis was made by only 11.5%, which is the lowest of all studies. Asthma was mostly diagnosed without the use of lung function tests. Salbutamol was used for acute asthma care by 89.3% of respondents and as a follow-up therapy by 90.8%, which is inconsistent with the GINA guidelines. None of the respondents assessed asthma control in their patients. Low knowledge of asthma treatment was demonstrated by lack of anti-inflammatory use in treating long-term asthma. The study outlined lack of diagnostic tool use and written asthma plan which was the least of all studies. This survey included more variant physician specialties and a larger number of practices in two cities; nevertheless, the number of participants was small. The total number of the eligible study population was not defined as well as the response rate.

Later on, in a descriptive cross-sectional study, surveyed 283 Nigerian physicians working in Internal Medicine, Pediatrics and Family Medicine [23]. Ninety percent of those who are working in a non-tertiary hospital and 92.5% of those in tertiary hospitals use
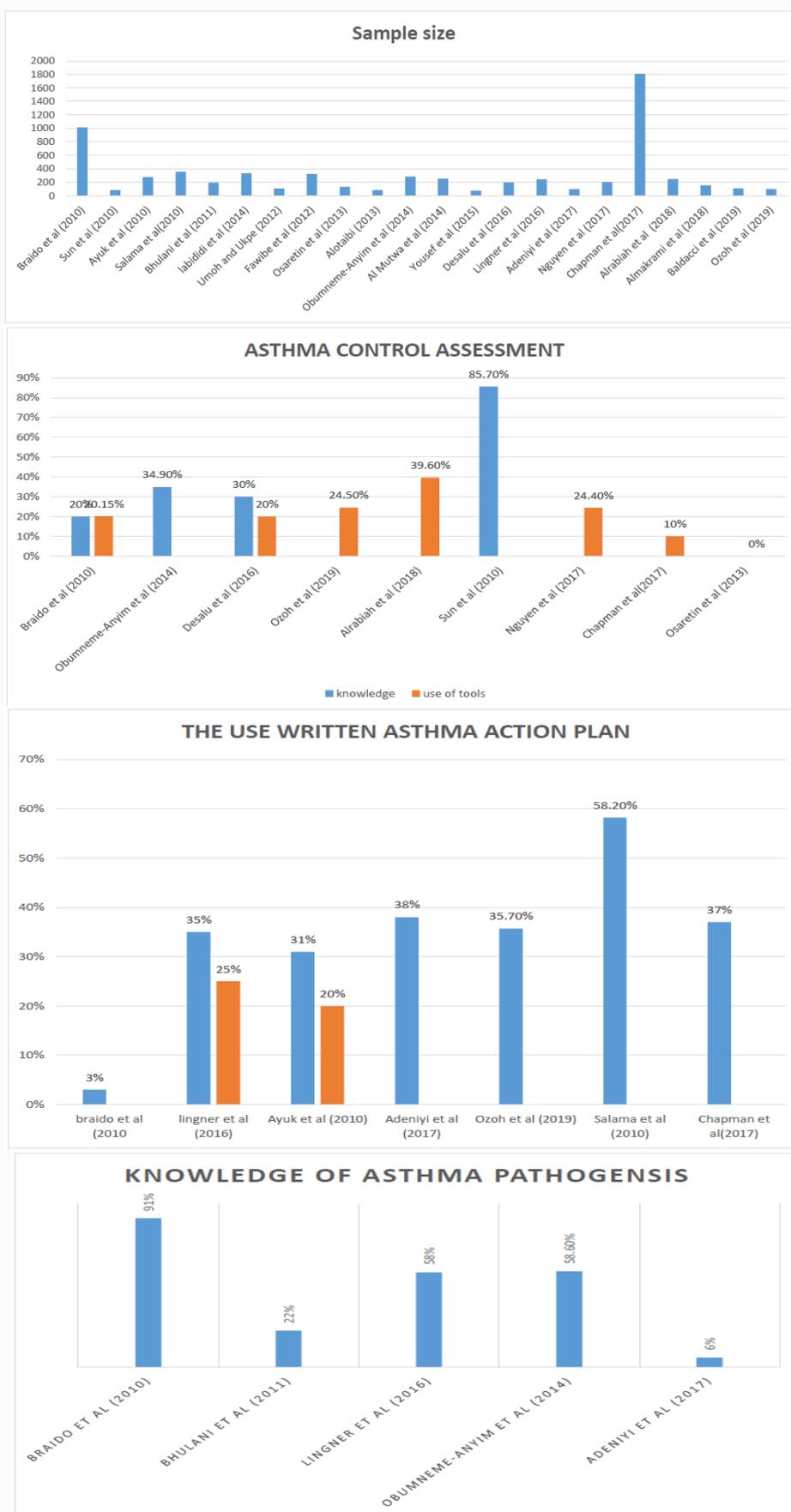
Sample size

ASTHMA CONTROL ASSESSMENT

THE USE WRITTEN ASTHMA ACTION PLAN

KNOWLEDGE OF ASTHMA PATHOGENSIS

Table 7: Summary of negative and positive observations.

lung function test to diagnose asthma. Regarding, acute exacerbation of asthma treatment, 29.3% did not know about the use of inhaled bronchodilators, 58.3% and 60.9% thought that aminophylline was the proper first-line treatment in exacerbation in tertiary hospitals and non-tertiary health facilities respectively. And, 80.7% of the doctors who had practiced for more than 20 years, 59.2% of those who had practiced for 11 years to 20 years and 56.9% who had practiced for 10 years and below had the same idea about aminophylline. 60% of consultants and 53.8% of those who are older than 20 years in medical practice thought that adrenaline had a role in the treatment of exacerbation of asthma.

Good knowledge of the utility of combined steroids and bronchodilators in the maintenance of asthma treatment with a similar percentage of 87.3% in both tertiary and non-tertiary facilities. On the other hand, about 35% of registrars/senior house officer had poor knowledge of the use of combination therapy for chronic asthma (P=0.001). This may be explained by a lack of awareness of the updated asthma guidelines. Knowledge of the Global Initiative on Asthma guideline (GINA) for asthma management was significantly poor with 43.4% among doctors in tertiary centers and 61.8% among those working in non-tertiary centers. The tertiary facilities in Nigeria seem to have better resources as will be discussed later and this might explain some of the previous results. There was a significant general lack of knowledge of the asthma control test among all doctors regardless of their experience or specialty. The conclusion of the study was poor adherence to guidelines in term of acute asthma management and control assessment.

Expressed their concerns about the low knowledge of GINA guidelines in physicians working in tertiary hospitals as they are in charge of a junior doctor's training [23]. The sample size was around the average of sample size of the studies included. The response rate was not mentioned in the study article but the number of participants is about a quarter of the total population of the medical practitioners. The majority were from tertiary health facilities, which might produce a randomization bias which affect the generalization of the results. As of all survey self-report bias could not be excluded. The questionnaire was not available for review.

The previous results confirm the conclusion by an earlier study by including 320 general practitioners with 54.7% resident 50.0% Fellows, and 23.9% medical officers responded that they do use asthma guidelines recommendation for drug choice but only 16.4% of these mentioned the asthma guidelines in a right way [24]. This could be compared to 47.3% good knowledge of guidelines reported by [23] and an almost close percentage of 20% by [21]. 65.6% said that drug choice was influenced by what they learned in medical school, 13.1% influenced by the cost, this was seen more in private practitioners. There was an overall poor prescribing to medication in acute settings and in control of asthma. 75% prescribed IV Methylxanthines in acute severe asthma in contrast to the asthma guidelines.

Systemic steroids were used by more than 90%, 60% of those used intravenous form. Oral steroids and oral Short-Acting Beta-Agonists (SABA) was commonly used as maintenance treatment, on the other hand, inhaled corticosteroids, combination long-acting beta-agonists and corticosteroid and were uncommonly prescribed by 6.6% and 15% respectively. This could be considered the lowest of all Nigerian studies included. The sample size is higher than other studies in Nigeria. The survey might have a selection bias as participants were chosen upon the convenience of the investigators from the capital of

six states. The questionnaire used was not included. Author claimed that it was pretested [25]. Study in Nigeria (with 194 participants) results were approximately close to Braido et al. [12] regarding asthma control assessment. The overall physicians' knowledge score of asthma control management tools was 4.49 ± 2.14 out of 12, with Pulmonologists scoring the highest. Around 70% had poor knowledge scores. Physicians who assessed their patients' level of asthma control in the past 12 months were 25.8%, 17.5% assessed them at every visit. The utility of asthma control management tools was 20% similar to that of GPs [12] study. GINA defined control was used by 15%, while the Asthma Control Test (ACT) was used by 5%. Pulmonologists who graduated within five years, attended CME within 6 months were using the asthma management tool the most. The sample size was small. Selection bias might occur due to the selection of centers upon the convenience of surveyors. Physicians were selected from private and public facilities, which could represent the overall practice. Pilot study of the questionnaire was done. Questionnaire was not available for review [26] conducted a cross-sectional study in West Nigeria with a small number of participants on the knowledge and adherence to guidelines recommendations. Ninety-six physicians attending a CME completed a survey with more than 80% had good general knowledge about asthma but only 6% followed the GINA guidelines. The use of ICS combination was also as low as 29% that is matching to observations made by other studies. Spirometry was used by 32%. The majority of those less than 40 years and less than 20 years of practice had a total high knowledge. Family physicians had high knowledge scores in all knowledge areas surveyed. The questionnaire took 20 min to fill; response rate was 87%. No data was provided about pretesting. A copy of questionnaire was not provided. The sample size was small which could be the most obvious limitation of the study. The sample was from physicians who attended CPD activity, which means no proper randomization of sample.

In a more recent study, done a cross-sectional study with 98 participants, attributed the poor adherence to asthma guidelines in Nigeria to the low level of knowledge as well as other causes such as lack of resources and high costs of drugs that lead to poor practice [27]. The majority answered correctly to the definition of the pathogenesis of asthma. Physicians who would use a written asthma plan were 35.7%. The percentage of using GINA guidelines assessment tool and ACT score to assess control was 28.6% and 24.5% respectively. This is approximate to the level in other studies by [12,25]. 45.9% use Inhaled corticosteroids for maintenance of asthma. Physicians who would use a combination of inhaled corticosteroids and long-acting beta-agonists were 57%. Overall, around 42% of the respondents to their questionnaire had a good knowledge score while 51% had a moderate knowledge score and 7.1% had a low score. Those who did not have postgraduate qualifications did not attend CME training and those who were not aware of the GINA asthma guidelines demonstrated poor knowledge. In terms of practice, around 43% had a good level of practice. Those working in private and non-tertiary hospitals had poor practice and knowledge. In spite of a significant positive relation between knowledge score and practice score, the relation between the percentage of participants with a good level of knowledge and percentage with a good level of practice was not significant. The study concluded poor knowledge and poor practice to asthma guideline recommendations. Although the study included physicians from private and public sectors as well as covering a lot of aspects of asthma including barriers but was limited by the small number of participants. The response rate was 82%. The questionnaire was pretested. The questions in the survey were mentioned, but the actual

survey was not included.

Studies from Nigeria were almost all agree with a low level of adherence to asthma guidelines. The Global Initiative on Asthma (GINA) estimates the prevalence of clinical asthma in Nigeria to be 5.4%. The delivery of asthma care in Nigeria is usually through the conventional general and medical outpatient clinic, respiratory clinic and emergency room [25]. In Nigeria, there is no state-supported social welfare system. National Health Insurance Scheme (NHIS) was established in 2005 but does not cover the whole population. Most people lack access to primary health care and self-pay for medical care. Lack of staff; equipment and medication still hamper health care facilities [24]. The percentage of NHIS coverage was around 5% in the last 14 years of its establishment [28].

Reported that more than 2 million Saudis affected by asthma and the majority of them are uncontrolled which is affecting their quality of life [29]. According to Al-Moamary et al. [30] the Saudi Initiative for Asthma (SINA) based on the Global Initiative for Asthma (GINA) and the National Asthma Education and Prevention Program, developed in 2009. SINA was modified according to local literature and current setting in the country.

A number of studies were done in Saudi Arabia concerning adherence to asthma guidelines. Surveyed 80 physicians from five governmental hospitals in Riyadh, 41 primary care physicians, and 39 pediatricians who are engaged in treatment of asthma [31]. The aim of the study was to assess the level of compliance with The Saudi National Asthma Protocol (SNAP), which was first published in 1995. The level of awareness of the Saudi national asthma protocol was 70% and was applied by 78.2% of those. The level of knowledge about the diagnosis of asthma ranged from 53.7% to 59.6%. The level of knowledge of asthma management was from 41.5% and 90.7%. The study did not reveal any significant association between guidelines compliance and age, gender, years of experience, nationality, or specialty. Physicians answering correctly according to the guidelines regarding the use of long-acting b-2 agonist in mild intermittent asthma were 52.7%, theophylline use in moderate attacks were 53.8% and the use of steroids in moderate persistent asthma were 58.5%. The response rate was 38.8%. The study sample was small which limit the generalizability of results. No pilot study of survey was done it was reviewed by a consultant pediatric pulmonologist.

Done a cross-sectional survey of physicians and family medicine residents in all primary health care centers in AL Khobar city in Saudi Arabia [32]. They included 74 respondents with a response rate of 98.3%. They reported an 8% level of good knowledge of asthma. 46% did not use any guidelines in asthma management, 13.5% used national asthma protocol, and 8% used the Saudi initiative for asthma. Knowledge of those following GINA guidelines was better than those who followed the national asthma protocol. Knowledge of residents was better than physicians' knowledge. The knowledge score of those who follow the guidelines was better those who did not. Around 23% had good knowledge of inhaler techniques.

The study focused mainly on inhaler technique and awareness of the guidelines, both aspects were inadequate. The tables describing other elements were not clear. The sample size was small. Pilot study of the questionnaire was done.

Another recent cross-sectional study including 246 physicians in primary care centers in Riyadh by [33]. The majority of participants use GINA asthma guidelines, the Saudi Initiative for Asthma

guidelines came second. The knowledge of Saudi national protocol (SINA) was significantly lower than the GINA guidelines Knowledge and application of asthma guidelines were low to average. There were significant variations among physicians' knowledge and application of the asthma guidelines. Particularly between junior doctors and their more senior peers. There was an association between gender, qualification, and position with knowledge and application of asthma guidelines. Physicians who were 30 to less than 40 years appeared to be more knowledgeable than the younger physicians were. Senior registrars were also having higher knowledge compared to General Physicians (GPs). Those who were holding the Membership of the Royal College of General Practitioners (MRCGP) had higher levels of knowledge and higher application of asthma guidelines when compared with MBBS holders. A higher level of asthma guidelines application was significantly found among female physician's more than male physicians. Residents, registrars, senior registrars, and consultants appeared to be having a higher level of application of asthma guidelines than general physicians were. They considered the knowledge of asthma diagnosis to be poor. The usage of asthma control tools was 39.6%; the lack of use was attributed to their unavailability. The majority did not use an asthma action plan for their patients. Correct answers about the use of inhaled corticosteroids and short-acting beta-agonist were 3.4% and 6.2% respectively. Low level of knowledge to asthma guidelines (5.4%) was close to and low level of use of assessment control tools and written asthma action plan was the conclusion of this study. The sample size was bigger than other studies in Saudi Arabia and around the average sample size around the world. The response rate was 84.7%. The validity of the questionnaire was pretested.

Done a cross-sectional study included 153 pediatric residents from multiple residency levels. A small percentage (5.9%) reported that they use lung function test for diagnosis of asthma. High knowledge was observed in 32 of the participants while 121 had low knowledge. Only 44.4% of residents thought that compliance with the guideline's recommendation improve outcome. No difference in knowledge level was noticed between different residency levels. An earlier mentioned study by showed that residents had higher knowledge when compared to primary care physicians [32]. Residents are supposed to have higher knowledge as the nature of their post as training. The study showed that resident from governmental hospitals had better knowledge and hence suggest that training received in governmental hospitals were much better. Despite the low knowledge of guidelines and under utility of lung function test, the responders had good attitude toward the guidelines. The survey included only resident physicians and focused on SINA pediatric guidelines that hinder the generalization of results this in addition to the small sample size no data about pretesting of the questionnaire or a sample of it was provided.

Discussed the Saudi Arabian health care system [34]. The national Saudi health care system is operated mainly by the ministry of health, 40% of the healthcare system is managed by the semipublic and private sector. Insurance coverage is assumed to be covering expatriates and citizens in the future. Challenges facing the system include supply deficit, growing population and the need to provide free services. Another important struggle is the increasing load of non- communicable diseases.

In Kuwait, The prevalence of asthma was estimated to be 15% of adults and 18% of children, 90% of asthmatic adults and 84.0%

of asthmatic are using government healthcare facilities [35]. The healthcare system provides free public hospital care [36].

Conducted an observational cross-sectional study about the perception of primary care physicians in Kuwait towards guidelines of bronchial asthma and concluded that out of 250 primary care physicians, only 37% of physicians adhere to guidelines [37]. 7.6% of non-adherent physicians knew about the guidelines and around 27.6% actually had a copy of it. "A non-significant" difference in adherence noticed between those who are older in age and those working longer in their job. On the other hand, the education level had a significant relationship with the level of adherence as 14% of the adherent groups were holding a doctorate or board certificate compared with only 4.5% of those not adhering. Those who adhere to asthma guidelines had a higher mean of practice and knowledge score.

Nevertheless, both adherent and non-adherent physicians demonstrated a high positive attitude score toward asthma guidelines. Physicians included in this survey were selected randomly from primary care centers from two health districts. A number of 250 physicians approve to take part from 376 physicians. The response rate was 66.5%. The sample size is around the average size of the included studies' sample. Pilot study of the questionnaire was carried out. The actual questionnaire no sample of it was available for review; the researcher did not investigate the knowledge or practice toward asthma diagnosis and management as the previous studies.

In Lebanon, The prevalence of asthma in adults is around 9%. Surveyed 302 registered general physicians about diagnosis, treatment, and patient education and asthma guidelines from 4 regions in Lebanon [38,39].

Spirometry was used by 47.0%, 0.7% were done on-site, 46.3% were done in specialized centers. One physician only referred a patient for spirometry. Short- acting inhaled beta-agonists was the most prescribed medication by 94.3%. Inhaled corticosteroids were prescribed by 87.4%; long-acting beta-agonists were prescribed by 27.5% and theophylline by 20.9%. Around 65% use asthma guidelines to manage their patients. High awareness of the GINA guidelines was reported (72.5%).

Random selection of the sample was made from different districts in Lebanon. The sample size was the same as the average sample size around the world. Ethical approval was obtained. The questionnaire was constructed on the basis of surveys developed by the NHLBI and the Chicago Asthma Surveillance Initiative Report Team. The validity of the questionnaire was ensured through a pilot sample of 15 GPs. Sample was taken from different regions. Data analysis was explained. Actual survey was included for review.

In Egypt, assessed attitude, knowledge and practice of 352 physicians of asthma guidelines recommendations through a self-administered questionnaire in Cairo, Egypt [40]. Participants were 101 General practitioners, 131 pediatric specialists, 35 pediatric consultants and 85 doctors who did not reveal their qualifications, all engaged in direct childhood asthma care. Physicians who agree with asthma guidelines were 76.2% of respondents. Physicians referred to the cause of non-agreement to patients' socioeconomic status and compliance. 71.9% use lung function test for diagnosis. 45.2% answered that they know how to use a peak flow meter. 58.2% use a written asthma action plan which is considered a high percentage compared to other studies. The use of controllers and reliever was

known by 90.6%. Poor knowledge was evident in 28.5% and was positively correlated to qualifications. A poor attitude was found in 14.4%. The poor practice was more pronounced than poor knowledge. Positive correlations between qualification and practice and between qualification and attitude were noticed.

Physicians in this study had good attitude toward the guidelines as in [37,41] studies and the similar low knowledge and practice according to the guideline's recommendation. The sample size was big and around the average number of the studies in this review. Physicians were chosen randomly from public and private sector but the response rate of 55% to 60% may limit the generalizability of the results. A sample of the questionnaire was presented with the study. All the questions were closed ended with only (yes or no) answers, this could make the questionnaire difficult to answer and increase the non-response rate.

Health care in Egypt is delivered by both public and private providers and financers. The largest public health-care payers are the Health Insurance Organization and the Curative Care Organization. The public system provides basic universal coverage; but suffers from low fund, low quality of service, and high self-payments. The private sector is considered higher in quality than public sector [42].

Mentioned that the prevalence of asthma in Korea is around 3.9% and the severity is often underrated by physicians as well as patients [43]. Conducted a cross-sectional survey on 81 pediatricians in primary care in Incheon, Korea [44]. The peak flow meter was used by 21.5% and only 10.3% used spirometry. The assessment of the severity of asthma was accurate in 85.7%. A written asthma action plan was given to 5.2% of patients only. Intermittent asthma was 51.3% accurately managed to the GINA guideline at the time of the study, mild persistent was 68.5% accurate and moderate was 56.9% accurate. Generally, an overuse of beta-agonist and less inhaled corticosteroids was prominent. The low utility of inhaled of corticosteroids agree with other results as well as the low use of asthma action plans, spirometry and peak flow meters. The response rate was 61.8%. The sample size was small; the surveyor had included primary care pediatricians only. These might limit the generalization of the study but results agree with those around the world.

Health care in Korea is financed through National Health Insurance which covers the whole population. Health care depend mainly on private providers. That is the reason for the referral system is not functioning well. Patients in Korea tend to prefer tertiary care hospitals [45].

Cross-sectional study from Vietnam concluded the same low level of knowledge to asthma management guidelines as the previously mentioned studies [46]. 201 Primary care physicians from the urban and rural area from 2 provinces (Ho Chi Minh City and Tien Giang province) completed the questionnaires. 50% of primary care physicians used spirometry for asthma care but only 24.4% used ACT score to assess control. GINA-defined levels of asthma control related questions were all answered correctly by 20% to 42%. This agreed with the level of knowledge of asthma control by physicians in other studies from Nigeria and Italy discussed previously. The pharmacological choice was 50% correct by 22%. 46.8% adjusted their patients' medication if they were uncontrolled on Inhaled Corticosteroids (ICS) alone. Long-acting beta-agonists alone were used by 70% of physicians although it was not allowed to be used in asthma management. Inhaled corticosteroids were the most favorable

first choice of treatment in contrast to other studies which reported low use. Increasing age, internist and the general practitioner had a better overall score. Low adherence to guidelines recommendation about medications and control assessment was obvious. The study sample is high compared to other studies. All participants were primary care physicians, who attended a family medicine course. This might represent a randomization bias but they were chosen from both rural and urban areas which may reflect different practices. A sample of the questionnaire and correct answer was provided.

Stated that asthma prevalence in Vietnam was estimated at 3.9% to 5.6% of those 21 to 70 years in Ho Chi Minh City, the prevalence of asthma in Tien Giang was 6% [46]. The prevalence of "ever asthma" in children 6 to 7 years was 10.9% and that of wheezing in children 13 to 14 years was 29.5%. The Global Initiative for Asthma guidelines was used since 2009 and updated guidelines in 2015 for more feasibility for primary care where most asthmatic are managed. The majority of the ambulatory care of asthma in Vietnam is provided by primary care physicians but it's challenged by unavailability of resources and lack of knowledge, which had been outlined by their study.

A survey by Chapman et al. [4] that included 1,809 general practice and internal medicine physicians from Australia, Canada, China, France, Germany, And Japan, with around 300 physicians from each country. They were seeing 4 or more asthmatics monthly. Physicians showed a high level of awareness about the guidelines with regard to monitoring control and Single Maintenance and Reliever Therapy (SMART/MART) strategy but only a few apply them correctly. Physicians used written asthma action plans by a percentage of 37%. This varied from country to country with 30% in China to 50% in Japan. This low utility of an asthma action plan is consistent with other studies. Assessment of asthma control differed from country to country. In china, monitoring symptom frequency was used by 95% of physicians. Only 8% of physicians used it in Japan. Lung spirometry was the most used in France and Germany. In Australia and Canada, monitoring the use of short- acting beta-agonists for symptom control was the most common. Only 10% of all physicians used validated patient-reported questionnaires, which are the Asthma Control Test (ACT) and Asthma Control Questionnaire (ACQ) score.

The majority of physicians (72%) had prescribed Single Maintenance and Reliever Therapy (SMART/MART), but 91% prescribed a Short-Acting Bronchodilator (SABA) with it sometimes. The highest level of awareness and use of MART was noted in China. The dearth of use of a written asthma action plan in this study is consistent with other studies mentioned. Fewer physicians had attended continuous medical education on asthma were from Japan and France.

Surveys were presented with different languages according to the country. Questionnaires were filled either by telephone, online or face-to-face. The health care systems of countries included were considered high, which might affect the generalizability of the results. The sample size was the biggest of all studies included in this review. Worth a mention that, Australia has a universal medical public health insurance program. Health care system is run by federal, state and territory and local government. The federal government provides funds and indirect support to the states and health professions. Canada has a universal public insurance program. Provinces and territories in Canada are responsible for organizing and delivering health services and supervising providers. Almost all health care providers are private. In China, the central government is totally responsible for national health legislation and policies. Also reported poor adherence to the 2007 National Asthma Education and Prevention Program (NAEPP) asthma guidelines in 22 primary care health practices in the United States [47,48]. They have done a retrospective analysis of 1,176 asthmatic patients' data from 5 years old to 65 years old. Assessment of control was done at least once per year in 15% of the patients. Only 1.3% of patients had a documented observation of their inhaler technique. Documented Asthma action plans were found in only 3.1% of patients' records in all age groups. Maintenance long term medications were prescribed for 70.4%, with 57.5% of children receiving only Inhaled Corticosteroids (ICS), leukotriene modifiers or both with 16.5% with combinations of long-acting bronchodilator therapy and anti-inflammatory prescriptions. Adults and adolescents had higher rates of combined Inhaled Corticosteroid (ICS) s with Long-Acting Beta-Agonist (LABA) prescriptions. This chart review concluded a low assessment of control, lack of use of an asthma action plan. Low prescription of maintenance medication.

The researchers had a large sample size and they accessed all primary care records. The practices were selected from different areas and practice types. The method of data extraction was explained. Refusal rate of eligible patients was included. All data required were identified. Elements identifiable through medical record review were selected from the 2007 NAEPP asthma guidelines. Abstractors were trained and experienced nurses. Inter-rater reliability was assured. No information on blinding was provided. No data about how confidentiality was assured.

In the United States, the government and employers share responsibility to provide good quality health insurance. There are wide gaps in the rate of insured population across the U.S. population. Medicare provides coverage for adults age 65 and older and people with disabilities. Medicaid and the Children's Health Insurance Program are for certain low-income populations. Private insurance is mainly managed at the state level [47]. Prevalence of asthma is approximately 7.6% among adults In the United States and varies between different ethnic groups [49].

Performed an audit on asthma care in 50 general practices in Bedfordshire UK and found out a considerable variation in practice from the standard care [50]. Short-acting bronchodilators were over-prescribed. More than 5% of patients in 25 practices were given more than 12 short-acting bronchodilator inhalers in the year before the audit. Some patients, on the other hand, did not collect preventer inhaler. A median of 32% of patients ordered <75% of the permitted prescriptions for inhaled corticosteroids. This audit outlined the need for a system to calculate the number of inhalers prescribed to identify excess short- acting beta-agonist use and those at-risk patients. The centers included in the audit were kept anonymous. Results were described in median. All general practices in Bedfordshire were invited to participate in the audit. Data for the preceding 12 months was extracted. Method used to extract data was explained. Data analysis of this audit was not clear but results agree with other audits. High utility of short-acting and beta-agonists and low assessment of inhaler technique.

Health legislation and general policy are set by the Parliament, the Secretary of State for Health, and the Department of Health in England. The Department of Health leads the whole health system, but NHS England is responsible for day-to-day operation [47]. Asthma prevalence among adults in the UK according to The World

Health Survey (WHS) is 18.2% [49].

Similar variations were seen in an audit done by Price & Agarwal et al. [51]. They performed a prospective cohort study using an electronic audit of asthma care in 2 academic family health teams consisting of family physicians, nurses and allied Health members and one community-based family health team using 884 patients' charts in Ontario, Canada. Asthma control was assessed in 202 patients from 4,122 patients. 136 patients from 884 patients had the assessment of their control once in the study year. One hundred fifty three had poor control and one had good control. Only 61 of the poor controlled patients were on controller medication (50.8% on ICS, 44% on ICS/LABA, 5% on ICS +Leukotriene Receptor Antagonist (LTRA). Among those who had a good or unknown control 47% were on ICS alone; 49.8% on ICS/LABA, 3.2% on ICS+LTRA. Initiation or escalation of controller medications was done in 15.4%, with 0.02% who had a medication De-escalation. No asthma action plans were given to any patient during the study periods. The conclusion of the audit was as the following: 85% of patients were not assessed although they had almost five visits per year. Augmentation was done in 15%, although 59% were poorly controlled. Overtreatment was found in around 35% of patients who were on controller medications. The study revealed poor adherence to guidelines in term of asthma control assessment, written asthma plan and pharmacological management.

A validated method was used to identify patients' records. Inclusion and exclusion criteria were explained and the sample was randomized. The form used was assessed by trained reviewer. Pretesting was done to assure agreement and inter-rater reliability was calculated. Elements tested were identified. The sample size was less than those of [48]. The researcher mentioned that they had ethical approval; they also mentioned that patient consent was not required but any information about confidentiality and blinding of the reviewer was provided.

Chart review can provide information about a big number of patients but physician poor documentation can lead to data error.

Barriers to Compliance

Almost all barriers that would be mentioned below were referred to by the GINA guidelines. The GINA [2] revealed that primary care settings and developing countries face challenges to implement asthma management recommendations. Mentioned that lack of knowledge is not the only barrier to follow asthma guidelines but insufficient time for control assessment and providing patients with a written asthma plan [7]. Some physicians simply forget to do so. Another important barrier is the lack of experience and confidence. Ignorance about the importance of written asthma plans was obvious with the low referral rate to asthma educators. Surveyed reasons for noncompliance and revealed the same causes, in addition to lack of resources, mentioned by 13.5%. However, lack of awareness remained the most important barrier [31].

Lack of resources was a big obstacle for asthma guideline implementation in Nigeria. According to, there was no asthma clinics in 68 hospitals included in their survey [25]. 38% had peak expiratory flow rate meters in the emergency department. Twenty nine percent had spirometers, 14.7% had skin allergy test facilities, 38% had pulse oximeter, 17.6% had arterial blood gases analyzer, and 41% had nebulizers while 20.6% had spacer devices. Oral Short-Acting Beta 2 Agonists (SABA) and oral glucocorticosteroid were available in 79.4% of the hospitals. Theophylline and SABA inhaler were available

in 76.5%. Long-Acting Beta 2 Agonists (LABA) with steroid fixed combination inhalers was available in 50% of tertiary hospitals. The percentage of doctors and nurses attending asthma CME was 8.8% and 14.7% respectively. Study results were attributed to the lack of resources as only 38.9% had peak flow meter and 13.7% had spirometry in their practices [22]. The majority of physicians diagnosed asthma by symptoms only which did not concur with the GINA guidelines in addition to the lack of qualified health practitioners to manage asthma. They blamed this deficit to the inappropriate government health policies which had a limited 3% budget allocated to health care *vs.* 15% recommended by the world health organization.

Study participants reported that barriers to good guideline-based practice were the unavailability of diagnostic and treatment facilities (44.3%), poor medication adherence (25.7%), and high cost of asthma medications (18.6%) [27]. One important knowledge related barrier was mentioned by is that physicians who were working for long years seemed to have a low implementation of guidelines explained by their dependence on early gained knowledge which was not guideline adherent, so long years of experience may have a negative impact on guidelines application [19].

Referred to elements which influence guidelines implementation including elements related to guidelines for example complexity, reliability, being tribal, level of evidence, and transparency, elements related to their implementation for example communication methods, educational approaches, and to the social and cultural conditions which includes practice standards, recommendations agreement with the values, social and clinical norms and habits [5].

Another physician-related element that affects guidelines implementation was the difficulty in changing old practices. Physicians' low confidence, the inapplicability of the guidelines, difficulty to accept them and presumption of failure in following them were all factors that hinder guidelines implication.

Worked on identifying the reasons for lack of adherence to pediatric asthma guidelines in Saudi Arabia [52]. Some of the elements mentioned above were stated by the majority of physicians who were not aware and not familiar with the recommendations. The main reasons for that were attributed to them not being included in the development of the guidelines and the guidelines were not circulated well in their facility. Some physicians did not even agree with these guidelines. Some thought they were not applicable to their patients. Assessed the adherence of primary care physicians to the Saudi National Asthma Protocol [53]. Eighty two percent were aware of the presence of the National Protocol for Management of Asthma. 3/4 read it, less than half of those who read it, received training on it. Over 90% were not using it. More than 25% of physicians, who read it, read it once. 50% reviewed it every 3 to 6 months. 97.8% of the physicians, who read it, agree with it on the other hand 62.2% find the classification of severity difficult. Half of the physician mentioned that had the skill to use a peak flow meter and 63.9% said that they could interpret the readings. One-fifth of physicians mentioned the language barrier. Forty per cent claimed that there is a lack of basic asthma medications. Patients 'noncompliance was referred to by 32.4% Insufficient time to manage asthma was stated by 27%. The lack of training on the Saudi National Asthma Protocol was reported by 21.6%. In 54.5% of the centers, the National Protocol for Management of Asthma was available. Peak flow meters were available in 5 centers but were not working in three of these. Beta-2 agonist inhalers were available in 90.9%, while no steroid inhalers or sodium cromoglycate.

Described a different set of barriers, the institutional barriers, which include inappropriate follow-up systems and deficient resources [37]. Other health care worker related barriers include workload and absence of training, these apart from patient-related barriers. Reported that not only the lack of spirometry as a barrier but the improper use and interpretation [37]. It was surprising that only 17% knew that they were available in their facility. The practice was the main source of knowledge to 25.8% of the physicians who were adherent to guidelines and 35.7% of the non-adherent in their study. Forty nine percent of physicians related their non-adherence to patients, 24.2% mentioned that guidelines are not complete and 22.3% claimed that these guidelines are difficult to adhere to. Those who disclosed that the guidelines were not suitable to be used in their country were 15.9%.

Price and Agarwal [51] revealed that short consultation time to be a barrier for guidelines implementation regarding the assessment of control and the lack of knowledge to the treatment escalation and initiation as per guidelines. Related the physicians' non-compliance to pharmacological recommendations to them being non-confident and non-comfortable toward prescribing long-term inhaled corticosteroids [54].

Study participants regarded lack of familiarity to be the reasons for non-compliance to guidelines in general (50%), the use of ICS (33.3%) and the use of peak flow meters (24.6%) [44]. External barriers (insufficient time, equipment and staff shortage) affected the guideline compliance in general in 52.5%, ICS use in 10% and the use of peak flow meter in 64%. Correlated the poor uptake of asthma guidelines to the confusion noted by some physicians in terms of assessment of control and treatment escalation. This might have led to the frustration of health care practitioners and a lack of trust. They stated that a positive attitude toward the guidelines affect the compliance more than knowledge does. The impact of the attitude toward the guidelines might extend to decrease the faith of decision-makers in asthma guidelines and therefore might limit the guidelines implementation enablers.

Consequences

Asserted that prescriptive adherence to GINA guidelines was significantly related to increased probability to have well-controlled asthma than prescriptive non-adherence Baldacci et al. [13].

Addressed the importance of assessment of asthma control when a physician needs to choose medication and to make a decision about stepping or stepping down the treatment [48]. The guidelines recommend assessing reasons for non-control before the escalation of treatment. Physicians must assess triggers, medication adherence, and inhaler technique. Failure to do so would result in overtreatment in case of poor compliance, presence of triggers and inadequate inhaler technique, adding or escalating treatment would have a limited effect.

Asthma action plans could reduce both mortality and morbidity in children since they are prone to acute exacerbation during school time, yet reported that less than 10% of the grade school-aged children and 3% of adolescents had a documented asthma action plan [48].

Stated that failure to implement guidelines implementation affects proper asthma care, clinical effectiveness, quality of life and health care expenditure [5]. Patients may be using unnecessary or even suffer from side effects of medication if guidelines are not followed.

Referred to The NRAD that outlined that the excess use of short-acting beta-agonists can be the cause of missing the risk of asthma attacks and even death it was stated that the use of more than four puffs of short-acting beta-agonists per week was equivalent to poor control [50]. Using more than 3 salbutamol inhaler per year increase the risk of hospital admission.

Study concluded that 447 asthma emergency hospital admissions, which constituted a great burden, occurred in those who required inhaled steroids but prescribed <10 inhaled corticosteroids per year [55]. In this group, rising numbers of prescribed SABA canisters is a clear marker of risk for hospital admissions. In few cases around 0.3%, long-acting beta-agonists were prescribed alone without inhaled corticosteroids. Long-acting beta-agonists increase the risk of mortality if used in unstable poorly controlled patients without concomitant ICS therapy or planned medical follow up.

Methods of Improvement

Suggested that the use of electronic medical records might improve guidelines adherence [48]. Although it may not advance the actual delivery of recommendations but serve to achieve better documentation [56]. Pointed to the importance of teamwork and distribution of tasks as a feature of high guidelines adherent practice in the primary care settings. They as well stated that the presence of electronic medical records might enhance guideline compliance. In their study, they argued that teamwork; coordination of care within the health care practice has a greater impact on guidelines implementation than individualized intervention such as improving healthcare professional knowledge and providing resources and time. According to over prescribed short-acting beta-agonists and under prescribed inhaled corticosteroids are the causes of most asthma hospital admission [55]. The introduction of electronic surveillance of the prescription refill system could alert the physicians to facilitate monitoring populations at risk. Computer decision support systems, including electronic alerts, are gaining popularity around the world to raise prescribing safety. They referred to practice policies that can pick up inappropriate LABA monotherapy and give feedback to physicians [57] found that intervention that can support health care workers adherence to asthma guidelines include: Health information technology and paper-based interventions planned to help in decision-making, feedback and audit to deliver information about the performance of health care workers and clinical pharmacy support interventions [58,59].

Conclusion

Asthma guidelines were set to assure patients are managed in the best way and their asthma is well-controlled. Failure to adhere to asthma guidelines was noticed among several practice settings around the world. Generally, Low knowledge of asthma guidelines, diagnostic methods, control assessment, management in the acute setting as well as maintenance treatment can be concluded from this review.

Another issue raised was the difficulty of applying the guidelines due to the other several barriers. Enhancing the knowledge to fill the gap between physicians' knowledge and physicians' practice by starting with building physicians' capacity and then enable them to practice with performing routine assessments might be a solution. Ensuring that resources are available such as spirometry, peak flow

meters and control assessment charts is very vital. Changing believes and attitude is the greatest challenge and would require time and effort.

Enablers and barriers should be addressed in the guidelines. Policy makers in health care sectors need to find the best way to implement guidelines and advocate best practice. Collaboration between those who set the standards and those who should practice them can be the key to success.

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