Determinants of family medicine physicians’ knowledge and application of asthma management guidelines at primary healthcare centers in Riyadh, Saudi Arabia

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Abstract

Background: The level of uncontrolled asthma is still high despite the availability of effective treatments and evidence-based guidelines for controlling asthma. Knowledge and adherence to evidence-based guidelines among care providers are crucial to the treatment.

Objective: To investigate the determinants of family physicians’ knowledge and application of asthma management guidelines at primary healthcare setting in Saudi Arabia.

Methods: This is a cross-sectional study, conducted at 18 primary healthcare centers in Riyadh, Saudi Arabia. The sample consisted of 246 physicians. A self-administered questionnaire was distributed among the physicians. The questionnaire included demographic, job characteristics, knowledge of asthma guidelines, and application of asthma guidelines’ questions about the essential items related to diagnosis and management of asthma according to the international/local guidelines. The minimum acceptable level for each knowledge and application of guidelines was defined as scoring 70% correct answers.

Results: The results show very low level of knowledge of guidelines among physicians with 94.6% scoring below the acceptable knowledge level. The guidelines are applied below the acceptable level with 55.6% scoring below the cut-off point. Higher level of knowledge is associated with higher position of the physician (P = 0.006), qualification held by the physician, namely, MRCGP qualification vs. MBBS (P < 0.001), and the physician’s experience, namely, 10–15 years of experience vs. less than 5 years (P = 0.01). The application of guidelines is associated with position of the physician (P = 0.041). Physicians with registrar position scored higher application for guidelines than general practitioners and senior house officers.

Conclusion: Recognition of the low level of knowledge and application of guidelines among care providers and working toward minimizing this problem can be through education, training, and monitoring of application; this can potentially improve asthma control among patients.

Keywords: Bronchial asthma, Global Initiative for Asthma, guidelines, primary care, Saudi Initiative for Asthma

Introduction

Bronchial asthma (BA) is one of the common diseases seen by primary care physician (PCP) in Saudi Arabia; its prevalence is nearly 4.1%, and around 2 million people are affected in Saudi Arabia¹,¹³ and around 334 million people in the world are found to be affected as stated in the global asthma report.¹³

Asthma, despite considerable morbidity and mortality, is a controllable disease when it is treated well, accounting for 1% of all deaths in most countries.¹² In a study that was conducted by Al-Jahdali et al., using the Asthma Control Test (ACT) to assess patients in five major hospitals, they found that the control rate was uncontrolled (64%), partially controlled (31%), and controlled (5%); this finding can be due to many factors related to patients, such as inappropriate inhaler technique, poor compliance to treatment, or doctor-related factors in evaluating the severity of asthma and its effect on patient’s life.⁴

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Asthma has a considerable effect on quality of life and can lead to a decrease in the productivity of the person in his or her work or school achievement; it might also have an impact on the economy and reflect on the cost of treatment and the individual’s productivity; the loss is estimated to be around $3.8 billion each year.\(^{[5]}\)

Controlling asthma could be achieved by adapting clinical practice guidelines to standardize diagnostic criteria and treatment options. Over the past years, clinical practice guidelines have increasingly become an essential part of clinical practice; clinical guidelines are defined by Institute of Medicine as “Systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances.”\(^{[6]}\)

The important benefit of clinical practice guidelines is their potential to improve the quality and process of care and patient outcomes. On the other hand, it can be complicated by concerns about the quality of available guidelines, its adaptation for local sociality, and perhaps, most importantly, harm to patients.\(^{[7]}\)

Evaluation of the current guidelines is important to assure that the guidelines have the intended impact on the quality of care. It is important to select an appraisal process. Guideline appraisal methods are intended to be used to systematically assess and compare guidelines using the same criteria. The Appraisal of Guidelines Research and Evaluation (AGREE) instrument is a gold standard for guideline appraisal.\(^{[7]}\)

Global Initiative for Asthma (GINA) was established in 1993 by the World Health Organization and National Heart Lung and Blood Institute; the goal is to have a standard to prevent and manage asthma; many updates since that time starting in 2002 adopted the new evidence-based methodology for guideline update moving from expert opinion;\(^{[8]}\) also, GINA guidelines shifted from subdividing asthma by severity because of its difficulty of application in practice; a tool was developed to help better assess the patients and to categorize them based on the control: controlled, partially controlled, and uncontrolled.\(^{[8]}\) This may be of particular importance, as it is easy to understand by a patient and physician, and a simple to-use approaches regarding treatment decisions are more likely to be accepted and applied in a clinical setting.\(^{[8]}\) The final update was made in 2016; the changes were considering many elements: stepwise treatment for adults and adolescents, management of asthma in low-resource settings, primary prevention of asthma, and also they highlighted the barriers to implement the clinical guidelines that included insufficient knowledge of recommendations, lack of agreement with recommendations or expectation that they will be effective, resistance to change external barriers (organizational, health policies, financial constraints), lack of time, and resources.\(^{[8]}\)

The standard guidelines can be adapted to the culture where it is applied; the Saudi Initiative for asthma (SINA) was introduced in 2009, using international guidelines, National Asthma Education and Prevention Program (NAEPP), and GINA. The reasons are to help non-asthma specialists, including primary care and general practice physicians. Furthermore, SINA is customized to align with available medication in the country. Local natural phenomena such as sand storms are another reason for SINA development. SINA was reviewed twice in 2012 including the guidelines for difficult-to-treat asthma and 2016 when this study was conducted; final version was focused on pediatric management, difficult patient, and patient education.\(^{[9]}\)

Studies that have been conducted to evaluate the knowledge and application of GINA guidelines are rare, especially in primary care setting SINA was developed to help achieve the best care; it needs to be assessed in a real-life situation.

This study aims to assess the knowledge and application of guidelines among PCPs, in particular SINA guidelines. In addition, it aims to assess the determinants associated with knowledge and application of guidelines among PCPs.

Methods

Study design and sampling method

The study design is a cross-sectional study conducted at 18 primary healthcare centers operated by the Medical Services Division of the Ministry of Defense in Riyadh. The target population of the study is all physicians working at these primary centers. The sampling technique was surveying of all the physicians. Hence, no sample size calculation is required as all the physicians were surveyed without random sampling taking place. The physicians registered in those PMCs are 281 physicians. The questionnaire was distributed electronically using the Intranet e-mail service over 3 waves between March 2016 and September 2016 until 238 completed questionnaires were collected. The response rate was 84.7% which indicates good level of response.

The research tool

The research tool is a self-administrated questionnaire designed by the authors. The questionnaire was designed through extensive literature search, experts opinions, and using different manuals about the practice of asthma management. The research tool went through phases of validation until we arrived at the final version that was distributed among the physicians. The first phase of validation was face validation by three experts (consultant physicians) in the field. The questionnaire was adjusted according to the experts’ feedback. The process was repeated until an approval for the final form was accepted by the three experts. The second phase consisted of test–retest process where the questionnaire was distributed to a small sample of 28 physicians from the outpatients’ clinics in Prince Sultan Military Medical City (PSMMC) (not included in the final questionnaire distribution). The questionnaire was redistributed again after 2 weeks. Measures of agreements between the answers in the first and second distribution were conducted using intraclass correlation. The items that would show a low agreement will be excluded from the questionnaire.
The minimum accepted level for agreement is 75%.[11] No items found to have less than 75% agreement. Therefore, no items were removed from the final version.

**Scoring**

The scoring method included two types of questions. The first type consists of the questions that only can have one correct answer. These questions have binary score (1 mark for the correct answers, 0 marks for incorrect answers). The second type of questions consisted of answers that can be scaled in terms of correctness. These questions do not have incorrect answers. The best answer among the correct answers took the highest mark, and the least correct answer took the lowest mark. The scale used 1 mark step between the answers for this type. For example, if the question has 5 answers, then the best answer will have 5 marks, the second best will have 4, and so on, with the least correct answer having a single mark.

The maximum score for the questions that measured the physicians’ knowledge about asthma management equals 13 marks. The maximum score for the physicians’ application of asthma management equals 21 marks. The cut-off point that was considered as minimum acceptable score is 70%. The cut-off point based on the minimum acceptable level applied in quality control standards at the hospital.[12]

**Statistical analysis**

The sociodemographic characteristics of the participants are described in the results with graphical representation of the scores for the items that measured the physicians’ knowledge and application of asthma management. In addition, barriers for using ACT are represented graphically. One-sample t-test is used to test the differences between the scores and the proposed minimum acceptable score. Two independent samples t-test was carried out to test any differences between two groups within the same variable, for example, males’ score vs. females’ score. One-way analysis of variance is used for the variables that contained three or more levels such as job title. The final results are presented in the next section.

**Results**

Table 1 shows the sociodemographic characteristics of the participants. Most of the physicians who participated in the study are less than 40 years old (180/246). Females represented 57% of the sample. Approximately 65% of the participants are married. Saudi nationals formed 68.7% of the participants. The residents are the majority of the participants (41.0%). This also reflects the qualifications of the participants where physicians with MBBS formed the biggest portion (55.3%). The holder of Arab board represented the smallest group of qualifications (10/246, 4.1%).

The guidelines for asthma management used by the participants are presented in Table 2. The majority of the participants (69.5%) use the GINA guideline. The SINA guideline came in second place (22.4%), other guidelines received 5.3% of the answers, and only seven physicians reported using the National Heart, Lung, and Blood Institute (NHLBI) guideline. See Table 2 for the results.

The participants were asked about the barriers for using ACT. The participants were allowed to choose more than one barrier. The availability of the ACT questionnaire is considered the biggest barrier (63.2%). Recall bias is the second major barrier (39.1%). Subjectivity of the questions is considered to

### Table 1: Sociodemographic and job aspect characteristics of the participated physicians (n=130)

| Characteristic                                | Frequency (%) |
|----------------------------------------------|---------------|
| Age (years)                                  |               |
| 20<=30                                       | 85 (34.6)     |
| 30<=40                                       | 95 (38.6)     |
| 40<=50                                       | 38 (15.4)     |
| 50<=60                                       | 16 (6.5)      |
| 60<=70                                       | 12 (4.9)      |
| Total                                        | 246 (100.0)   |
| Gender                                       |               |
| Male                                         | 105 (42.7)    |
| Female                                       | 141 (57.3)    |
| Total                                        | 246 (100.0)   |
| Marital status                               |               |
| Single (including divorced, widowed, and separated) | 87 (35.4)   |
| Married                                      | 159 (64.6)    |
| Total                                        | 246 (100.0)   |
| Nationality                                  |               |
| Saudi                                        | 169 (68.7)    |
| Non-Saudi                                    | 77 (31.3)     |
| Total                                        | 246 (100.0)   |
| Job title                                    |               |
| GP/senior house officer                      | 25 (10.2)     |
| Resident                                     | 101 (41.0)    |
| Registrar                                    | 57 (23.2)     |
| Senior registrar                             | 27 (11.0)     |
| Consultant                                   | 36 (14.6)     |
| Total                                        | 246 (100.0)   |
| Qualification                                |               |
| MBBS                                         | 136 (55.3)    |
| MRCGP                                        | 33 (13.4)     |
| Saudi board                                  | 50 (20.3)     |
| Arab board                                   | 10 (4.1)      |
| Other**                                      | 17 (6.9)      |
| Total                                        | 246 (100.0)   |

**Table 2: Guidelines for asthma management used by the participating physicians**

| Guideline         | Frequency (%) |
|-------------------|---------------|
| GINA              | 171 (69.5)    |
| SINA              | 55 (22.4)     |
| NHLBI             | 7 (2.9)       |
| Other guidelines  | 13 (5.3)      |
| Total             | 246 (100.0)   |

GINA: Global Initiative for Asthma; SINA: Saudi Initiative for Asthma; NHLBI: National Heart, Lung, and Blood Institute
be the third barrier (34.8%). Figure 1 is a bar chart showing the percentages associated with each barrier.

**Guidelines’ knowledge score**

The questions that measured knowledge of guidelines are described in this section. Figure 2 shows the results for three questions of binary output (correct vs. incorrect). The horizontal line at 70% mark shows the minimum acceptable level of correct answers. Two questions show less than 70% correct answers. The “how many steps in asthma management plan do you know?” received 52.6% correct answers only. The second question “which of the following is not an item of asthma control test” received 66.9% correct answers. However, this percentage is still below the minimum acceptable level. The only question that received 70% or more correct answers is the question about criteria used to classify patient with asthma.

The next question in the knowledge of guidelines is about the percentage of physicians prescribing inhaled steroids for their asthma patients. This question is a scaled question. As described in the methodology section, the least correct answer took 1 mark and the best correct answer took 5 marks. For this question, <20% is least correct answer, and as the percentage categories increase the mark increases. Hence, the best correct answer is 81%–100%. Most of the participants preferred the middle ground where they use corticosteroids between 41% and 60% of the times; 41.2% of the asked physicians preferred this amount of usage. The best usage per guidelines is 81%–100%; however, this category received the lowest percentage of selections with only 3.4%. Figure 3 shows the answers’ distribution for the usage of inhaled corticosteroids among the participated physicians.

The last question that measured knowledge of guidelines asked the physicians about the percentage they use rescue medication (short-acting beta agonist). This question is also scaled question similar to the previous question. The only difference is the marks are reversed in this question. The least percentage corresponds with highest mark, that is, 5 marks, and the highest percentage corresponds with the lowest mark, that is, 1 mark. Figure 4 shows the distribution of the answers for this question. The least correct two answers have the highest percentages of answers 30.3% and 28.7%, respectively. The best correct answer (<20%) received the lowest number of answers with only 6.2% of the answers.

**Guidelines’ application score**

The questions regarding the guideline application score are described in this part of the analysis. Figure 5 shows the...
distribution of answers for binary questions (correct vs. incorrect). The horizontal 70% line is the minimum acceptable level of correct answers percentage. Only 4 questions of 10 questions got 70% or more correct answers. The question that showed the lowest correct answers is the one concerned with the frequency of using ACT on the patients (27.1%). Using physical examination to assess patients with asthma was only identified in 34.6% correctly as unnecessary examination. Lung function test in assessing asthma received low responses with only 38.9% of the physicians using it. The question about using step-up and step-down in asthma management plan received the highest percentage of correct answers (94.3%). For the rest of the answers, see Figure 5.

The physicians were asked about the items they include in the written management plan. The answers included six items and each one of the items is given 1 mark in the total score, that is, including the full six items in the written plan means the maximum number of marks is 6. Figure 6 shows the distribution of the items included in the written management plan. Only two items passed the 70% mark, namely, conditions where the patient is needed to go to emergency room (82.3%) and instruction for

![Figure 5: Percentages of correct and incorrect answers for the questions concerning the guidelines’ application (n = 246)](image)

![Figure 6: Items included in written management plan for bronchial asthma (n = 246)](image)
Determinants of knowledge and application

In Table 3, the physicians’ scores are stratified into two main categories (acceptable score, i.e., 70% or above, and unacceptable score, i.e., less than 70%). The results in the table show that physicians who scored acceptable marks in guidelines knowledge are only 7.3% (18/246). The application shows higher results in the satisfactory score with 48.0% (118/246) of the physicians having acceptable score. The overall average scores of the physicians in knowledge and application score are compared with the minimum acceptable level. Table 4 shows the results of the comparisons using one-sample t-test. The results indicate that both average scores are statistically below the minimum acceptable level. The overall average score of knowledge is 54.8% which is well below the 70% mark. The application average score is 68.6% which is statistically not different from the 70% mark.

Table 4: One tailed, one-sample t-test for testing knowledge and application scores versus the minimum acceptable score 70% (n=246)

| Score   | Mean±SD | Minimum acceptable score | p** | 95% CI of the difference |
|---------|---------|--------------------------|-----|--------------------------|
| Knowledge | 55.4±12.5 | 70 | <0.001 | 53.8 – 57.0 |
| Application | 68.6±14.2 | 70 | 0.067 | 66.7 – 70.4 |

For gender, males are considered the group of comparison, and for marital status variables singles are the lowest category in the age variable is considered the category of comparison, i.e., for age 20–<30 years. The knowledge level without any of the factors included in the model averaged 51% score. This model explained 26% of the variations between the physicians with regard to the differences. Regression analysis

The determinants for knowledge among physicians were assessed using multiple linear regression [Table 5]. Physicians with age group 30–<40 years showed highest knowledge when compared with their younger peers. Married physicians have less knowledge than single physicians. Senior registrars also show higher levels of knowledge when compared to general practitioners (GPs). Holders of MRCGP qualifications have higher levels of knowledge when compared with MBBS holders. The knowledge level without any of the factors included in the model averaged 51% score. This model explained 26% of the variations between the physicians with regard to the differences.
between the physicians’ knowledge of asthma guidelines. Such level of explanation can be considered moderate in the scope of health education assessment.

The level of application similarly was modeled using multiple linear regression. Females have statistically higher level of application score than male physicians. Residents, registrars, senior registrars, and consultants show higher level of application than GPs. MRCGP holders have higher application level than MBBS-qualified physicians. Physicians who apply SINA guidelines have higher application score than physicians who apply GINA. Physicians who answered that they use other than GINA, SINA, and NHLBI guidelines show statistically lower score than GINA users. The model explained 34% of the variation between physicians with regard to the application of guidelines. Again, this is considered a moderate explanation.

Discussion

This study found that knowledge and application of asthma guidelines among PCPs are low to average at best. The knowledge of the locally adapted guidelines (SINA) is significantly lower than the global guidelines (GINA). There were differences among the physicians in knowledge and application of the guidelines especially between junior doctors and their more senior colleagues. The physician’s gender, qualification, and position were associated with knowledge and application.

A recent Saudi study published in 2015 showed that 68% of the adults assessed have uncontrolled asthma. In 2008, another survey conducted in Saudi Arabia reported that only 5% of the surveyed patients have controlled asthma, 31% partially controlled, and 64% were uncontrolled. The 2010 National Health and Well-being Survey reported an average of 53.5% not well-controlled asthma in five European countries. In the United States, the Asthma Control Characteristics and Prevalence Survey Study (ACCESS) reported 58% uncontrolled asthma among US adult patients. The asthma prevalence among Saudi adults is estimated to be approximately 4.1% and among children to be between 8% and 25%. Several studies suggested that the lack of adherence to asthma control guidelines by care providers may play major role in the issue of uncontrolled asthma. These studies also suggested that lack of knowledge among care providers about the guidelines can be part of the problem. This can lead to significant increase in morbidity and mortality among patients and decrease in their quality of life.

In 2000, GINA published guidelines for asthma control. These guidelines are revised and updated annually. Since 2006, GINA guidelines shifted from subdividing asthma by severity (intermittent, mild persistent, moderate persistent, and severe persistent) to more practical approach by assessing, treating, and monitoring asthma based on patients’ level of control rather than on severity. This shift helps incorporate the patient’s perspective in controlling asthma.

In Saudi Arabia, the SINA was established in 2009. The guidelines were based on GINA and NAEPP. The two existing guidelines “were customized based on reviewing the available local literature and the current setting in Saudi Arabia.” Two reviews used the same approach in 2012 and 2016. In this study, 74.6% used GINA guidelines, 20% of the participants used SINA guidelines, 0.8% used NHLBI, and 4.6% reported using other guidelines. The evidence found in this study suggests low practice of the locally customized guideline SINA among the sampled physicians; one would have expected that the locally adapted guidelines would have a larger percentage of use. This issue needs to be explained as such guidelines are customized to account for local settings.

An assessment of the physicians’ knowledge and application of asthma guidelines showed lack of knowledge and low to moderate application of these guidelines. A scoring method developed by the authors to assess both areas suggested a cut-off point mark of 70% based on the acceptable level for quality and good practice at PSMMC. The results show that only 18 of 246 (7.3%) physicians have higher or equal minimum satisfactory level of knowledge for the guideline items related to the barriers for the guidelines can partially explain this result, but the profound lack of knowledge has to be addressed. The application of the guidelines shows better results with 118 of 246 (48.0%) physicians scored above or equal to the 70% cut-off point. This variability between knowledge and application can be due to the use of hospital’s guidelines and standards for practice. The comparison of the overall average of the scores in knowledge and application shows that both averages are significantly statistically below the minimum acceptable level or borderline equal to the cut-off point.

The second part of the analysis tried to assess the determinants of the physicians’ scores using demographic and job characteristics. The job title of the physician is found to be associated with the physicians’ knowledge and application score. Senior registrars show statistically higher average knowledge score than other position including the higher position of consultant. The reason is unclear; however, it can be because older physicians are less motivated to keep updated about recent changes in guidelines or due to plateau effect (efficiency variation decrease overtime). This result conforms to the expectations as higher medical position indicates longer experience, higher level of training, and higher level of practice. The application score shows statistical difference between all positions and GPs. The qualification of the physician shows that it could have a role in both the physician’s knowledge and application scores. MBBS holders showed lower average scores in knowledge and application than holders of MRCGP. The gender of the physician was only significant in application. Female physicians have higher application score. In addition, SINA users have the highest application score when compared with other guidelines. This can be due to the additional information about SINA provided by the hospitals and PHCs to PCPs for any update or training.
The knowledge of guidelines was very low similar to our finding in two studies. The study by Yousef and colleagues conducted in Al-Khobar city in Saudi Arabia reported 8% of good knowledge of the guidelines vs. 5.4% in our study. This low level of knowledge was also reported by Cabana et al. with only 5% of the physicians reporting familiarity of the guidelines. Wisnivesky and colleagues reported 39% of general knowledge of the guidelines. However, the authors did not use a scoring technique to assess such knowledge. In their study, the authors asked the physicians whether they have read the guidelines or not. This may explain the higher percentage they reported in their study. A study conducted in the United States and another in Egypt reported 55% and 71.5% of good knowledge of guidelines among physicians, respectively. This higher percentage of knowledge may be due to the less strict cut-off point (50%) used in these studies in comparison to our study (70%) and the availability of resources for guidelines application (electronic/paper forms, system support, patients education methods, etc.) in the American study. The application of guidelines ranged from 21% in Doershug’s study up to 56.4% in Salman’s study. Our study reported 44.6% of good application of guidelines which conforms to the results in these studies.

This study measured the knowledge and application of asthma control guidelines among PCPs at PHCC in Riyadh. The importance of this study stems from the importance of measuring knowledge and application of guidelines for several reasons: (1) measuring knowledge and application of guidelines are crucial for minimizing the variation in practice, which could lead to fewer medical errors; (2) standardizing the provided healthcare will guarantee consistency and equality of the care provided among patients; (3) it will improve care by keeping an eye on the level of knowledge and application among the physicians for the dynamically changing guidelines. The guidelines’ reviews are continuous to support the most recent evidence and identifying potentials for improvements. Therefore, measuring knowledge and application will ensure an alignment between practice and evidence.

The results shown in Figures 5 and 6 are the areas of deficiency in both knowledge and practice. In Figure 5, we identified five areas that showed unacceptable level of knowledge. The areas are low knowledge in using ACT, using physical assessment, using lung function tests, the procedure of using ACT, the person who is responsible for educating the patient about his or her condition, and the frequency of getting reviews for inhaler techniques. Similarly, areas of deficiency have been identified in the practice of guidelines: low practice including the required items in BA management. The four items that have been least reported are as follows: condition when a patient needs to use oral steroid, instructions for the patient on how to document exacerbation, condition when the patient needs to increase dose of their inhaler, and condition when the patient needs to contact their physician. These items are of extreme importance to fulfill the practical use of the guidelines.

GINA 2016 acknowledged the existence of these problems. In the final chapter of the guideline “implementing asthma strategies into health system,” the report acknowledged the lack of knowledge among care provider as one of the major barriers: “Insufficient knowledge of recommendations, Lack of agreement with recommendations or expectation that they will be effective. Resistance to change, external barriers (organizational, health policies, financial constraints), lack of time and resources and medico-legal issues.” In the same chapter, as part of the recommendations the report encourages the assessment of local needs and upgrading the guideline accordingly.

This is the essence of the SINA guideline that takes local settings into consideration. A recent meta-analysis addressed the barriers and possible interventions to minimize the problem of guidelines’ lack of knowledge and adherence among physicians. In this meta-analysis study, several effective interventions have been recommended to tackle this issue. The study recommended using decision support tools’ interventions which is defined as health information technology and/or paper-based interventions designed to support/facilitate healthcare provider decision-making, feedback, and audit interventions providing performance data to healthcare providers about their quality of care, and clinical pharmacy support interventions target pharmacists’ delivery of care. In spite of many challenges reported by investigators for using and application of the guidelines such as lack of knowledge and need for further training.

### Table 6: Comparison between the findings of our study with similar studies

| Study          | Year | Country         | Guideline* | Physicians with acceptable level of knowledge (%) | Physicians with acceptable level of application (%) | Score cut-off point |
|----------------|------|-----------------|------------|-----------------------------------------------|-----------------------------------------------|---------------------|
| Al-Rabiah      | 2016 | Saudi Arabia    | GINA, SINA | 7.3                                           | 48.0                                          | 70                  |
| Yousef et al.  | 2015 | Saudi Arabia    | SINA       | 8.0                                           | 23                                            | -                   |
| Salama et al.  | 2010 | Egypt           | National, GINA | 71.5                                       | 56.4                                          | 50                  |
| Wisnivesky et al.  | 2008 | USA             | NHLBI      | 39                                            | -                                            | NS**                |
| Cabana et al.  | 2001 | USA             | NHLBI      | 5                                             | 43                                          | -                   |
| Doershug et al.| 1999 | USA             | NHLBI      | 55                                            | 21                                           | 50                  |

SINA: Saudi Initiative for Asthma; GINA: Global Initiative for Asthma; NHLBI: National Heart, Lung, and Blood Institute; NAEP: National Asthma Education Program; NS: No score was used. *SINA, **NS. The authors asked the physicians whether the physician has read the guidelines or not. "Median of adherence to the guidelines"
to manage and prevent asthma, there is a noticeable positive attitude toward applying the guidelines and using it to promote asthma management and control.

**Conclusion**

This study has identified genuine issues in asthma management; only 7.3% showed a good knowledge and application. The lack of knowledge and application of guidelines among physicians in primary care setting should be addressed more seriously; such issue as the evidence from several studies suggests can be crucial in asthma control. This was apparent in young doctors with low experience; SINA guidelines were designed to adapt the local difference; lack of knowledge on essential items in SINA management guidelines showed lower than average in knowledge and application; SINA was underutilized in only 22% of the PCPs using it.

**Recommendation**

- Training and educating young physicians on the clinical guidelines to improve the outcome of care
- Increase the awareness of the availability of local guidelines (SINA)
- Preparing the tools to help implement guidelines like ACT, spirometer, and forms for self-management guide for patients
- Conducting future research to make sure that the guidelines are applied in different areas and physicians are aware of local guidelines.

**Ethical considerations**

The study was approved by the ethical committee at PSMMC. The research did not include any interventional therapies or any form of medical testing. The participants were informed that their participation is voluntary and they are free to refuse the participation in the study or withdraw at any stage without being asked about the reasons or being persuaded. The participants were informed that their refusal or withdrawal from the study participation has no consequences and their information will be confidential.

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**Conflicts of interest**

There are no conflicts of interest.

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