Assessment of Asthma Knowledge, Attitudes, and Practice among Health Professionals at Two Hospital Settings in Tabuk Region, Saudi Arabia

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Abstract

Asthma is one of the most common diseases in the world, with particularly high prevalence in KSA. Poor asthma management compliance, including inaccurate diagnoses, inappropriate medication use, poor patient knowledge, low understanding of the disease, unsatisfactory self-management adherence, incorrect techniques in administering inhalant medications and insufficient education are known to exist. The aims of this study is to assess asthma knowledge, attitudes and practice among the health professionals within two hospitals in Tabuk city, Saudi Arabia. This survey was carried out using self-reporting questionnaires. The hospital was a Level 3 site because it has an Emergency department that is open for admissions 24 hours a day, and is equipped with a Medical Assessment Unit. For this survey, a descriptive approach was adopted. 112 (n=112) health professionals were interviewed (nurses n=65 and doctors n=47) through the use of a convenience sample. The data was collected using a combination of two questionnaires, both of which were validated and deemed reliable while inclusive of demographics. Findings may also be used in the planning and implementation of awareness programmes about asthma care and its treatment. Finally, the findings of the study may be valuable to researchers interested in conducting further studies to improve asthma management.

Keywords: *Nurses, Doctor, Asthma Knowledge, Attitudes, Saudi Arabia*

Introduction

Asthma is one of the most common respiratory problems causing lung airway obstruction (Global Initiative for Asthma [GINA], 2019). It is a disease which has no cure, but can be controlled by use of proper medication and effective self- management education (National Heart, Lung, and Blood Institute [NHLBI], 1997). Poor control of asthma may lead to frequent use of emergency department, hospitalization, school absences, and can also lead to death in severe cases. During an asthma episode the child develops shortness of breath due to the swelling of the airways. In addition, the muscles around the airways tighten, making the airways become narrow. The shortness of breath may also be caused by the thick mucus which blocks the small airways. Different triggers cause the asthma episodes, and their effect is stronger when they are multiple, such as cigarette smoke, odours, pollution, sulphite preservatives, weather changes, and emotions (Eggleston, 1994).

Asthma episodes could be mild, moderate, and severe. In general, according to the International Classification of Diseases [ICD], a child with asthma categorised as "mild" could experience in recurrent attack that react well to early medications and have very little disorder of their daily activities, while a child who experiences "moderate" asthma episodes would have symptoms regularly and a marked asthma exacerbation twice monthly (NHLBI). Severe asthma is the difficult pattern that has no exact definition; it can produce symptoms that disturb child's daily activities of life, increase school absenteeism, and interrupt normal sleep. The classification of asthma severity is generally applied

to adults, and the application of arbitrary characteristics to children has been questioned by some authors (Baker et al., 2003; Koterba and Saltoun, 2012). However, internationally accepted values do exist to determine severe asthma warranting hospital admission (National Asthma Education and Prevention Program [NAEPP], 1997).

In terms of assessing the patient with asthma, it is important to have a detailed history of the child, particularly regarding family history of asthma, hospitalization and previous emergency visits, Intensive Care Unit [ICU] admissions, intubation and co-morbidity, which are pivotal for effective assessment of the patient (GINA, 2019). The patients are also required to indicate whether they are experiencing the symptoms associated with this disease, which include shortness of breath, coughing and wheezing, tight chest or a combination of any of these. A thorough assessment is an important consideration to help the physician reach a proper diagnosis and prevent confusion with other disease such as chronic obstructive pulmonary disease (COPD), cardiogenic and non-cardiogenic pulmonary oedema and bronchiectasis (NAEPP, 2018)**.** As a result, the current study seeks to assess asthma knowledge, attitudes and practice among the health professionals (doctors and nurses) at two hospitals. Besides, it will outline the needed strategies to improve asthma management.[1,2]

Literature Review

Asthma is a common chronic disease affecting an average of 297.4 million people worldwide annually translating to 3-7% of the general population (WHO, 2020).The disease can be managed pharmacologically and also conservatively through lifestyle adjustment and lifestyle changes. Being a lifetime disease recorded cases are managed mostly through combined pharmacological and conservative approaches. The international mortality rate is identified as 0.86 per 100,000 cases commonly linked to inappropriate management and failure in the management approaches applied. According to Al Ghobain et al. (2018), the representation of the World's occurrence of Asthma identifies a small number of those that are indeed affected. Epidemiology research has identified an increased incidence than the one that is commonly identified on national and international reports thereby suggesting that more advanced, mechanisms of identifying cases need to be applied in order to capture the real-time values (Cahill et al., 2009; Spina & Morris, 2011).Asthma-related morbidity and mortality can be reduced but are significantly high in developing countries owing to the poor status of healthcare systems. Developed countries show a reduced rate of mortality as a result of advanced health systems and care models applying modern technology and better approaches to management.[3]

Research on the capacity of the international community to curb the incidence of respiratory diseases identified that the challenge was most common increased numbers of people living below the respective national poverty level (Farhana &Alnasser, 2018; NAEPP, 2007).Poverty reduces the financial capacity to seek health services and also reduces the ease to attain the ideal environment for management with reduced levels of allergens. Poverty in these nations is associated with congestion in residential places and low income that insufficiently covers for adequate management of the diseases (Yas, Alkaabi, Al Mansoori, Masoud, & Alessa, 2021). Asthma was identified as one of the most common poorly managed respiratory infections in the studies owing to low intellectual capacity in poor settings and mythical beliefs around the disease (Alshammari et al., 2020). In most of these countries with a high poverty margin, health systems are not devolved entirely on each level of health to reach the general population housed in slums and the streets. An evaluation of the health systems in Saudi Arabia in regards to the management of chronic diseases identifies weakness in the adoption of health services in certain religious blocs and among women Ministry of Health, Saudi Arabia, 2021). The population of women living with asthma is generally half that of men in early childhood with a number equalizing upon puberty (AL MANSOORI, ALSAUD, & YAS, 2021). The access to health care in these high numbers is affected by social and cultural settings explaining the increased negligence in the management of Asthma and mortality.[4,5] The inaccessibility of the results and lack of knowledge in proper management of the disease

leave a large number of people outside the management quota (Alshammari et al., 2020; Chipps, 2011). The general occurrence of Asthma today in Saudi Arabia is increased as a result of the heightened occurrence of the risk factors in the environment commonly pollution from industrialization and poor management related to sociocultural factors. The management approach used today is however also scaled up with a greater chance to attain the ideal clean environments within homes and hospital settings that exclude the allergens.

The spread and incidence of Asthma could be associated with genetically and social class mediated factors within the patients affected. A meta-analysis of the factors that are commonly related to incidence and the spread of the disease could result in more appropriate and individualized care. A systemic review of the incidence of Asthma in Saudi Arabia by Farhana & Alnasser (2018) shows a relative relationship between the factors responsible for asthma and the management of choice in different individual. The research utilized sample sizes of 100 to more than 10000 patients with predominantly urban residence to identify the results propagated; the pooled weight of results show significant differences in symptoms and duration and style of attack as well as the response to different treatment modalities suggesting the need for individualized care. The report utilizes meta-analytic research approaches to explain the relationship between the management of Asthma and the genetic makeup of an individual and how the interplay between the two can result in advanced and personalized care. It concludes that there is a relative disparity in the rural and urban incidence of asthma and shows useful linkages in utilizing personalized studies in the management of the disease (Farhana & Alnasser, 2018). The presentations of Asthma in patients that fail treatment are unique; ideally, the best management practice to prevent failure of treatment is the institution of individualized care that studies the behavior and individual's body interaction with the disease process.

The etiology of Asthma is closely related to natural causes and an increased incidence in industrialized nations where the most likely cause of infection is increasing pollution levels and a new set of atopy in persons that are risked for the disease. The disease process involves an inflammatory response to naturally occurring atopic allergens, natural physiologic processes, autoimmune processes, and environmental changes (Cottrell et al., 2009; Louis & Manise, 2012). Saudi Arabia being a business and industrial hub reports an annual increase of the incidence of Asthma by at least 1.23% with equal gender and racial distribution (Al-Frayh&Hasnain, 2007).In childhood, the occurrence of asthma in boys is higher than in females until puberty where the ratio almost equalizes. In younger cases, the incidence increases as a result of sensitive airway responsiveness which is higher in young people than older counterparts (Al Ghobain et al., 2018; AlAhmari, 2018). An increasing incidence in the stress factor that causes the disease result in an increased incidence of the disease annually and the likeliness of occurrence can be accumulative increase to result in a generally high number (Yas, Alsaud, Almaghrabi, Almaghrabi, & Othman, 2021). The effects of the stress factors are slow, increased exposure, higher doses, and poor hygienic management of the condition propose a higher attack by asthma. Similarly in Saudi Arabia, industrialization and modern adoption constitute the increasing occurrence of asthma backed up by poor social and cultural environments.

An increased risk of incidence of Asthma, for example with pollution, increases the number of patients that report the disease but also inadequate or poor management of the disease is a reason for the increased incidence of the disease. Management of Asthma is generally a multifaceted approach applying pharmacological agents and supportive management approaches that reduce the exposure to allergens and atopic agents. A consideration of the increased mortality commonly associated with chronic Asthma by Alshammari et al. (2020) concludes that increased death rates in asthma patients are caused by improper management which encompasses late and improper diagnoses, lack of adherence or low dose use, inappropriate medication, poor patient knowledge, inappropriate social-cultural beliefs, unsatisfactory self-management by the patient, poor professional practice and inaccessibility of the services. The research results include patient and caregiver responses and clinical assessments around the care provided and the

environments of the patients. Inappropriate management also exposes the patient to more dire consequences and increases the risk of acquiring other respiratory diseases as a result of airway remodelling (Alshammari et al., 2020). The physiologic response to infections by the airway canal is compromised and remodelling replaces the normal cell and organelle composition with structures that easily lead to the occurrence of other diseases. Other diseases that are implicated are pneumonia commonly, and recurrent acute respiratory diseases (Bizzintino et al., 2010; NAEPP, 2019; Louis &Manise, 2012). The etiology of other infections in remodelled cell linings and hypertrophy of the cell wall is related to the loss of the expectorating ability of the wall lining and restructuring of the cells such that the immune response-ability of the airway cells is lost.

Asthma in Saudi Arabia has a high prevalence higher than the rest of the incidence of chronic illnesses across all age groups. The regions high incidence of the disease is associated to genetically and environmentally mediated factors superimposed on social and cultural structures that do not support the access to care especially by women Ministry of Health, Saudi Arabia, 2021). Journal evidence shows that the increased experiences of chronic diseases and the likeliness of death in patients with Asthma is related to individual experiences the installed health systems in the country citing strong and developing health systems in Saudi Arabia although they are not sufficient to cater for the incidence. Research associates the occurrence of Asthma to an increased risk of other chronic and airway diseases thus increasing the likeliness of death in these patients. Specific regional studies within Saudi Arabia show a varied regional distribution with slight variance in rural and urban disparity in distribution. Further identification of factors increasing the incidence of the disease can be used in individualizing care in patients which resultantly will lead to containment of the health condition. Sociocultural adjustment is necessary to institute equal access to healthcare and appropriate response to the disease in all gender and race within Saudi Arabia.

RESEARCH METHODS

A cross-sectional descriptive study was conducted from March to Jun 2019 within two governmental hospitals in Tabuk city, Saudi Arabia. The 112 subjects were recruited from these two hospitals. Purposive sampling used in this study. All participants fulfilled the inclusion criteria, consented to participation in the study. Health professionals (doctors, nurses) who are working with asthmatic patients in targeted hospitals. We clearly explained the study objectives to the participants and obtained written consent from all of them. Their right to refuse participation and their right to confidentiality were communicated. We obtained ethical approval from the IRB committee in the University of Tabuk. There were no potential risks from the research.

Sample Size and Setting

An approximately 210 settings (outpatient clinic, Emergency Room, medical and surgical wards). Returned responses questionnaires were distributed at the two hospital sites. Participants were recruited from specific clinical area numbered, with a response rate of 56%.

Demographic Information

A summary of demographic information is presented in table (1) above. 60.5% of the sample respondents were from King Khaled hospital and 39.5% were from King Fahad Specialist hospital. It also clear that 40.7% of sample respondents are males and 59.3% are females which reflect fairness distribution of gender variable among research sample. Most of respondents were in age period 36-45 years. According to position 46 % of the respondents held nurse staff position, 44.4% were physicians, 1.2% for medical director position and 7.4% held other positions. 45.7% from respondents were doctors including resident, specialist or consultant, while 45.3% were nurses including specialist and technician. According to specialist area 34.6% specializes in medical ward, 32.1% for surgical ward, 16% for emergencies, 8.6% for OPD, 1.2% for critical care units and 7.4% for other areas.

Table 1.0 Demographic Information

Category		Frequencies	Percentage
Hospital	King Khaled Hospital	49	60.5%
	King Fahad Specialist Hospital	32	39.5%
Gender	Male	33	40.7%
	Female	48	59.3%
Age	23-35	26	32.1%
	36-45	28	34.6%
	46-55	13	16.0%
	> 55	14	17.3%
Position	Medical Director	2	1.20%
	Physician	45	44.4%
	Nurse staff	59	46.0%
	Others	6	7.40%
Qualifications	Resident	15	18.5%
	Specialist	18	22.2%
	Consultant	4	4.90%
	Nursing Specialist	14	17.3%
	Nursing technician	30	37.0%
Specialties area	Critical care units	1	1.20%
	Emergency Room	13	16.0%
	Medical ward	28	34.6%
	Surgical ward	26	32.1%
	OPD	7	8.60%
	Other	6	7.40%

Methods of Learning about Asthma

Doctors and nurses try to increase their knowledge about Asthma using different methods of learning table (2) below indicate the percentage of each method based on research sample. Books and experience were the most used methods for doctors and nurses to increase their knowledge about Asthma, 38.6% of nurses and 40.5% use books, 34% of nurses and 35.1% of doctors based on their experience to increase their knowledge

Table (2) Methods of Learning about Asthma

	Asthma Guide line	Books	Internet	Conferences and Training courses	Experience
All	19.8%	56.8%	46.9%	12.3%	49.4%
Nurses	11.3%	38.6%	29.5%	6.8%	34%
Doctor	16.2%	40.5%	32.4%	8.1%	35.1%

Data Analysis

Asthma knowledge assessment between doctors and nurses

For the purpose of Asthma assessment between doctors and nurses we calculated the mean and standard deviation for each statement first for doctors then for nurses. If the mean value for the statement is greater than or equal to 2.34 then we can conclude that this statement is effective otherwise it will be not effective. Table (3) below show the results of mean and standard deviation for both doctors and nurses for the first section in the questionnaire.

Table 3: Mean and Standard deviation of Section A-D

		Doctors		Nurses	
		Mean	St. Dev.	Mean	St.Dev
Asthma Symptoms can be caused by: Allergy, air pollution or any other type of irritate (dust, fumes, etc.)	· Asthma etiology · Pathophysiology of Asthma · Asthma Medication · Beliefs and Attitudes	2.95 2.78 2.95 2.19	0.39 0.584 0.329 0.927	2.86 2.57 2.91 2.43	0.510 0.801 0.421 0.136
A common cold and Exercise	· Asthma etiology · Pathophysiology of Asthma · Asthma Medication · Beliefs and Attitudes	2.27 2.89 2.89 1.59	0.932 0.393 0.393 0.458	2.25 3.00 2.80 2.07	0.943 0.00 0.553 0.974
Asthma is a genetic disease (in previous generation already has asthma)	· Asthma etiology · Pathophysiology of Asthma · Asthma Medication · Beliefs and Attitudes	2.23 2.30 1.73 2.74	0.884 0.909 0.939 0.837	1.93 2.74 2.80 1.89	0.902 0.544 0.553 0.868

Cont... **Table 3: Mean and Standard deviation of Section A-D**

Asthma damages the heart	· Asthma etiology · Pathophysiology of Asthma · Asthma Medication · Beliefs and Attitudes	1.86 1.22 1.73 2.57	0.156 0.630 0.962 0.836	1.48 1.14 2.32 2.84	0.762 0.472 0.664 0.526
Can Asthma be deadful	· Asthma etiology · Pathophysiology of Asthma · Asthma Medication · Beliefs and Attitudes	2.95 2.38 2.62 1.49	0.329 0.758 0.758 0.944	3.00 2.38 1.73 2.57	0.00 0.583 0.924 0.695

Asthma Knowledge Assessment for Hospitals

To assess the knowledge between doctors and nurses in two different hospitals king Khaled hospital and king Fahad specialist hospital mean and standard deviation were calculated for responses. Table (1) shows the results of Asthma etiology assessment, we can notice mean difference between the hospitals. It is clear from table (11) below that doctors and nurses in both hospital strongly agree that Asthma is life threating disease and it can be caused by allergy, air pollution or any other type of irritate such as dust, fumes. Doctors and nurses from King Khaled hospital have stronger agree that Asthma symptoms can be caused due to common cold and exercises than doctor and nurses in King Fahad Specialist Hospital.

Table 5 :Asthma Knowledge Assessment for Hospitals

		King Khaled Hospital		**LKing Fahad Hospital**	
		Mean	**St. Dev.**	**Mean**	**St.Dev**
Asthma Symptoms can be caused by: Allergy, air pollution or any other type of irritate (dust, fumes, etc.)	· Asthma etiology · Pathophysiology of Asthma · Asthma Medication · Beliefs and Attitudes	3.00 1.22 2.95 2.19	0.000 0.621 0.329 0.927	2.75 1.47 2.91 2.43	0.652 0.842 0.421 0.136
A common cold and Exercise	· Asthma etiology · Pathophysiology of Asthma · Asthma Medication · Beliefs and Attitudes	2.35 2.89 2.89 1.59	0.925 0.393 0.393 0.458	2.13 3.00 2.80 2.07	0.942 0.00 0.553 0.974
Asthma is a genetic disease (in previous generation already has asthma)	· Asthma etiology · Pathophysiology of Asthma · Asthma Medication · Beliefs and Attitudes	2.23 2.30 1.73 2.74	0.884 0.909 0.939 0.837	1.93 2.74 2.80 1.89	0.902 0.544 0.553 0.868

Cont... **Table 5 : Asthma Knowledge Assessment for Hospitals**

Asthma damages the heart	· Asthma etiology	1.86	0.156	1.48	0.762
	· Pathophysiology of Asthma	1.22	0.630	1.14	0.472
	· Asthma Medication	1.73	0.962	2.32	0.664
	· Beliefs and Attitudes	2.57	0.836	2.84	0.526
Can Asthma be deadfall	· Asthma etiology	2.95	0.329	3.00	0.00
	· Pathophysiology of Asthma	2.38	0.758	2.38	0.583
	· Asthma Medication	2.62	0.758	1.73	0.924
	· Beliefs and Attitudes	1.49	0.944	2.57	0.695

It is clear from statistical analysis results that there is a statistical significant differences between some of responses between doctors and nurses. Nurses have strongly agreed that: Severity of asthma can be measured at home by simple device called a peak flow meter, medicine of asthma has to be taken till the symptoms persist and then can be stopped, asthma inhalers can cause addiction and cannot be stopped them, prescribing inhaler for longer period cause severe adverse effect. On the other hand doctors strongly agreed that asthma can be caused without obvious reasons, medicines for asthma has to be taken even the symptoms are no longer there.

Also there was a significant statistical mean difference for Doctors and nurses responses in King Khaled hospital and King Fahad Specialist hospital. Doctors and nurses in King Khaled Hospital strongly agreed that allergy, air pollution or any other type of irritate such as dust, fumes cause asthma, and the best way to assess the severity of asthma is using asthma control test. While doctors and nurses in King Fahad Specialist hospital strongly agreed that Asthma cannot be cured and medicines for asthma has to be taken even the symptoms are no longer there.[8,9]

There were a significant difference between doctors and nurses in the same hospital related to Knowledge about Etiology of asthma and their beliefs and attitudes about asthma. While there were a significant difference between doctors and nurses in different hospital related to knowledge about asthma pathophysiology.

Discussion

Numerous studies in the literature have revealed that factors such as knowledge, beliefs, medication and etiological factors impacts the management of asthma. The current study was conducted to assess asthma knowledge, attitudes and practice among the health professionals (doctors and nurses) at two hospitals. Besides, it outlined the needed strategies to improve asthma management.[11,12] The findings of the current study depicts that books and experience are the most education resources used by nurses. This findings were supported by the existing literature which indicates asthma knowledge, patients' negative emotion and some health care givers provide an inappropriate education are the main factors which have shown a decrease with increased experience and evidence review (William, 2005).

The current study established that Asthma is a deadly disease. This findings are supported by the existing literature. For instance, in a study conducted by Al-Ali et al., (2019),the severity of Asthma was found to have has a higher mortality and high impact on life quality especially in prolonged cases. This depicts how Asthma is a dangerous and life threatening disease whose prevalence seems to be on the rise. From the findings of the current study we can observe that that the value of mean for both doctors and nurses are slightly different, even though both nurses and doctors highly

agreed that Asthma symptoms can be caused by allergy, air pollution or any other type of irritate, and Asthma is a life threading diseases.[18] Further investigation about the significance of the mean difference between doctors Using one sample Kolmogorov-Smirnov to test data normality, the findings of the study indicates that the data don't follow the normal distribution. The findings of the study indicates that can conclude that there is no significance the mean difference for doctors and nurses responses. This findings are supported by the existing literature. For instance, in a study conducted by Abudahish & Bella (2006), Asthma was found to be a deadly disease caused by factors those that induce airway inflammation with eosinophil's (more common) or neutrophils along with airway hyper-responsiveness (AHR).

The findings of the study indicates that nurses agreed that severity of asthma can be measured at home by simple peak flow meter more than doctors, which means that the attack is dangerous. This findings also indicates that the breathing tubes in lung become narrow due to swelling of their walls and tightening of muscle and mucous collection as a result of Asthma. Besides, the findings indicated that whistling breathing is a symptom of Asthma. This findings are supported by the existing literature, for instance, a study conducted by Abutien et al., (2019) it was established that effective home asthma diagnosis and treatment requires routinely tracking symptoms and measuring how well your lungs are working. Taking an active role in managing your asthma treatment helps patients to maintain better long-term asthma control, prevent asthma attacks and avoid long-term problems.[21,22]

The existing literature points out that Asthma medication can either be given as relievers or preventers. In a study conducted by Besh (2018), most Asthma medications would either relive the severity of the disease or prevent it from occurring. The findings of the current study depicts that Asthma medications can always be given as tablets, syrups, or inhalers. Additionally, they depict that the identification of trigger factors are important in the management of Asthma. This findings is supported by the existing literature, for instance, Haughei et al., (2008) argues that returning to the basics of making a diagnosis is essential. This includes a thorough history, physical examination, and appropriate diagnostic testing. Ideally, a diagnosis of asthma should be based on objective evidence of reversible airflow obstruction. Because asthma is a variable disease, challenge testing may be required.[25,26])

Limitations of the Study

One of the major limitations of this study is that its participants were drawn from urban institutions, that is, King Khalid Hospital and King Fahad Specialist Hospital. The use of participants from this institutions might have had a significance influence on the outcomes of the study. This may indicate that the information may not be a good knowledge to the general population of health professionals in the region.[28]

Conclusion

Majority of the nurses and doctors participants in the current study have impeccable knowledge about Asthma epidemiology, path physiology. However, some of the doctors lacks information on the influence of beliefs and culture on the treatment of asthma. Besides, based on the statistical analysis results and for the purpose of asthma management improvements, it is recommended to provide more education or training courses for health care providers (nurses and doctors). Additionally, institutions should understand that there is the need to improve the ability of doctors to transform the base knowledge into clinical practice.

Conflict of Interest: we declare that there is no conflict of interest

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References

1. Abudahish A, Bella H. Primary care physicians perceptions and practices on asthma care in Aseer region, Saudi Arabia. Saudi Med J. 2006;27(3):333-7. PMID 16532093.

2. Abutiheen AAK, Al-Saadi AMMA, Et al. Quraini, A.N.H.A. 2019. Knowledge and attitudes of parents about bronchial asthma among their children whom attending karbala teaching hospital for children. Kerbala journal of pharmaceutical sciences, (16).
3. Al Ghobain MO, Algazlan SS, Oreibi TM. Asthma prevalence among adults in Saudi Arabia. Saudi Med J. 2018;39(2):179-84. doi: 10.15537/smj.2018.2.20974, PMID 29436567.
4. AL MANSOORI HM, ALSAUD AB, YAS H. The impact of covid 19 on increasing the cost of labor and project Price in the United Arab Emirates. Int J Pharm Res. 2021;13(1).
5. Al-Ali LA, Al Jasmi SA, Al Yammahi LM, Syeed A, Darwish EA. Parental knowledge, attitudes, and practices regarding the use of prescribed inhalers in asthmatic children attending Ambulatory Healthcare Services Clinics. Ibnosina J Med Biomed Sci. 2019;11(2):68. doi: 10.4103/ijmbs.ijmbs_12_19.
6. Al-Frayh AR, Hasnain SM. Prevalence of bronchial asthma in children in Saudi Arabia [journal]. World Allergy Organization Journal. 2007;&NA;:S167-8. doi: 10.1097/01.WOX.0000301793.03587.a3, & NA S167-S168. doi: 10.1097/01.wox.0000301793.03587.a3.
7. Alshammari E, Alshammari A, Alsubaie F, Alanazi Y, Alshawi L, Bakhamis R, Alashgar N, Alsowayan W. Evaluative study of asthma control in a Saudi hospital. Biomed Pharmacol J. 2020;13(2):865-72. doi: 10.13005/bpj/1952.
8. Beshah PS 2018. The knowledge, attitudes and practices of caregivers of children with asthma attending the Raleigh Fitkin Memorial Hospital, Manzini, Swaziland (Doctoral dissertation, Stellenbosch: Stellenbosch University).
9. Bizzintino J, Lee WM, Laing IA, Vang F, Pappas T, Zhang G, Martin AC, Khoo SK, Cox DW, Geelhoed GC, McMinn PC, Goldblatt J, Gern JE, Le Souëf PN. Association between human rhinovirus C and severity of acute asthma in children. Eur Respir J. 2011;37(5):1037-42. doi: 10.1183/09031936.00092410, PMID 20693244.
10. Cahill KN, Buchheit K, Word C, Borish L. Aspirin desensitization and high-dose aspirin therapy in aspirin-exacerbated respiratory disease. Pract Med Surg Manag Chronic Rhinosinusitis. 2015:313-22. doi: 10.1007/978-3-319-16724-4_19.
11. Chipps B 2011. Faculty opinions recommendation of acetaminophen use and risk of asthma, rhinoconjunctivitis, and eczema in adolescents: international study of asthma and allergies in childhood phase three. Faculty Opinions – Post-Publication Peer Review of the biomedical Literature. doi: 10.3410/f.6756956.10075054.
12. Cockcroft DW. Environmental causes of asthma. In: Seminars in respiratory and critical care medicine (Vol. 39, No. 01, pp. 012-018). Thieme Medical Publishers; 2018, February.
13. Cottrell L, Ice C, Neal W, Piedimonte G. Metabolic abnormalities in children with asthma: A population-based study. Risk Factors Child Asthma. 2009;C18. doi: 10.1164/ajrccm-conference.2009.179.1_meetingabstracts.a3971.
14. Haughney J, Price D, Kaplan A, Chrystyn H, Horne R, May N, Moffat M, Versnel J, Shanahan ER, Hillyer EV, Tunsäter A, Bjermer L. Achieving asthma control in practice: understanding the reasons for poor control. Respir Med. 2008;102(12):1681-93. doi: 10.1016/j.rmed.2008.08.003, PMID 18815019.
15. HPD. M, S.S. J Heal Sci. 2016. Knowledge attitudes and practices of asthma-Does it associate with demographic factors of adult patients. Asian Pacific;3:94-9.
16. Louis R, Manise M 2012. Mast cell phenotype, location, and activation in severe asthma.data from the Severe Asthma Research Program. Faculty Opinions – Post-Publication Peer Review of the biomedical Literature. doi: 10.3410/f.717960764.793463695.
17. Ministry of Health. Saudi Arabia; 2021. Chest diseases - Asthma: causes, symptoms and treatment. المملكة العربية السعودية - وزارة الصحة MOH.GOV. SA [cited Apr 28, 2021]. Available from: https://www.moh.gov.sa/en/HealthAwareness/EducationalContent/Diseases/Chest/Pages/001.aspx.
18. Mohamed Hussain S, Ayesha Farhana S, Mohammed Alnasser S. Time trends and regional variation in prevalence of asthma and associated factors in Saudi Arabia: A systematic review and meta-analysis. BioMed Res Int. 2018;2018:8102527. doi: 10.1155/2018/8102527, PMID 29951546.
19. National Asthma Education and Prevention

Program. Expert panel report 3 (EPR-3): guidelines for the diagnosis and management of asthma–summary report 2007. J Allergy Clin Immunol. 2007;120(5):S94-S138. doi: 10.1016/j.jaci.2007.09.029.

20. National Asthma Education and Prevention Program. The effect of FP-025, a MMP-12 inhibitor, on allergen-induced airway responses and airway inflammation in mild eosinophilic house dust mite (hdm)-allergic asthma. CMR. 2019. doi: 10.31525/ct1-nct03858686.
21. Scherer YK, Bruce S. Knowledge, attitudes, and self-efficacy and compliance with medical regimen, number of emergency department visits, and hospitalizations in adults with asthma. Heart Lung. 2001;30(4):250-7. doi: 10.1067/mhl.2001.116013, PMID 11449211.
22. Sharifi L, Pourpak Z, Heidarnazhad H, Bokaie S, Moin M. Asthma knowledge, attitude, and self-Efcacy in Iranian asthmatic patients; 2011.
23. Spina D, Morris A 2011. Faculty opinions recommendation of effects of interleukin-13 blockade on allergen-induced airway responses in mild atopic asthma. Faculty Opinions – Post-Publication Peer Review of the biomedical Literature. doi: 10.3410/f.9893962.10605058.
24. Williams ZA. Assessment of the knowledge of asthma amongst adult asthmatics and their quality of life [doctoral dissertation]; 2005.
25. World Health Organization. Asthma; 2020, May 20. Available from: https://www.who.int/news-room/fact-sheets/detail/asthma.
26. Yas H, Alkaabi A, Al Mansoori HM, Masoud M, Alessa A. A scoping review research on the dynamics managing of coronavirus disease (COVID-19). Ilkogretim Online. 2021;20(2):169-78.
27. Yas H, Alsaud AB, Almaghrabi HA, Almaghrabi AA, Othman B. The effects of TQM practices on performance of organizations: A case of selected manufacturing industries in Saudi Arabia. Manag Sci Lett. 2021;11(2):503-10. doi: 10.5267/j.msl.2020.9.017.
28. Zhao J, Shen K, Xiang L, Zhang G, Xie M, Bai J, Chen Q. The knowledge, attitudes and practices of parents of children with asthma in 29 cities of China: a multi-center study. BMC Pediatr. 2013;13(1):20. doi: 10.1186/1471-2431-13-20, PMID 23379859.
29. Zhou X, Hong J. Pediatric asthma management in china: current and future challenges. Paediatr Drugs. 2018;20(2):105-10. doi: 10.1007/s40272-017-0276-7, PMID 29222627.