

Original article:

Treatment adherence, knowledge, attitude and quality of life of adolescents with asthma in north-eastern Malaysia

Amirul Hisham Zainol¹, Ahmad Filza Ismail², Fahisham Taib³, Bachok Norsa'adah⁴

Abstract:

Introduction: Asthma is a chronic inflammatory condition that affect physically, emotionally and psychologically. In adolescent, various factors contributed to poor asthma control. This study aims to identify treatment adherence, quality of life, knowledge and attitude in adolescents with asthma. **Method:** This cross-sectional study randomly selected 14 schools in two districts of a state in North-eastern of Malaysia. Complete information was obtained from 262 adolescents aged 13 to 18 years old, who were diagnosed with bronchial asthma in the last six months or having recurrent wheeze for the past 12 months. The tools used include Asthma control test; Asthma treatment adherence; Knowledge on asthma; Attitude on asthma; Paediatric asthma quality of life questionnaires have undergone various process of translation, face validation and assessment of the reliability and validity to achieve a standardized Malay language version. **Results:** There were about 30% of the adolescent who have not taking their medicine regularly with 50% non-compliant once symptom control was achieved. 22.5% of the participants felt embarrass when using inhaler in front of their friends. Our study showed a higher adherenceto medication of more than 70% compared to other studies. However, more than 50% of of the participants have minimal understanding on the disease natural history. Approximately 20-30% of them admitted of experiencing overall poor quality of life at the time of the study. **Conclusion:** Most participants reported having good asthma treatment adherence; but in our study, half of the adolescent have poor knowledge of asthma and negative attitude towards medication which influenced the quality of life.

Keywords: asthma; adolescents; adherence; attitude; knowledge; quality of life

*Bangladesh Journal of Medical Science Vol. 19 No. 01 January'20. Page : 73-82
DOI: <https://doi.org/10.3329/bjms.v19i1.43875>*

Introduction

Asthma is a chronic inflammatory condition of the airways that resulted insignificant impairment of physical, emotion, social life, hence limitation in daily activities and absence from school. In adolescent, lack of knowledge, poor self-health responsibility, lack of guidance and poor attitude towards asthma contributed to poor adherence in treatment regime and self-management¹. The

presence of factors such as rhinosinusitis, skin atopy, early onset of menarche and obesity are adding to worse the asthma symptoms. Peers influence has also influenced adolescent socially, leading to a change in self-identity, image and character development². Knowledge on disease is fundamental approach in disease management. This includes understanding of physiological changes to the body, triggering factors and practical solution on prevention and management.

1. Amirul Hisham Zainol, Health office, kawasan Lahad Datu, Peti surat No. 61167, 91120 Lahad Datu, Sabah, Malaysia.
2. Ahmad Filza Ismail, Department of Community Medicine, School of Medical Sciences, Universiti Sains Malaysia, Kubang Kerian, 16150 Kelantan, Malaysia.
3. Fahisham Taib, Department of Paediatric, School of Medical Sciences, Universiti Sains Malaysia, Kubang Kerian, 16150 Kelantan, Malaysia.
4. Bachok Norsa'adah, Unit of Biostatistics and Research Methodology, School of Medical Sciences, Universiti Sains Malaysia, Kubang Kerian, 16150 Kelantan, Malaysia.

Correspondence to: Dr Bachok Norsa'adah, Unit of Biostatistics and Research Methodology, School of Medical Sciences, Universiti Sains Malaysia, 16150 Kubang Kerian, Kelantan, Malaysia.
e-mail: norsaadah@usm.my

The guideline for the management of childhood asthma was geared towards preventive measure against mortality, participation of children's activities and reduced the episodes of acute exacerbation³. This is achieved through a mutually agreed care plan by emphasising on the natural history of the disease and compliance to medications. Previous study showed many children did not acquire sufficient knowledge on asthma^{4,5}. Adherence among adolescents are often poor various reasons-denial, rejection, forgetfulness, misunderstanding on the medication regime, decreased cognition and functionality, and poor technique on inhaler device usage^{6,7}.

Frequent night symptoms and unscheduled visits to general practitioners have affected academic performance and learning in 52.8% of asthmatic children with average 3.6 days per year of missed school⁸. Frequent absence from school will affect their future career attainment and financial security. This study aims to identify treatment adherence, quality of life, their knowledge and attitude towards asthma.

Materials and Methods

The study was designed as cross-sectional analysis of participants on treatment adherence, knowledge, attitude and quality of life. Participants were selected from two districts (Kota Bharu and Pasir Mas) of Kelantan, a state located in the east coast of Peninsular Malaysia. Studied participants were adolescents' aged 13 to 18 years old, who had been diagnosed with bronchial asthma in the last six months or having recurrent wheeze for the past 12 months, at the commencement of the study. Seven schools in each district were selected using simple random method. The selection of schools and eligible participants were based on random number generated by website⁹. The data collection started in May 2013, following validation of 4 questionnaires into Malay version, until its completion in June 2014. Children aged 17 who were sitting in school major exam were excluded.

Adherence to medication questionnaire

The original version of the questionnaire was designed to measure treatment adherence behavioural to asthma medication among adult patients¹⁰. This questionnaire was adapted to accommodate among the studied adolescents¹¹. Twelve items for treatment adherence of medication and inhaler with Cronbach's alpha of 0.71¹⁰. The "No" answers for every item indicates better answer and score one point while the "Yes" answer score zero.

Knowledge on asthma questionnaire

This tool consists of 25 items and was constructed to measure components of asthma knowledge related to asthma management, symptoms, triggers, and interventions. The reported Cronbach's alpha for this instrument was 0.69¹². This instrument used a scale of 0 to 2. Every correct answer was given a score of two points while the wrong answer scored zero. Total mark for this instrument was 50.

Attitude on asthma questionnaire

The third instrument used is a 15 items self-administered questionnaire to assess attitudes towards asthma¹³. The domains cover tolerance towards asthma (eight questions), locus of control (two questions), powerful others (three questions) and chance (two questions). Responses were presented as five-point scales of 0 to 4, ranging from 'strongly agree' to 'strongly disagree'. Higher scores represented stronger or more positive attitudes in the domains assessed.

Paediatric asthma quality of life questionnaire

The instrument includes 23 items in three domains and subjective questions used to measure health related paediatric quality of life in asthma patient age 7-17-year-old¹⁴. The questionnaire required participants to recall impairment of their experience in the previous week before the assessment. Domains included were activity limitation (five items), symptoms (ten items) and emotional function (eight items). It has intra class correlation coefficient of 0.84¹⁴.

Validation of the questionnaires

The questionnaires used in this study (treatment adherence, asthma knowledge, attitude on asthma and asthma related quality of life) were translated to Malay language from original English version. These were carefully reviewed by research team members, which consisted of public health specialists, paediatrician and a postgraduate student.

The process of translation involved translation from original English version (US English) to Malay version by two native speakers of Malay. Backward translation to English version (US English) was then completed two different Malay native speakers. The original versions were compared with back-translated English version. Consensus on the finalised version in Malay language was then agreed. This followed by face validation process on the Malay version questionnaire to achieve reliability and validity for the so instruments as research tools. Data entry and analysis was done using IBM Statistical Package for Social Science (SPSS) version 20.0 (SPSS Inc.)

and Stata Statistical Software. Data on demographic characteristics was presented descriptively.

Ethical clearance: Ethical clearance were approved by Research and Ethic Committee (Human), School of Medical Sciences, Health Campus, Universiti Sains Malaysia (Ref: USMKK/PPP/JEPeM [264.3.¹³]).

Results

A total of 462 adolescents with asthma were identified from 14 schools and 429 fulfilled the selection criteria. 364 of them were selected using simple random sampling, however, 288 adolescents agreed to participate. Parental consent and assent were taken as part of procedure. However, only 262 successfully completed the study and answering

the given questionnaires. The questionnaire for adherence to medication was only answered by 246 of the participants. This overall response rate was 79.6%.

Socio Demographic Characteristics of Participants

Majority of the participants (99.2%) were Malay race with the remaining were Chinese. The mean age of all participants was 14.98-year-old with SD of 1.54 year. The mean age of asthma onset for all participants was 6.9-year-old with SD of 3.83 years. The sociodemographic data of participants was presented in table 1.

Table 1: Socio-demographics characteristics of adolescents with asthma in Kelantan Malaysia [n=262]

| | Frequency (%) | Mean (SD) |
|-----------------------------------|---------------|---------------|
| Age (year) | | 14.9 (1.5) |
| Age group | | |
| 13 | 46 (17.6) | |
| 14 | 79 (30.2) | |
| 15 | 44 (16.8) | |
| 16 | 62 (23.7) | |
| 18 | 31 (11.8) | |
| Sex | | |
| Female | 148 (56.5) | |
| Male | 114 (43.5) | |
| Education level of father | | |
| Lower secondary school and below | 68 (26.0) | |
| Upper secondary school | 157 (59.9) | |
| Higher Education institution | 37 (14.1) | |
| Education level of mother | | |
| Lower secondary school and below | 76 (30.0) | |
| Upper secondary school | 139 (53.1) | |
| Higher education | 47 (17.9) | |
| Household income (RM) | | 2,898 (3,270) |
| Family history of asthma | 164 (62.6) | |
| History of atopy | 148 (56.5) | |
| Smoker at home | 130 (49.6) | |
| Age of asthma onset (year) | | 6.9(3.8) |
| Duration of asthma (year) | | 8.1 (3.9) |
| Severity of asthma | | |
| Intermittent | 141 (53.8) | |
| Mild persistent | 86 (32.8) | |
| Moderate persistent | 35 (13.4) | |

Table 2 described the distribution of response for adherence to asthma treatment with 246 participants completed it. About 30% of the adolescent admitted of being careless and forgot to take their own medication. About half of them admittedly stop taking medication once symptom control was achieved. Their action was done without final consultation with their managing doctors.

Table 2: Distributions of response for adherence to asthma treatment among the adolescent

| Adherence to asthma treatment questions | Frequency (%) | |
|---|---------------|------------|
| | Yes | No |
| During the last 3 months, have you at times been careless about taking your asthma medicine? | 81 (32.9) | 165 (67.1) |
| During the last 3 months, have you ever forgotten to take your asthma medicine? | 78 (31.7) | 168 (68.3) |
| During the last 3 months, have you ever stopped taking your asthma medicine because you felt better? | 128 (52.0) | 118 (48.0) |
| During the last 3 months, have you ever stopped taking your asthma medicine because you felt worse? | 12 (4.9) | 234 (95.1) |
| During the last 3 months, have you ever taken less of your asthma medicine than the doctor prescribed because you felt better? | 93 (37.8) | 153 (62.2) |
| During the last 3 months, have you ever taken more of your asthma medicine than the doctor prescribed because you felt you were having an attack? | 48 (19.5) | 198 (80.5) |

Table 3 elucidated the response for knowledge of asthma. Interestingly, despite being diagnosed with asthma, many adolescents still misunderstood on their illness. The true response ranging as low as 4.6% and up to 80.9%. In the “don’t know” answer, there were a range between 15%-71% which means there were large number of adolescent have minimal understanding on the disease.

Table 3: Distributions of response for knowledge to asthma treatment among the adolescent

| Knowledge to asthma treatment question | Frequency (%) | | |
|---|---------------|------------|-------------|
| | True | False | Do not know |
| Coughing is not a symptom of asthma | 68 (26.0) | 74 (28.2) | 120 (45.8) |
| Asthma is due to inflammation in the lungs | 168 (64.1) | 10 (3.8) | 84 (32.1) |
| Smoking in the home can make a child’s asthma worse | 212 (80.9) | 5 (1.9) | 45 (17.2) |
| Asthma attacks can happen when you breathe things like paint fumes, gasoline smoke, or pollution | 199 (76.0) | 13 (5.0) | 50 (19.1) |
| Keeping an asthma attack from happening is something only a doctor can do. | 70 (26.7) | 72 (27.5) | 120 (45.8) |
| If you start to have an asthma attack, you might notice a tight feeling in your chest before wheezing starts. | 211 (80.5) | 8 (3.1) | 43 (16.4) |
| A peak flow meter is used to make sure your sinuses are open | 58 (22.1) | 24 (9.2) | 180 (68.7) |
| If asthma symptoms such as tightness and wheezing do not occur for several years, a child has outgrown his/her asthma | 77 (29.4) | 28 (10.7) | 157 (59.9) |
| Asthma is an emotional or psychological disease | 94 (35.9) | 32 (12.2) | 136 (51.9) |
| Most children with asthma have to go to the hospital for asthma attacks | 12 (4.6) | 152 (58.0) | 98 (37.4) |
| For some people, asthma becomes less severe as they get older | 94 (35.9) | 31 (11.8) | 137 (52.3) |
| Doctors are not really sure why some people have asthma, but they know what can start an attack | 71 (27.1) | 26 (9.9) | 165 (63.0) |
| With appropriate treatment, most children with asthma should lead a normal life with no restrictions on activities | 154 (58.8) | 28 (10.7) | 80 (30.5) |
| Anger, crying, or laughing can start an asthma attack. | 91 (34.7) | 77 (29.4) | 94 (35.9) |

| | | | |
|--|------------|------------|------------|
| If you don't have asthma by the time you are 40 years old, you will never get it | 36 (13.7) | 38 (14.5) | 188 (71.8) |
| Children with asthma should not play sports in which they have to run a lot | 174 (66.4) | 43 (16.4) | 45 (17.2) |
| In young children, asthma sometimes starts after a viral respiratory illness | 123 (46.9) | 17 (6.5) | 122 (46.6) |
| An allergen is the antibody missing in people with asthma | 161 (61.5) | 19 (7.3) | 82 (31.3) |
| It is possible for your asthma to be worse without noticing a change in your breathing | 24 (9.2) | 197 (75.2) | 41 (15.6) |
| Exercising in cold weather can start an asthma attack | 128 (48.9) | 36 (13.7) | 98 (37.4) |
| Fish and birds are both good pets for a child with asthma | 37 (14.1) | 71 (27.1) | 154 (58.8) |
| A rescue inhaler (ie, bronchodilator) is taken to reduce inflammation in the lungs | 100 (38.2) | 36 (13.7) | 126 (48.1) |
| Some asthma medications don't work unless you take them every day | 78 (29.8) | 47 (17.9) | 137 (52.3) |
| You don't need to shake most asthma medication inhalers before using them | 63 (24.0) | 83 (31.7) | 116 (44.3) |
| Fewer people have asthma today than 10 years ago | 44 (16.8) | 32 (12.2) | 186 (71.0) |

Table 4 showed the response of attitude from the participants. Positive attitudes statements ranged from 5% - 49.2% only. The maximum "strongly disagree" statement was 36.3%. There were around 23% of the students stated that they felt embarrass on using inhaler in front of their peers.

Table 4: Distributions of response for attitude to asthma treatment among the adolescent

| Attitude to asthma treatment question | Strongly agree | Agree | Not sure | Not agree | Strongly not agree |
|--|----------------|-----------|------------|------------|--------------------|
| If someone with asthma takes care of him/herself, he/she can avoid most asthma symptoms | 69 (26.3) | 51 (19.5) | 118 (45.0) | 10 (3.8) | 14 (5.3) |
| When someone has an attack of asthma symptoms at school, it is usually because he/she has been careless | 60 (22.9) | 30 (11.5) | 105 (40.1) | 26 (9.9) | 41 (15.6) |
| How soon someone recovers from an attack of asthma at school depends mainly on how well the teacher takes care of him/her | 60 (22.9) | 37 (14.1) | 89 (34.0) | 34 (13.0) | 42 (16.0) |
| When someone has an attack of asthma during sport, it is because the teacher hasn't checked up on whether the student has taken his/her medication | 18 (6.9) | 31 (11.8) | 59 (22.5) | 95 (36.3) | 59 (22.5) |
| If someone is going to have an attack of asthma, it will happen no matter what anyone does | 70 (26.7) | 44 (16.8) | 93 (35.5) | 20 (7.6) | 35 (13.4) |
| How soon someone recovers from an attack of asthma symptoms is mostly a matter of luck | 60 (22.9) | 40 (15.3) | 101 (38.5) | 22 (8.4) | 39 (14.9) |
| Most people can control their asthma well without seeing a doctor regularly | 75 (28.6) | 55 (21.0) | 60 (22.9) | 30 (11.5) | 42 (16.0) |
| Someone with asthma should not use his/her puffer in class | 27 (10.3) | 20 (7.6) | 86 (32.8) | 34 (13.0) | 95 (36.3) |
| Students are embarrassed about using their inhalers in class | 59 (22.5) | 38 (14.5) | 67 (25.6) | 22 (8.4) | 76 (29.0) |
| Students without asthma have a negative attitude to students with asthma | 16 (6.1) | 37 (14.1) | 53 (20.2) | 93 (35.5) | 63 (24.0) |
| Students play on their asthma | 13 (5.0) | 26 (9.9) | 79 (30.2) | 90 (34.4) | 54 (20.6) |
| There would be few problems with asthma at school if students could carry their puffers around with them | 129(49.2) | 55 (21.0) | 47 (17.9) | 11 (4.2) | 20 (7.6) |
| Teachers are worried about taking someone with asthma on a school camp or excursion | 21 (8.0) | 32 (12.2) | 58 (22.1) | 83 (31.7) | 68 (26.0) |
| Students with asthma are just as fit as students without asthma | 39 (14.9) | 22 (8.4) | 67 (25.6) | 43 (16.4) | 91 (34.7) |
| School teachers have a negative attitude to students with asthma | 13 (5.0) | 33 (12.6) | 67 (25.6) | 100 (38.2) | 49 (18.7) |

Table 5 described the difference in quality of life among the participated adolescent. Our study found that about 20-30% had unsatisfactory or negative response towards overall quality of life, if we were to take "extremely bothered" and "very bothered" as the answer. This may reflect unsatisfactory control of symptom despite on asthma medications. Those with "hardly bothered" and "not bothered" reflected good symptom control, was seen in less than 15% of our data.

Table 5: Distributions of response for quality of life among the adolescent

| Quality of life question | Frequency (%) | | | | | | |
|---|--------------------|---------------|----------------|-------------------|----------------|------------------------|--------------|
| | Extremely bothered | Very bothered | Quite bothered | Somewhat bothered | Bothered a bit | Hardly bothered at all | Not bothered |
| Activity at home: How much have you been bothered by your asthma during the past four weeks? | 56 (21.4) | 30 (11.5) | 22 (8.4) | 118(45.0) | 16 (6.1) | 6 (2.3) | 14 (5.3) |
| Activity at school: How much have you been bothered by your asthma during the past four weeks? | 47 (17.9) | 38 (14.5) | 34 (13.0) | 93 (35.5) | 26 (9.9) | 5 (1.9) | 19 (7.3) |
| Sports or recreational activity: How much have you been bothered by your asthma during the past four weeks? | 44 (16.8) | 38 (14.5) | 29 (11.1) | 88 (33.6) | 25 (9.5) | 12 (4.6) | 26 (9.9) |
| How much did asthma attacks bother you during the past four weeks? | 49 (18.7) | 32 (12.2) | 24 (9.2) | 102(38.9) | 27(10.3) | 7 (2.7) | 21 (8.0) |
| How much did coughing bother you in the past four weeks? | 32 (12.2) | 23 (8.8) | 36 (13.7) | 110(42.0) | 23 (8.8) | 13 (5.0) | 25 (9.5) |
| How much did wheezing bother you during the past four weeks? | 50 (19.1) | 33 (12.6) | 32 (12.2) | 87 (33.2) | 18 (6.9) | 14 (5.3) | 28 (10.7) |
| How much did tightness in your chest bother you during the past four weeks? | 46 (17.6) | 29 (11.1) | 22 (8.4) | 93 (35.5) | 2(10.7) | 12 (4.6) | 32 (12.2) |
| How much did shortness of breath bother you during the past four weeks? | 36 (13.7) | 28 (10.7) | 30 (11.5) | 95 (36.3) | 24 (9.2) | 14 (5.3) | 35 (13.4) |
| Think about all the activities that you did during the past four weeks. How much were you bothered by your asthma doing these activities? | 40 (15.3) | 28 (10.7) | 43 (16.4) | 89 (34.0) | 31(11.8) | 10 (3.8) | 21 (8.0) |
| How often did your asthma make you feel frustrated during the past four weeks? | 66 (25.2) | 26 (9.9) | 30 (11.5) | 114(43.5) | 14 (5.3) | 7 (2.7) | 5 (1.9) |
| How often did your asthma make you feel tired during the past four weeks? | 15 (5.7) | 8 (3.1) | 27 (10.3) | 119(45.4) | 35(13.4) | 23 (8.8) | 35 (13.4) |
| How often did you feel worried, concerned or troubled because of your asthma during the past four weeks? | 50 (19.1) | 26 (9.9) | 30 (11.5) | 110(42.0) | 25 (9.5) | 6 (2.3) | 15 (5.7) |
| How often did your asthma make you feel angry during the past four weeks? | 77 (29.4) | 23 (8.8) | 19 (7.3) | 100(38.2) | 21 (8.0) | 9 (3.4) | 13 (5.0) |
| How often did you feel irritable (cranky) during the past four weeks? | 25 (9.5) | 12 (4.6) | 20 (7.6) | 152(58.0) | 21 (8.0) | 13 (5.0) | 19 (7.3) |
| How often did you feel different or left out because of your asthma during the past four weeks? | 76 (29.0) | 20 (7.6) | 17 (6.5) | 104(39.7) | 30(11.5) | 5(1.9) | 10 (3.8) |
| How often did you have trouble sleeping at night because of your asthma during the past four weeks? | 49 (18.7) | 12 (4.6) | 17 (6.5) | 111(42.4) | 31(11.8) | 14 (5.3) | 28 (10.7) |
| How often did your asthma wake you up during the night during the past four weeks? | 51(19.5) | 11(4.2) | 23(8.8) | 117(44.7) | 23(8.8) | 14(5.3) | 23(8.8) |
| How often did you feel uncomfortable because of your asthma during the past four weeks? | 36(13.7) | 15(5.7) | 17(6.5) | 128(48.9) | 35(13.4) | 11(4.2) | 20(7.6) |
| How often did you feel out of breath during the past four weeks? | 32(12.2) | 19(7.3) | 23(8.8) | 120(45.8) | 30(11.5) | 17(6.5) | 21(8.0) |
| How often did you feel you couldn't keep up with others because of your asthma during the past four weeks? | 52(19.8) | 15(5.7) | 13(5.0) | 105(40.1) | 31(11.8) | 1(6.5) | 29 (11.1) |
| How often did you feel frustrated because you couldn't keep up with others during the past four weeks? | 80(30.5) | 21(8.0) | 11(4.2) | 97(37.0) | 21(8.0) | 12(4.6) | 20(7.6) |
| How often did you feel frightened by an asthma attack during the past four weeks? | 88(33.6) | 24(9.2) | 22(8.4) | 99(37.8) | 14(5.3) | 5(1.9) | 10(3.8) |
| How often did you have difficulty taking a deep breath during the past four weeks? | 35(13.4) | 17(6.5) | 16(6.1) | 126(48.1) | 34(13.0) | 15(5.7) | 19(7.3) |

Discussion

Adherence to treatment

Non-adherence to medication has become a perplexing issue especially among adolescents¹⁵. This is partly resulted from the decreased of parental role in managing their children's asthma once the child reaches teenage year¹⁶. The estimated range of adherence to asthma medication was about 10 to 55%^{5, 17}. There was deterioration in the trend over time. Our study showed a higher adherence rate of more than 70%. Factors involved were wider range of asthma medications use; including oral and inhaled reliever and preventer, different patients' selection criteria include those who have been diagnosed in the last 6 months. Majority of the adolescent enrolled had intermittent asthma (53.8%) and thus bronchodilator was used sparingly. Asthma control was directly related to the absence of triggers and co-morbid diseases.

Poor adherence leads to the increase of morbidity and mortality^{18, 19}. Measurement of adherence reflects the level of quality of life in patients. The use of self-reported adherence questionnaire is liable tool to evaluate treatment compliance^{20, 21}. Improving participants' knowledge and self-efficacy resulted in significant improvement in treatment adherence. A barrier to treatment adherence includes the erroneous belief, misunderstanding on the use of medication, inaccurate perception on the illness, poor motivation and support affecting the compliance to medication²².

Knowledge on asthma among participants

More than half of participants failed to answer correctly on knowledge on asthma questionnaire. These indicate inadequate knowledge on asthma by participants which was noted in previous study^{23, 24}. Expert Panel for National Asthma Education and Prevention Program (NAEPP) recommended that asthmatic patients need to have adequate knowledge on asthma to achieve effective control²⁵. This includes recognizing asthma symptomatology, triggering factors and skills of delivery of asthma medication. Poor knowledge leads to poor adherence to treatment, poor asthma control and poor quality of life^{25, 26, 27}.

Reinforcement of the education contents enhanced patients' recall memory on asthma knowledge and self-management skills²⁸. Attractive home education materials have allowed for repeated revision and reference that strengthen their knowledge on asthma. Individual coaching sessions were found to be useful method to increase patients' general knowledge²⁹. Significant difference in the knowledge on asthma score were noted despite having prior knowledge in asthma³⁰.

Attitude on asthma among participants at baseline

Positive attitude is required to promote willingness to adopt self-control over symptoms with positive self-management behaviour³¹. More than half of participants did not show positive attitude towards asthma. Problems identified were related to poor perception on their symptoms control and misguided on asthma self-management. Almost 40% of participants said they were embarrassed to using inhaler in front of their peers which was similar to previous studies^{13, 31}.

Change of attitude is related to perception on susceptibility of the disease and benefit gained if changes to be made³². Adolescents who possess the control over their asthma symptoms would be less likely to feel embarrass with their peers^{33, 34}. The benefits would later translate in the improvement of the quality of life.

Quality of Life among Participants

Children and adolescents with more severe asthma disease reported to have lower quality of life^{35, 36}. Our study showed 20-30% have reported overall poor quality of life, especially in the symptoms domain. In a survey, there was 1.4% of children nationally experienced activity limitation due to asthma³⁷. Approximately 80% of our participants reported of having limitation of activities either at home, school or during recreational activities. Female adolescents with asthma reported a higher symptomatology with lower quality of life^{38, 39}. Majority of participants in our study were categorized as intermittent asthma severity. Male teenagers with asthma commonly hide their illness from their social networks and tend to restrict from sport activities. The misperception about physical activity in asthma was the reason for avoiding exercises^{40, 41}. The fear is compounded by their parents concerns which negatively impede such activities⁴². Exercise conditioning has been suggested to improve asthmatic symptoms, reduce activities limitation and improve the well-being^{43, 44, 45}.

Interventional programme should include asthma self-management, recognizing asthma symptoms, correct inhaler techniques and modifying triggering factors. This would have resulted in a better asthma control, reduce emergency visit and hospitalizations⁴⁶. Passive smoking contributed to half of exposure to trigger while participants at home. This was associated with worsening nocturnal cough and exercise induced bronchospasm⁴⁷.

Psychological aspect such as anxiety, stress and depression influenced the treatment adherence and behaviour such as smoking⁴⁸. Stress and depression

may worsen asthmatic symptoms through increment of inflammatory state physiologically^{49,50}. High-risk behaviour worsened the condition which was similar to the adult asthmatic study⁵¹⁻⁵³. Learning on breathing relaxation technique will improve patients' symptoms thus relieving the anxiety related bronchospasm.

Conclusions

Poor quality of life and control of symptoms among adolescent were mostly due to insufficient knowledge and negative attitude towards asthma management. The challenge is to ensure compliance to treatment and prevention of symptoms. Asthma education program is pivotal in providing better understanding, skill and practice towards positive outcome and

attitude especially among the adolescents.

Acknowledgements

The study received a short term grant (304/PPSP/61313016) from Universiti Sains Malaysia as part of the Doctor of Public Health (DrPH) thesis.

Conflict of interest:

The authors declared no conflicts of interest.

Individual Contribution of the Authors:

Conceptual work: Norsa'adah B, Zainol AH

Data collection: Zainol AH, Ismail AF, Taib F, Norsa'adah B

Manuscript writing: Norsa'adah B, Zainol AH, Taib F

Editing of final manuscript: Zainol AH, Ismail AF, Taib F, Norsa'adah B

References:

1. Rhee H, Belyea MJ, Ciurzynski S, Brasch J. Barriers to asthma self-management in adolescents: Relationships to psychosocial factors. *Pediatr Pulmonol.* 2009;44(2):183-91. doi: 10.1002/ppul.20972. <https://doi.org/10.1002/ppul.20972>
2. Naimi DR, Apter AJ. Adolescent and asthma. 2010 In *Asthma, Health and Society*. Springer, pp 201-216 https://doi.org/10.1007/978-0-387-78285-0_12
3. Academy of Medicine 2014. Clinical practice Guideline for the Management of Childhood asthma
4. Fadzil A, Norzila MZ. Parental asthma knowledge. *The Medical Journal of Malaysia.* 2002; 57:474-481
5. Kyngäs HA. Compliance of adolescents with asthma. *Nursing & Health Sciences.* 1999; 3: 195-202 <https://doi.org/10.1046/j.1442-2018.1999.00025.x>
6. Clifford S, Barber N, Horne R. Understanding different beliefs held by adherers, unintentional non adherers, and intentional non adherers: Application of the Necessity-Concerns Framework. *Journal of Psychosomatic research.* 2008; 64: 41-46. <https://doi.org/10.1016/j.jpsychores.2007.05.004>
7. Bender BG. Overcoming barriers to nonadherence in asthma treatment. *Journal of Allergy and Clinical Immunology.* 2002; 109:S554-S559. <https://doi.org/10.1067/mai.2002.124570>
8. Public Health Institute (2006) The third National Health and morbidity Survey (NHMS III). Asthma Public Health Institute, Ministry of health Malaysia
9. Daniels M. (2008). Random number generator and checker. [Online] Available from: <http://www.psychicscience.org/random.aspx> [Accessed 30 August 2013].
10. Mears CJ, Charlebois NM, Holl JL. Medical adherence among adolescent in a school based Health Centre. *Journal of School Health.* 2006; 76: 52-56 <https://doi.org/10.1111/j.1746-1561.2006.00068.x>
11. Brooks CM, Richards JM, Kohler CL, Soong SJ, Martin B, Windsor RA, Bailey WC. Assessing adherence to asthma medication and inhaler regimens: a psychometric analysis of adult self-reported scale. *Medical Care.* 1994; 32: 298-307 <https://doi.org/10.1097/00005650-199403000-00008>
12. Ho J, Bender BG, Gavin LA, O'Connor SL, Wamboldt MZ, Wamboldt FS. Relationship among asthma knowledge, treatment adherence and outcome. *Journal of*

- Allergy and Clinical Immunology. 2003; 111: 498-502. <https://doi.org/10.1067/mai.2003.160>
13. Gibson P, Henry R, Vimpani G, Halliday J. Asthma knowledge, attitudes and quality of life in adolescent. Archives Disease of Childhood 1995; 73: 321-326 <https://doi.org/10.1136/adc.73.4.321>
 14. Juniper EF, Guyatt GH, Feeny DH, Ferrie PJ, Griffith LE, Townswnd M. Measuring quality of life in children with asthma. Quality of life research 1996;5: 35-46 <https://doi.org/10.1007/BF00435967>
 15. Fitzgerald D. Non-compliance in adolescents with chronic lung disease: causative factors and practical approach. Paediatr Respir Rev. 2001;2:260-267 <https://doi.org/10.1053/prrv.2001.0149>
 16. Bruzzese JM, Unikel LH, Evans D, Bornstein L, Surrence K, Mellins RB. Asthma knowledge and asthma management behavior in urban elementary school teachers. J Asthma. 2010;47:185-91. <https://doi.org/10.3109/02770900903519908>
 17. Dinwiddie R, Müller WG. Adolescent treatment compliance in asthma. J R Soc Med. 2002;95:68-71. <https://doi.org/10.1177/014107680209500204>
 18. Williams L, Pladevall M, Xi H, Peterson, EL, Joseph C, Lafata, JE, Ownby DR, Johnson, CC. Relationship between adherence to inhaled corticosteroids and poor outcomes among adults with asthma. Journal of Allergy and Clinical Immunology. 2004; 114:1288-1293 <https://doi.org/10.1016/j.jaci.2004.09.028>
 19. Gamble J, Stevenson M, McClean, E, Heaney, LG. The prevalence of non-adherence in difficult asthma. American Journal of Respiratory and Critical Care Medicine. 2009;180: 817-822. <https://doi.org/10.1164/rccm.200902-0166OC>
 20. Sherman J, Hutson A, Baumstein S, Hendeles L. Telephoning the patient's pharmacy to assess adherence with asthma medications by measuring refill rate for prescriptions. The Journal of Pediatrics. 2000;136: 532-536. [https://doi.org/10.1016/S0022-3476\(00\)90019-2](https://doi.org/10.1016/S0022-3476(00)90019-2)
 21. National Collaborating Centre for Primary Care (2009). Medicines adherence: Involving patients in decisions about prescribed medicines and supporting adherence.
 22. Couriel, J. Asthma in adolescence. Paediatric respiratory reviews. 2003;4: 47-54. [https://doi.org/10.1016/S1526-0542\(02\)00309-3](https://doi.org/10.1016/S1526-0542(02)00309-3)
 23. Leiria-Pinto P, Cordero M, Pinto M. Adolescents and school asthma knowledge and attitudes. Allergologia et Immunopathologia. 1999;27:245-53
 24. Shaw SF, Marshak HH, Dyjack DT, Neish CM. Effects of a classroom-based asthma education curriculum on asthma knowledge, attitudes, self-efficacy, quality of life, and self-management behaviors among adolescents. Journal of Health Education. 2005;36: 140-147. <https://doi.org/10.1080/19325037.2005.10608175>
 25. National Asthma Education and Prevention Program. Expert Panel Report 3 (EPR-3): Guidelines for the Diagnosis and Management of Asthma-Summary Report 2007. Journal of Allergy and Clinical Immunology. 2007; 120(5 Suppl): S94 <https://doi.org/10.1016/j.jaci.2007.09.029>
 26. Academy of Medicine Malaysia (2014). Clinical practice guideline for the management of childhood asthma. [Online] Available from: http://www.acadmed.org.my/index.cfm?&menuid=67#Respiratory_Medicine [Accessed 15 May 2014]
 27. Global Initiative for Asthma (GINA) (2014). Pocket Guide for Asthma Management and Prevention
 28. Janiszewski C, Noel H, Sawyer AG. A Meta-analysis of the Spacing Effect in Verbal Learning: Implications for Research on Advertising Repetition and Consumer Memory. Journal of Consumer Research. 2003;30: 138-149. <https://doi.org/10.1086/374692>
 29. Berg J, Tichacek MJ, Theodorakis R. Evaluation of an educational program for adolescents with asthma. The Journal of School Nursing. 2004;20: 29-35 <https://doi.org/10.1177/10598405040200010601>
 30. Henry RL, Gibson PG, Vimpani GV, Francis JL, Hazell J. Randomized controlled trial of a teacher-led asthma education program. Pediatric Pulmonology. 2004; 38: 434-442. <https://doi.org/10.1002/ppul.20095>
 31. Cohen R, Franco K, Motlow F, Reznik M, Ozuah PO. Perceptions and attitudes of adolescents with asthma. Journal of Asthma. 2003;40: 207-211 <https://doi.org/10.1081/JAS-120017992>
 32. Rosenstock IM, Strecher VJ, Becker MH. Social learning theory and the health belief model. Health Education & Behaviour. 1988;15: 175-183. <https://doi.org/10.1177/109019818801500203>
 33. Bitsko MJ, Everhart RS, Rubin BK. The Adolescent with Asthma. Paediatric Respiratory Reviews. 2014;15: 146-153. <https://doi.org/10.1016/j.prrv.2013.07.003>
 34. Halterman JS, Riekert K, Bayer A, Fagnano M, Tremblay P, Blaakman S, Borrelli B. A pilot study to enhance preventive asthma care among urban adolescents with asthma. Journal of Asthma. 2011;48: 523-530 <https://doi.org/10.3109/02770903.2011.576741>
 35. Varni JW, Limbers CA, Burwinkle TM. Impaired health-related quality of life in children and adolescents with chronic conditions: a comparative analysis of 10 disease clusters and 33 disease categories/severities utilizing the PedsQL™ 4.0 Generic Core Scales. Health and Quality of Life Outcomes. 2007; 5: 43

- <https://doi.org/10.1186/1477-7525-5-43>
36. Everhart RS, Fiese BH. Asthma severity and child quality of life in pediatric asthma: A systematic review. *Patient Education and Counselling*.2009; 75: 162-168. <https://doi.org/10.1016/j.pec.2008.10.001>
 37. Newacheck PW, Halfon N. Prevalence, impact, and trends in childhood disability due to asthma. *Archives of Pediatrics and Adolescent Medicine*. 2000;154: 287-293. <https://doi.org/10.1001/archpedi.154.3.287>
 38. Warschburger P, Busch S, Bauer CP, Kiosz D, Stachow R, Petermann F. Health-Related Quality of Life in Children and Adolescents with Asthma: Results from the ESTAR Study. *Journal of Asthma*.2004; 41: 463-470. <https://doi.org/10.1081/JAS-120033989>
 39. Van De Ven MO, Van Den Eijnden RJ, Engels RC. Atopic diseases and related risk factors among Dutch adolescents. *The European Journal of Public Health*. 2006;16: 549-558. <https://doi.org/10.1093/eurpub/ckl022>
 40. Callery P, Milnes L, Verduyn C, Couriel J. Qualitative study of young people's and parents' beliefs about childhood asthma. *British Journal of General Practice*.2003;53: 185-190.
 41. Abu-Hasan M, Tannous B, Weinberger M. Exercise-induced dyspnea in children and adolescents: if not asthma then what? *Annals of Allergy, Asthma & Immunology*. 2005; 94: 366-371 [https://doi.org/10.1016/S1081-1206\(10\)60989-1](https://doi.org/10.1016/S1081-1206(10)60989-1)
 42. Lang DM, Butz AM, Duggan AK, Serwint JR. Physical activity in urban school-aged children with asthma. *Pediatrics*. 2004; 113: e341-e346 <https://doi.org/10.1542/peds.113.4.e341>
 43. Lucas SR, Platts-Mills TA. Physical activity and exercise in asthma: relevance to etiology and treatment. *Journal of Allergy and Clinical Immunology*. 2005;115: 928-934 <https://doi.org/10.1016/j.jaci.2005.01.033>
 44. Satta, A. Exercise training in asthma. *The Journal of Sports Medicine and Physical Fitness*. 2000;40: 277-283.
 45. Basaran S, Guler-Uysal F, Ergen N, Seydaoglu G, Bingol-Karakoc G, Ufuk AD. Effects of physical exercise on quality of life, exercise capacity and pulmonary function in children with asthma. *Journal of Rehabilitation Medicine: Official Journal of the UEMS European Board of Physical and Rehabilitation Medicine*.2006;38: 130-135. <https://doi.org/10.1080/16501970500476142>
 46. Bryant-Stephens T, Kurian C, Guo R, Zhao H. Impact of a household environmental intervention delivered by lay health workers on asthma symptom control in urban, disadvantaged children with asthma. *American Journal of Public Health*. 2009;99(suppl 3): S657-S665. <https://doi.org/10.2105/AJPH.2009.165423>
 47. Lee SL, Wong W, Lau YL. Increasing prevalence of allergic rhinitis but not asthma among children in Hong Kong from 1995 to 2001 (Phase 3 International Study of Asthma and Allergies in Childhood). *Pediatric Allergy and Immunology*.2004;15:72-78. <https://doi.org/10.1046/j.0905-6157.2003.00109.x>
 48. Lehrer P, Feldman J, Giardino N, Song HS, Schmalting K. Psychological aspects of asthma. *Journal of Consulting and Clinical Psychology*.2002;70: 691-711. <https://doi.org/10.1037/0022-006X.70.3.691>
 49. Ritz T, Steptoe A, DeWilde S, Costa M. Emotions and stress increase respiratory resistance in asthma. *Psychosomatic Medicine*. 2000; 62: 401-412. <https://doi.org/10.1097/00006842-200005000-00014>
 50. Kullowatz, A., Rosenfield, D., Dahme, B., Magnussen, H., Kanniss, F. & Ritz, T. Stress effects on lung function in asthma are mediated by changes in airway inflammation. *Psychosomatic Medicine*. 2008; 70: 468-475. <https://doi.org/10.1097/PSY.0b013e31816f9c2f>
 51. Holloway EA, West RJ. Integrated breathing and relaxation training (the Papworth method) for adults with asthma in primary care: a randomised controlled trial. *Thorax*. 2007; 62: 1039-1042. <https://doi.org/10.1136/thx.2006.076430>
 52. Mohamed, N., Mohamed Ridzuwan, M., Ungah, N. A., & Jamaluddin, T. Z. (2018). Effects of "Bacterfree Hand Intervention" on the knowledge, attitude of handwashing and its technique, among pre-schoolers in Wilayah Persekutuan, Malaysia. *Bangladesh Journal of Medical Science*, 17(1), 67-70. <https://doi.org/10.3329/bjms.v17i1.35283>
 53. Chiang LC, Ma WF, Huang JL, Tseng LF, Hsueh KC. Effect of relaxation-breathing training on anxiety and asthma signs/symptoms of children with moderate-to-severe asthma: a randomized controlled trial. *International Journal of Nursing Studies*. 2009;46 1061-1070. <https://doi.org/10.1016/j.ijnurstu.2009.01.013>