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Asthma questionnaire content analysis

Systematic Review and Content Analysis of Asthma Knowledge Questionnaires: A Focus on Knowledge Surrounding Acute Exacerbation Management

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ABSTRACT

Objectives

Asthma education is a key component of asthma management. Asthma education around management of a person who is having an acute exacerbation of asthma (often referred to as asthma first-aid training) is important, particularly in a school setting. There is no gold standard assessment of asthma knowledge and no specific tool to measure knowledge of asthma first-aid. Our aim was to identify asthma knowledge questionnaires and perform a content analysis. We were interested in evaluating the number, the type and the format of asthma first aid questions.

Method

A literature search was performed to identify instruments able to assess asthma knowledge of people with asthma and/or caregivers of people with asthma. An electronic database search was performed in EMBASE, IPA, MEDLINE and PUBMED. Articles which described the development or psychometric testing of an asthma knowledge questionnaire were included. The content of questions in each instrument were analysed and categorized using N Vivo software, and a secondary analysis was performed to identify knowledge questions relevant to the management of an acute asthma exacerbation.

Results

Forty four papers with 37 different instruments met the inclusion criteria. The majority of the instruments contained a relatively low proportion of questions related to management of acute asthma, only 162 of the 780 questions (21%). No questionnaire had sufficient specific emphasis on acute asthma management knowledge to test the impact of asthma first-aid training.

Conclusion

There is scope to develop an up-to-date validated acute asthma management knowledge questionnaire for use in research and clinical settings.

Keywords

Asthma Knowledge, Asthma Education, Asthma First-Aid, Asthma Exacerbation, Content analysis, **Questionnaire**

INTRODUCTION

Death from asthma is tragic. Studies have highlighted that greater than two thirds of asthma deaths reviewed were preventable.^(1, 2) Preventable factors included inappropriate use of medications and a lack medical assistance during the fatal attack.⁽³⁾ With 37500 hospitalisations in Australia in 2012-2013 for which asthma was the principal diagnosis ⁽⁴⁾ it is clear that morbidity is also still a concern. International Asthma Guidelines⁽⁵⁻⁷⁾ acknowledge asthma education as a key component of asthma management, and a powerful tool in improving patient outcomes.⁽⁵⁾

Education around asthma management has been widely researched.^(8, 9) Previous research has shown that the educational interventions which focussed more on the management of an acute exacerbation of asthma, were not common.⁽¹⁰⁾ Soo et al⁽¹⁰⁾ and Al-Aloola et al⁽¹¹⁾ investigated different types of asthma educational interventions in preschools and primary schools respectively, and found there was a lack of data concerning knowledge specific to exacerbation management⁽¹⁰⁾. Unsurprisingly, knowledge was the key outcome measured in educational interventions facilitated by asthma knowledge questionnaires^(10, 11). Asthma educational needs of non-primary caregivers such as teachers and staff at schools should focus on issues such as management of symptoms of asthma, and the treatment of an acute exacerbation rather than preventative measures, and education around asthma self-awareness. The focus of our research was the questionnaires which were used to ‘test’ the knowledge acquired through asthma education so that we could establish how much emphasis had been placed on testing knowledge around the management of an acute exacerbation of asthma.

International Asthma Guidelines were reviewed to define appropriate treatment of an acute exacerbation of asthma in the absence of an asthma action plan otherwise known as asthma first aid (AFA). Generic protocols were located in the international guideline GINA⁽⁸⁾ as well as UK Guidelines,⁽¹²⁾ and guidelines from The United States^(13, 14) Each of these guidelines included similar AFA directions. A short acting beta agonist (SABA) was recommended to be administered via a spacer (holding chamber) device. Each of the protocols stated that SABA should be given within the first minute and that urgent medical attention should be sought. The protocols differed in the timing between doses, and the US guidelines^(13, 14) were the least prescriptive. Current Australian guidelines⁽¹⁵⁾ recommend the delivery of four puffs of SABA bronchodilator with a spacer every four minutes in addition to practical measures such as calling the ambulance.

The content of a questionnaire should be relevant to the education and for AFA it should include key information found in the international guidelines including; asthma medicines, recognition of asthma symptoms, especially those suggesting a serious exacerbation requiring emergency treatment with bronchodilator^(5, 6), and finally, when to call emergency services^(5, 6). The structure of the questionnaire is also relevant when assessing the usefulness of a particular knowledge measure for AFA. Dichotomous (true /false) and multiple choice questions are examples of closed end questions which are suited to testing AFA knowledge⁽¹⁶⁾. Conversely, likert scales, (or bipolar scales) were largely developed to assess underlying beliefs and opinions of the participant,⁽¹⁷⁾ and open ended questions are by their nature broad and non-specific not thought to be ideally suited to assessing AFA knowledge.

The purpose of our systematic review was to perform a content analysis of all published asthma knowledge questionnaires, with a particular focus on the number and types of questions contained within these tools that dealt with knowledge surrounding acute asthma exacerbation management. To ensure that education regarding the management of an acute exacerbation of asthma has been successful, the knowledge test (questionnaire) should be valid⁽¹⁸⁾ and contain relevant items fit for the purpose for which it was defined.

METHODS

The search strategy was designed to identify instruments that had been developed to assess asthma knowledge of people with asthma or caregivers of people with asthma. The scope of the review included the entire spectrum of instruments/questionnaires assessing knowledge of children, adolescents, parents, carers, teachers and the general public. Questionnaires used to assess specific knowledge of health care professionals were excluded.

Search Strategy

The databases EMBASE, IPA (International Pharmaceutical Abstracts), MEDLINE and PUBMED were searched using the following terms: ('asthma' OR 'wheeze' OR 'exacerbation' OR 'asthma first-aid') AND ('knowledge' OR 'health knowledge, attitudes, practice' OR 'health education' OR 'intervene') AND ('questionnaire' OR 'survey' OR 'test' OR 'data collection' OR 'measure' OR 'assess') (Appendix 1). All searchable dates to May 2015 were included and language was limited to articles available in English. Titles and abstracts previewed by this search strategy were manually screened for relevance and eligibility for full text retrieval.

Inclusion/Exclusion Criteria

Articles were included if they described the development and testing of asthma knowledge measures. Types of articles included validation studies, or educational interventions involving knowledge related outcomes as a measure. Articles lacking data regarding the development or testing of the knowledge measure were excluded, as were articles describing measures that were unavailable for content perusal (after reasonable attempts to contact authors). Articles relating to multi-dimensional measures (such as knowledge and quality of life, attitude, practice) were considered, however only questions related to asthma knowledge were content analysed. Any modification made to an existing questionnaire was deemed a unique questionnaire for the purpose of this study and included in the analysis. However, if a questionnaire had been re-used in totality with no modification it was only content analysed once.

Categorization of Questionnaires

The purpose of each questionnaire was recorded to establish whether or not it was used in an educational intervention, and if so the purpose of the research (asthma self-awareness education evaluation for the patient / primary caregiver or general asthma education relevant also for the non- primary caregiver)..

Content analysis of questions

Questions from each instrument regarding asthma knowledge were analysed using QSR NVivo software. The software package was used to identify different patterns or themes in the questions. A coding framework was established and each question/item mapped according to the type of knowledge it was assessing. This process was initially performed by TCP and continually verified via discussion with other authors. The eight categories (or nodes) that were used for this

process were general knowledge, prevalence, pathophysiology, signs & symptoms, medication & treatment, triggers, asthma & sports and others. Attitudes, beliefs, demographic data, experience, practice or other items were classified as “others.” Independent categorization of 10% of all asthma knowledge questions were chosen randomly from all instruments (Table 1). This was undertaken by RM and VK to validate category allocation. Any discrepancies were discussed and finalised by all team members. No discrepancies were found, so no further independent categorization was required. All questions then underwent a secondary analysis and categorization by KL to identify those which related to acute exacerbation and its management. (results from this secondary analysis are shown in Table 1). The formatting of each question was examined and questions which were formatted in a manner not conducive to AFA knowledge testing were excluded from the secondary analysis. An example of this was a question which used a likert scale.

Questions relating to AFA were categorized as follows: general knowledge; pathophysiology; signs & symptoms; medication & treatment. Inclusion of questions relating specifically to acute exacerbation, required rigorous discussion but was performed under stringent criteria; The question had to relate directly to the information present in the local^(5, 15) and international guidelines^(7, 19) which related to the management of an acute severe exacerbation of asthma. Questions which related to preventative asthma management such as triggers, and asthma and sport, were not thought relevant to acute exacerbation management. A distinction was made between the management of symptoms versus the management of an acute asthma exacerbation. It was thought for instance that a question relating to ‘difficulty in breathing’⁽²⁰⁾ related to an acute exacerbation while the identification of persistent cough without wheeze as a symptom of

poorly controlled asthma was not included in this secondary analysis (Table 1) as it is not always associated with acute asthma exacerbation⁽²⁰⁾. Conversely questions categorised under symptoms such as *‘If you start to have an asthma attack you might notice a tight feeling in your chest before wheezing starts.’*⁽²¹⁻²³⁾ were thought to be relevant to acute asthma exacerbation and were therefore included. Questions relating to correct inhaler technique⁽²⁴⁻²⁶⁾ were included when they related specifically to the use of a bronchodilator for the treatment of an acute exacerbation. An example of this is the following true/false question; *‘When using a metered dose inhaler, a child should breath in deeply and slowly’*⁽²⁷⁾.

RESULTS

Our search identified 44 articles that met our inclusion criteria (Figure 1) and we subsequently analysed the content of 37 asthma knowledge questionnaires. Details of each article including details regarding the use and development of the instruments were summarised. (Appendix 2).

Questionnaires

A total of thirty seven different instruments were located in the literature. (table 1). The earliest included instrument was published in 1980⁽²¹⁾, and the most recent was published in 2015⁽²⁸⁾. Whilst there was no gold standard asthma knowledge questionnaire, two had been used widely; The Newcastle Asthma Knowledge Questionnaire (NAKQ)⁽²⁹⁾ and the Knowledge, Attitude, and Self-efficacy Questionnaire (KASE-AQ)⁽³⁰⁾. Of the 37 instruments meeting our inclusion criteria, 15 instruments were specifically designed to compare pre-test and post-test scores of an educational intervention. Twelve articles included in the review, aimed to describe the use of an instrument to assess asthma knowledge of staff at schools or childcare centres⁽³¹⁻⁴²⁾. The rest were focussed on asthma self-management^(21-23, 26, 28-30, 43-67).

There were no asthma knowledge questionnaires which had been developed specifically to test the knowledge of respondents regarding the management of an acute exacerbation. In fact, out of the 37 instruments located in the literature 10 instruments (27%) had no questions relating to the management of an acute asthma exacerbation. The number of items relating to acute asthma exacerbation varied significantly between the questionnaires. Parcel et al.⁽²¹⁾ included a relatively high proportion of questions relevant to the management of acute asthma exacerbation (10 out of 20 in the questionnaire designed for children with asthma). However, most instruments had a very limited focus on acute asthma exacerbation with fewer than 25% of the total number of questions dealing with an acute exacerbation. It is worth noting that the (NAKQ) and (KASE-AQ) questionnaires contained a relatively small proportion of their total questions relating to an acute exacerbation of asthma; 25% and 35% respectively.

Content analysis of Asthma First Aid specific questions

There were a total of 1018 questions that were categorized into each of the predetermined categories using NVivo software. Of these, 780 items were related to general/specific asthma knowledge with the other items such as demographics categorized as “others.” Analysis of these 780 questions found 162 questions (21%) which focused on acute asthma exacerbations. Questions which dealt with information pertaining to AFA have been summarised in Table 1. Items relating to medication & treatment were the most prevalent accounting for 35% of the total acute exacerbation related questions. There was an even spread of questions in the three other categories; 25% of the questions relating to general knowledge, 20% relating to signs and symptoms and the remaining 20% relating to pathophysiology (Table 1).

There were a number of similarities in the questions relating to the treatment of acute exacerbations across questionnaires. As expected most questionnaires referred to the use of bronchodilators to treat an exacerbation of asthma^(21, 22, 24, 26, 27, 29, 30, 40, 44, 50, 53, 60, 62, 68, 69). There were also many questions regarding the usefulness of medicines in asthma exacerbation such as: ‘*Are quick reliever medications taken when asthma symptoms occur?*’⁽²⁷⁾ and ‘*which three medications are useful in an asthma attack*’⁽²⁹⁾, and what to do if reliever medication are required every two hours⁽²⁹⁾. The usefulness of non-pharmacological treatments of acute asthma exacerbations such as rest^(23, 24, 30, 69) or drinking water^(21, 23, 30) were prevalent.. The importance of calling emergency services was stressed with questions such as: *Can you die from asthma?*^(31, 51, 62, 69) Or whether or not death from asthma occurred only when the severity of the asthma attack allowed no time to start treatment^(29, 40, 44).

Format of Asthma Knowledge Questions

The format of the 780 general asthma management questions within the questionnaires also differed significantly. Some required written responses and were open-ended whilst others were the true-or-false format. “Not sure” or “don’t know” were also provided as a choice of answer. Multiple choice format with four or five options was also used. A number of instruments incorporated Likert scales or 5 point bipolar ratings^(23, 37, 42, 51, 68, 70). In some instances, these were used to assess underlying beliefs and behaviours of participants^(23, 70) and supplemented knowledge questions, however, Likert scales and bipolar ratings were also used to assess knowledge in some questionnaires. Appendix 2 provides more detail about each individual outcome measure and includes details of the types of questions which were used.

In contrast to quantifiable questionnaires, Kolbe et al⁽⁴³⁾ included two scenario-based interviews regarding “slow-onset attack” and “rapid-onset attack” of asthma requiring written response. While this approach to the assessment of knowledge pertaining to the management of an acute exacerbation is novel, the qualitative element in assessing awareness about managing an asthma exacerbation may be difficult to compare, should the same instrument be applied to assess outcomes of a range of educational interventions. Hence this paper was included in our analysis as it satisfied our inclusion/ exclusion criteria but it did not contain any quantifiable asthma knowledge questions.

The format of the 162 questions used to test the knowledge of AFA showed that 4 of these questions were open ended requiring a written response (table 2). The remainder of the questions were closed ended; 90 true /false questions with a further 51 adding the option of ‘do not know’, 17 using the multiple choice format (table 2).

DISCUSSION

In this review, we have systematically searched the literature and analysed items within instruments that were developed to assess asthma knowledge. This was done to establish the extent to which these instruments focussed on AFA. We explored the number of AFA related questions, their type, and their format.

Questionnaires

Our literature search found that there was no instrument which focussed specifically on AFA. Instead the instruments were mostly developed to test knowledge around general asthma awareness in patients and or caregivers. This led to a broader emphasis on preventative measures alongside the management of an acute exacerbation with the former being more of a focus.^{(20, 22-}

27, 29, 30, 32, 34, 35, 37, 38, 43-48, 50-61, 68-73). Nearly a third of the instruments contained no questions which could be related to the management of an acute asthma exacerbation. We believe that the primary needs of the carer in regards to exacerbation management have been neglected in the development of many asthma knowledge questionnaires. There is a need for researchers to move forward and build customised questionnaires to achieve their individual endpoints. We believe that questionnaires need to be specific enough to assess the knowledge required in the management of an acute exacerbation of asthma and that future development of questionnaires should be guided by pragmatism and pedagogical robustness.

The only questionnaire that included a substantial number of items which related to acute asthma management (10 items), was the 20-item instrument reported by Parcel et al¹⁵ developed for children with asthma. This questionnaire, published in 1980, was the oldest instrument in this review and update of content would by now be appropriate. Whilst our analysis did not focus on the validity of instruments it was apparent that some items contained in questionnaires required updating. Wording was often ambiguous and could be improved with more recent and universally accepted terminology for certain components of asthma management, evidenced by the reference made to nebulised bronchodilators in the original NAKQ questionnaire, and the use of the term 'asthma attack' rather than 'asthma exacerbation' or 'asthma flare up'.

All of the 37 instruments reviewed included information on their development and validation, however there was variation in the nature and the extent of these processes. A more detailed analysis of the validation processes was outside the scope of this review. (The systemic review conducted by Pink et al⁽¹⁸⁾ however did look in detail at psychometric properties of asthma knowledge questionnaires).

Content Analysis of Individual Questions Within Asthma Questionnaires

The categorization of questions dealing with AFA (as seen in table 1) followed predictable themes such as timing of contacting emergency services, and the need to give reliever medication promptly. The management of an acute asthma exacerbation requires quick action and practical steps in a real-life situation. Items testing knowledge surrounding this management should reflect the context in which the knowledge needs to be applied. It may be recommended that future development of questionnaires testing knowledge around asthma exacerbation management, contain practical test items. For example, instead of using words such as ‘reliever medication’, perhaps practical knowledge of which inhaler would be appropriate e.g. ‘the blue coloured inhaler containing reliever medicine’. These seemingly simple questions are important in establishing a person’s knowledge of the skills needed to administer asthma first-aid. It is the opinion of the research team that from an educator’s viewpoint, likely mistakes that a lay first-aid deliverer may make should be tested as distracters within questions, so that feedback about performance in the questionnaire can help re-align any factually incorrect issues a learner has.

The nature of the questions within the instruments were surprisingly varied in structure. It is clearly shown in our results (table 2) that most questions which dealt with AFA used multiple choice and/or true/false formats, which are preferable when trying to elicit a definitive response or answer⁽¹⁶⁾. However there were a small number of open-ended questions (table 2). It was often debateable whether or not they could be applied specifically to the management of an acute exacerbation. It is important to note that such questions may be effective for patient-centred objectives for which they were developed such as the need to gain insight into confidence of patients or caregivers in relation to asthma knowledge. However for the purposes of testing

knowledge in AFA they were not thought to be useful. In most questionnaires, it was not clear if pedagogical principles had been applied in the construction of the questionnaires.

The strength of this review is the systematic manner in which it was conducted and the analysis of the questions within the asthma knowledge questionnaires. We believe that our search strategy was specific enough, and the databases were broad enough to identify the majority of asthma knowledge questionnaires. It is important to note that we were not able to obtain all original instruments from the authors ($n = 7$) leaving some questionnaires that we believe to exist, but which were not possible to content analyse. We were able however, to identify a range of questions that were relevant to the knowledge that surrounds acute asthma exacerbation management. With updates from current guidelines we believe this review can form the basis for the development of a specific acute asthma exacerbation management knowledge questionnaire.

This review has demonstrated that there is a genuine need to develop a tool which is specifically designed to test the content of any particular asthma educational intervention that focuses on knowledge of acute asthma exacerbation. Knowledge items pertaining to common sense actions required for the management of an acute exacerbation of asthma are necessary to be included in asthma knowledge questionnaires to ensure clarity for all who may be faced with an emergency situation. This is especially the case for the non-primary caregiver such as the teacher in a school who has different educational requirements to the patient with asthma. A recent pilot study⁽⁷⁴⁾ conducted by the research team has shown that specific education around AFA including a skills assessment is required for caregivers of young children. This research found that at baseline pre-school staffs' asthma knowledge scores were high however this did not translate into appropriate AFA skills required to treat an acute exacerbation of asthma. This suggests that the questionnaire

lacked specificity to AFA. Questionnaires need to be tailored to the specific content relevant to the education that is being assessed. The results are only as good as the measure that was employed to obtain them.

In conclusion, this review found that few instruments have sufficient specific focus on knowledge on acute asthma exacerbation management, and no one instrument was specific enough to test knowledge in this area alone. There is scope for further work in the development and validation of a specific knowledge questionnaire for teachers or caregivers to assess their knowledge of acute asthma exacerbation management before and after asthma educational interventions.

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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APPENDIX 1. Example of database search strategy

Search result from the EMBASE database

No.	Query	Result
1	asthma	238165
2	exacerbation	72766
3	1 OR 2	298267
4	questionnaire	555497
5	interview	230791
6	outcome assessment	280459
7	data collection	1137153
8	survey	1068386
9	4 OR 5 OR 6 OR 7 OR 8	2896761
10	knowledge	568083
11	health education	266606
12	intervene	9029
13	intervention	566404
14	10 OR 11 OR 12 OR 13	1317775
15	3 AND 9	46211
16	3 AND 9 AND 14	6281
17	limit 16 to [adolescent OR adult OR child OR preschool OR school OR young adult]	3348
18	limit 17 to [human OR questionnaire]	3293
19	limit 18 to [asthma]	2495
20	limit 19 to [disease management OR drug therapy OR inhalational drug administration]	893
21	manually screen	58
22	removal of duplicates	26
23	articles met criteria and with questionnaires	7

Appendix 2. -- Asthma Knowledge Questionnaires characteristics

Year, First author	Country	Subjects / Recruitment	Purpose	Intervention	Description	Validation
1980 Parcel ⁽¹⁹⁾	USA	Children (5-11) / Elementary schools	To assess asthma knowledge before and after an educational program	Educational program once a week for 24 week	20-item self-administered or interview T/F questionnaire	
1990 Fitzclarence ⁽²⁷⁾	Australia	Parents / Respiratory clinics and local asthma support groups	To develop a validated asthma knowledge questionnaire as a few existed	No	##NAKQ: 31-item self-administered questionnaire with 25 T/F questions and 6 open-ended questions	
1992 Madsen ⁽³⁷⁾	Denmark	Teachers / Primary schools	To assess asthma knowledge among teachers and identify areas with limited knowledge	No	44-item self-administered questionnaire	
1993 Mesters ⁽²¹⁾	USA	Parents / Community	To develop and evaluate	Educational protocol	73-item self-administered	

			an education program	consists of five volumes with one manual for every discipline and a booklet	T/F knowledge questionnaire	
1993 Wigal ⁽²⁸⁾	USA	Adults with asthma / Clinics and physicians' offices	To assess asthma knowledge, attitude and self-efficacy of patients with asthma	Two-part asthma education and self-management training video	*KASE-AQ: 60-item MC questionnaire	
1995 Gibson ⁽²⁹⁾	Australia	Students and teachers / Secondary Schools	To assess asthma knowledge among adolescents with asthma, their peers and their teachers	No	#NAKQ: 31-item self-administered questionnaire with 25 T/F questions and 6 open-ended questions	
1996 Kolbe ⁽⁴⁵⁾	New Zealand	Patients / Asthma clinics in hospital	To assess practical knowledge of self-management of acute asthma	No	2-scenario based face-to-face open-ended interview	
1997 French ⁽³⁸⁾	Australia	Teachers / Primary	To assess asthma	No	38-item self-administered	

		schools	knowledge among teachers and identify area of specific needs		T/F and MC questionnaire	
1998 Allen ⁽⁴⁶⁾	Australia	Adults / Clinic and university	To develop a validated, reliable questionnaire for randomized control trial of education program	No	**31-item self- administered T/F/DK questionnaire	
2000 Bell ⁽³⁴⁾	UK	Teachers / Primary schools	To assess asthma knowledge among teachers and evaluate impact of the training package	Training session	***NAKQ: 30- item self- administered questionnaire with 24 T/F questions and 6 open-ended questions	
2000 Yawn ⁽⁴⁷⁾	USA	Students / Elementary schools	To assess the efficacy of low- cost asthma educational package (computer- based	Computer- based games	17-item self- administered MC questionnaire	

			education)			
2001 Meyer ⁽²⁴⁾	USA	Adults with asthma / A&E in hospital	To assess asthma knowledge relevant to recent innovations in asthma management	No	25-item face-to-face questionnaire with mostly T/F questions	
2001 Scherer ⁽³²⁾	USA	Adults with asthma / Private-practice primary care provider	To examine the relationship between asthma knowledge, attitude, self-efficacy and compliance with medication, A&E visits and hospitalizations	No	KASE-AQ: 60-item self-administered MC questionnaire	
2002 Fadzil ⁽³⁰⁾	Malaysia	Parents with asthmatic children / Respiratory clinics in hospital	To assess asthma knowledge among parents with asthmatic children	No	#NAKQ: 31-item self-administered questionnaire with 25 T/F questions and 6 open-ended questions	

2002 Tse ⁽³⁹⁾	Hong Kong	Teachers / Primary schools	To assess asthma knowledge among teachers	No	37-item self-administered T/F questionnaire	
2003 Ho ⁽²⁰⁾	USA	Parents / Schools and secondary care	To develop an updated validated measure and assess asthma knowledge and management behaviour	No	###mNAKQ & 1980 Parcel: 25-item self-administered T/F questionnaire	
2004 Bryant-Stephens ⁽⁴⁸⁾	USA	Parents and caregivers / Community	To assess the effectiveness of community asthma education	Five-week educational session	16-item MC questionnaire	
2005 Butz ⁽²⁵⁾	USA	Parents and caregivers / Schools	To assess asthma knowledge before and after educational intervention	One-hour asthma education session	20-item face-to-face MC questionnaire	
2005 Kritikos ⁽⁵⁰⁾	Australia	Adults / Community pharmacies	To develop and validate asthma knowledge	No	12-item self-administered T/F questionnaire	

			questionnaire for health care professionals and consumers			
2005 Rodriguez Martinez ⁽⁵¹⁾	Colombia	Parents / Secondary care	To develop a validated asthma knowledge questionnaire in Spanish	No	#### 17-item self- administered 5-point likert scale questionnaire	
2005 Shivbalan ⁽⁵²⁾	India	Parents with asthmatic children / Hospitals	To assess asthma knowledge, attitude and practice among parents with asthmatic children	No	34-item semi- structured questionnaire	
2006 Hazell ⁽³¹⁾	Australia	Childcare staff / Child care Services	To develop, implement and evaluate a health education program	Educational workshops	#NAKQ: 31- item self- administered questionnaire with 25 T/F questions and 6 open-ended questions	
2006 Ones ⁽⁴⁰⁾	Turkey	Teachers / Primary schools	To assess asthma knowledge	No	26-item likert scale questionnaire	

			among teachers			
2007 Schaffer ⁽⁵³⁾	USA	Adults with asthma / Walk-in clinics	To develop an asthma self-management questionnaire for adults covering contents recommended by NAEPP ^{52,53}	No	24-item self-administered T/F questionnaire	
2007 Zayas ⁽⁵⁴⁾	USA	Local residents / Community	To assess asthma knowledge within community and develop practical educational interventions	No	10-item semi-structured interview open-ended questionnaire	
2008 Anwar ⁽⁵⁵⁾	Oman	Students with asthma / Schools	To assess asthma knowledge among students with asthma	No	20-item T/F questionnaire	
2008 Costa ⁽⁵⁶⁾	Portugal	Children with asthma / Outpatient	To evaluate the impact of a educational	Five-day educational camp, 20-min	12-item questionnaire	

		clinics in hospitals	camp program for children with asthma	interactive educational sessions daily		
2009 Angelini ⁽⁵⁷⁾	Brazil	Patients / Asthma outpatient clinic in hospital	To assess changes in asthma knowledge before and after educational intervention	Educational program with two 1-hour lectures	14-item questionnaire	
2009 Getch ⁽⁴¹⁾	USA	Teachers / Elementary and middle-school teachers	To assess asthma knowledge and management among teachers	No	13-item likert scale questionnaire	
2009 Mancuso ⁽⁵⁸⁾	USA	Patients / Primary care	To develop and test asthma self-management questionnaire	No	16-item MC questionnaire	
2009 Trebuchon ⁽⁵⁹⁾	France	Patients / A&E in hospital	To develop, validate and assess asthma knowledge and behaviour before and after	Asthma School educational program	45-item French self-administered questionnaire	

			educational intervention			
2010 Bruzese ⁽¹⁸⁾	USA	Teachers / Pre- Kindergarten and elementary schools	To assess asthma knowledge, prevention and management behaviours among teachers	No	21-item self- administered T/F questionnaire	
2010 Deis ⁽⁶⁰⁾	USA	Parents / A&E in tertiary care centres	To assess asthma knowledge and use of preventive care measures among parents	No	38-item in- person questionnaire	
2010 Mancuso ⁽³³⁾	USA	Patients / Hospital	To assess asthma knowledge, attitude and self-efficacy among patients	No	KASE-AQ: 60- item self- administered MC questionnaire	
2011 Motlaq ⁽³⁵⁾	Al- Australia	Children / Primary school	To develop and validate an asthma knowledge questionnaire for children	No	###mNAKQ: 24- item self- administered questionnaire with 23 T/F questions and	

					1 open-ended questions	
2011 Largo ⁽⁶¹⁾	USA	Caregivers / Fliers distributed in community	To assess changes in asthma symptom control in children before and after educational intervention	Four in-home environmental public health program	37-item face-to-face T/F questionnaire	
2011 Razi ⁽⁶⁸⁾	Turkey	Adolescents / School	To assess asthma knowledge among children before and after educational intervention	Asthma knowledge booklet and answers of questionnaire	29-item self-administered T/F questionnaire	
2012 Zuniga ⁽⁶⁴⁾	USA	Parents / Head start centres	To test effectiveness of an asthma educational intervention	45-min asthma education training	12-item T/F questionnaire	
2013 Al-Motlaq ⁽³⁶⁾	Australia	Teachers / Primary school	To assess asthma knowledge among teachers and	No	###mNAKQ: 30-item questionnaire with 29 T/F questions and	

			confidence in managing asthmatic children		1 open-ended questions	
2013 Rastogi ⁽⁶⁹⁾	USA	Caregivers / Hospitals	To assess asthma knowledge, aptitude and practice among caregivers	15-min interactive education session with hand-out	57-item face-to-face questionnaire	
2014 Binsaeed ⁽⁶⁶⁾	Saudi Arabia	Caregivers/ Hospital	To assess asthma knowledge in caregivers and relationship to asthma control	No	17-item self-administered 5-point likert scale questionnaire	
2014 Kawafha ⁽⁴³⁾	Jordan	Teachers/ Primary School	To assess the knowledge of teachers before and after an educational intervention. A randomized control study	yes	31-item self-administered T/F/DK questionnaire	
2014 Akcay ⁽⁴⁴⁾	Turkey	Teachers/ Daycare Centres	To assess the knowledge of teachers at daycare	No	32-item self-administered 5 point likert scale	

			centres		questionnaire	
2015 Auger ⁽²⁶⁾	USA	Caregiver/ Hospital	To examine asthma knowledge beliefs and adherence and their association with readmission for acute asthma	No	13 item self- administered 5 point likert scale questionnaire.	

#NAKQ: Newcastle Asthma Knowledge Questionnaire

*KASE-AQ: Knowledge, Attitude and Self-Efficacy Asthma Questionnaire

##mNAKQ: modified Newcastle Asthma Knowledge Questionnaire

**Asthma General Knowledge Questionnaire for Adults

Rodriguez Martinez Questionnaire

Table 1. Content Analysis of Questions on Asthma First Aid

Year, First author	Total no. of questions in the outcome measure	Total no. of knowledge questions	Total no. of asthma first aid questions	No of asthma first aid questions in each questionnaire in each category			
				General Knowledge	Pathophysiology	Signs & Symptoms	Medication & Treatment
1980 Parcel	20	20	10	4	1	2	3
1990 Fitzclarence +	31	31	8	1	2	1	4
1992 Madsen	44	32	5	1	-	-	4
1993 Mesters	73	73	27	6	7	6	8
1993 Wigal ⁺⁺	60	20	7		3	1	3
1996 Kolbe	16	16	0	-	-	-	0
1997 French	38	31	1	1	-	-	-
1998 Allen ⁺⁺⁺	31	31	11	3	7	-	1
2000 Bell	30	30	7	1	2	1	3
2000 Yawn	18	18	5	2	1		2
2001 Meyer	25	25	8	3	-	2	3
2002 Tse	37	37	10	1	1	7	1
2003 Ho	25	25	6	2		2	2

2004 Byrant- Stephens	16	16	1	1	-	-	-
2005 Butz	20	20	6	1	-	-	5
2005 Kritikos	12	12	4	-	-	-	4
2005 Rodriguez Martinez ⁺⁺⁺⁺	17	17	0		-	-	-
2005 Shivbalan	34	19	0	-	-	-	-
2006 Ones	26	26	0	-	-	-	-
2007 Schaffer	24	24	9	1-	-	2	6
2007 Zayas	10	4	0	-	-	-	-
2008 Anwar	20	20	5	1	-	4	-
2008 Costa	12	8	1	-	-	1	-
2009 Angelini	12	8	1	1	-	-	
2009 Getch	13	13	2	2	-	-	-
2009 Mancuso	16	16	1	1	-	-	-
2009 Trebuchon	45	11	4	-	4	-	-
2010 Bruzzeze	21	21	1	-	-	1	-
2010 Deis	38	3	2	-	-	1	1
2011 Al- Motlaq	24	24	6	3	1	1	1

2011 Largo	37	37	7	3	1		3
2011 Razi	29	24	0	-	-	-	-
2012 Zuniga	12	4	0	-	-	-	-
2013 Al- Motlaq	30	30	7	2	2	1	2
2013 Rastogi	57	5	0	-	-	-	
2014 Akcay	32	32	0	-	-	-	-
2015 Auger	13	13	0	-	-	-	-
Total	1018	780	162	41	32	33	56

⁺1995 Gibson, 2002 Fadzil, 2006 Hazell shared the same NAKQ from 1990 Fitzclarence

⁺⁺ 2001 Scherer, 2010 Mancuso shared the same KASE-AQ from 1993 Wigal

⁺⁺⁺2014Kawaha shared 1998 Allen

⁺⁺⁺⁺2015 Binsaeed shared 2005 Rodriguez Martinez

Table 2 Format of Questions on Asthma First Aid

	True/False	True/False/Don't Know(or not sure)	Multiple Choice	Open Ended Question-Requiring Written Response
Number of Asthma First Aid Specific Questions	90	51	17	4

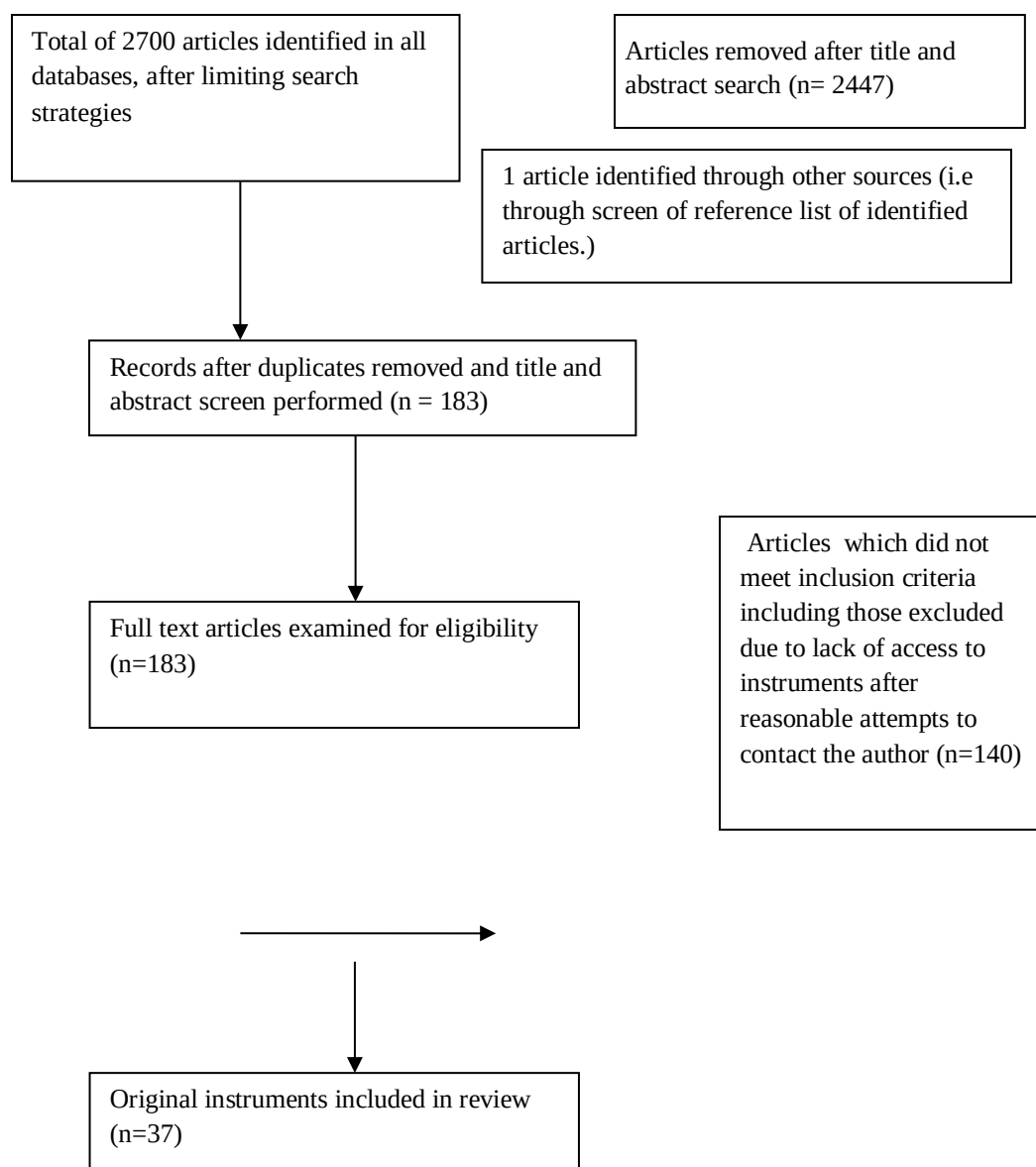


Figure 1. Flow diagram of included studies