

DR. REBECCA CLAIRE KNIBB (Orcid ID : 0000-0001-5561-0904)

DR. CHERRY ALVIANI (Orcid ID : 0000-0003-1527-0495)

DR. CHARLOTTE G. MORTZ (Orcid ID : 0000-0001-8710-0829)

DR. AUDREY DUNNGALVIN (Orcid ID : 0000-0002-1540-3959)

DR. HELENA PITE (Orcid ID : 0000-0002-7300-928X)

DR. ALEXANDRA SANTOS (Orcid ID : 0000-0002-7805-1436)

PROF. GRAHAM C ROBERTS (Orcid ID : 0000-0003-2252-1248)

Article type : EAACI Position Paper

The effectiveness of interventions to improve self-management for adolescents and young adults with allergic conditions: a systematic review

Rebecca C Knibb¹, Cherry Alviani^{2,3}, Teresa Garriga-Baraut^{4,5}, Charlotte G Mortz⁶, Marta Vazquez-Ortiz⁷, Elizabeth Angier⁸, Katerina Blumchen⁹, Pasquale Comberiat^{10,11}, Bettina Duca⁷, Audrey DunnGalvin^{12,13}, Claudia Gore¹⁴, Valerie Hox¹⁵, Britt Jensen⁶, Helena Pite^{16,17}, Alexandra F Santos¹⁸⁻²¹, Silvia Sanchez-Garcia²², M Hazel Gowland²³, Frans Timmermans²⁴, Graham Roberts^{2,3,25}

Affiliations:

1. Department of Psychology, School of Life and Health Sciences, Aston University, Birmingham, UK
2. University of Southampton Faculty of Medicine, Southampton, UK
3. The David Hide Asthma and Allergy Research Centre, St Mary's Hospital, Isle of Wight, UK
4. Unitat d'Allergologia Pediàtrica, Hospital Universitari Vall d'Hebron, Barcelona, Spain.
5. Grup d'Investigació "Creixement i Desenvolupament", Institut de Recerca de l'Hospital Universitari Vall d'Hebron (VHIR), Barcelona, Spain.
6. Department of Dermatology and Allergy Centre, Odense Research Centre for Anaphylaxis (ORCA), Odense University Hospital, University of Southern Denmark, Odense, Denmark
7. Department of Paediatrics, Faculty of Medicine, Imperial College London, UK
8. Primary Care and Public Health, Faculty of Medicine, University of Southampton, UK
9. Department of Paediatric and Adolescent Medicine, Paediatric Pneumology, Allergy and Cystic Fibrosis, University Hospital Frankfurt, Frankfurt am Main, Germany

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the [Version of Record](#). Please cite this article as [doi: 10.1111/ALL.14269](https://doi.org/10.1111/ALL.14269)

This article is protected by copyright. All rights reserved

10.

Department of Clinical and Experimental Medicine, Section of Paediatrics, University of Pisa, 56126 Pisa, Italy

11. Department of Clinical Immunology and Allergology, I.M. Sechenov First Moscow State Medical University, 119991 Moscow, Russia.

12. Applied Psychology and Paediatrics and Child Health, University College Cork, Cork, Ireland,

Paediatrics 13. Child Infectious Diseases, First Moscow State Medical University, Russia.

14. Claudia Gore: Paediatric Allergy, St Mary Hospital, London, UK

15. Department of Otorhinolaryngology, Head and Neck Surgery, University Hospitals Saint-Luc, Brussels, Belgium.

16. Allergy Center, CUF Descobertas Hospital and CUF Infante Santo Hospital, Lisbon, Portugal

17. CEDOC, Chronic Diseases Research Center, NOVA Medical School/Faculdade de Ciências Médicas, Universidade Nova de Lisboa, Lisbon, Portugal

18. Department of Women and Children's Health (Paediatric Allergy), School of Life Course Sciences, Faculty of Life Sciences and Medicine, King's College London, London, United Kingdom

19. Peter Gorer Department of Immunobiology, School of Immunology and Microbial Sciences, King's College London, London, UK

20. Children's Allergy Service, Guy's and St Thomas' Hospital, London, UK

21. Asthma UK Centre in Allergic Mechanisms of Asthma, London, UK

22. Allergy Department, Hospital Infantil Universitario del Niño Jesús, Madrid, Spain

23. Allergy Action, St Albans, UK

24. Netherlands Anaphylaxis Network – European Anaphylaxis Taskforce, Dordrecht, The Netherlands

25. NIHR Southampton Biomedical Research Centre, University Hospital Southampton NHS Foundation Trust, Southampton, UK

Address for correspondence:

Professor Graham Roberts, Paediatric Allergy and Respiratory Medicine, University Child Health (MP803), University Hospital, Southampton NHS Foundation Trust, Tremona Road, Southampton SO16 6YD, UK.

Tel.: +44 (0) 2380796160 E-mail: g.c.roberts@soton.ac.uk

Key words: adolescent, allergy, asthma, education, e-health, interventions, peers, psychological, young adult.

Word count: 3892; Tables: 2; Figures: 1

Short title: Interventions for adolescents and young adults

Conflict of interests:

GR reports research funding from Asthma UK and National Institutes of Health Research into the challenge associated with asthma during adolescents. FT reports being a parents of a young adult with food allergy. None of the other authors have anything to disclose.

Contributions:

Study concept and design, G.R., R.C.K., M.V-O.. Acquisition of data including search, G.R., R.C.K., C.A., T.G-B., C.G.M.. Analysis and interpretation of data, G.R., R.C.K., C.A., T.G-B., C.G.M.. Drafting of the manuscript, G.R., R.C.K., C.A., T.G-B., C.G.M.. Critical revision of the manuscript for important intellectual content, all authors. Obtained funding, G.R., M.V-O..

ABSTRACT

Background: This systematic review aimed to review the literature on interventions for improving self-management and wellbeing in adolescents and young adults (11-25 years) with asthma and allergic conditions.

Methods: A systematic literature search was undertaken across eight databases. References were checked by two reviewers for inclusion. Study data were extracted and their quality was assessed in duplicate. A narrative synthesis was undertaken.

Results: A total of 30 papers reporting data from 27 studies were included. Interventions types were psychological (k=9); E-health (k=8); educational (k=4); peer led (k=5); breathing re-training (k=1). All interventions were for asthma. Psychological interventions resulted in significant improvements in the intervention group compared to the control group for self-esteem, quality of life, self-efficacy, coping strategies, mood and asthma symptoms. E-Health interventions reported significant improvements for inhaler technique, adherence and quality of life. General educational interventions demonstrated significantly improved quality of life, management of asthma symptoms, controller medication use, increased use of a written management plan and reduction in symptoms. The peer led interventions included the Triple A (Adolescent Asthma Action) programme and a peer-led camp based on the Power Breathing Programme. Improvements were found for self-efficacy, school absenteeism and quality of life.

Conclusion: Although significant improvements were seen for all intervention types, many were small feasibility or pilot studies, few studies reported effect sizes and no studies for allergic conditions other than asthma met the inclusion criteria. Research using large longitudinal interventional designs across the range of allergic conditions is required to strengthen the evidence base.

ABBREVIATIONS

PRISMA Preferred Reporting Items for Systematic Reviews and Meta-Analyses

INTRODUCTION

Adolescents and young adults with asthma and allergies are reported to be a group that have poor engagement in their self-care and health condition management, poor adherence with medication regimes and a low perception of risk¹⁻⁴. This may be due to increasing independence from parents, peer pressure and a lack of knowledge regarding their condition^{1-3,5,6}. This can result in an increased risk of anaphylaxis or asthma exacerbations⁷. For example, adolescents and young adults have been identified as the age group most at risk for fatal anaphylaxis to foods⁸ and have a high incidence of asthma-related death⁹⁻¹⁰. Asthma and food allergy have also been related to increased risk of anxiety and depression in this age group¹¹. Other allergic conditions such as allergic rhinitis and atopic dermatitis have been shown to affect quality of life, school performance, self-esteem and identity in this population¹²⁻¹⁴.

Adolescence presents a great opportunity for education as this age group are keen to gain independence. While education will have been provided to parents of pre-adolescent patients, we know that young adolescents have a surprisingly poor understanding of their condition and how to self-manage them¹⁵. Certain types of interventions might be useful to improve adolescent and young adult engagement and address barriers to self-care, such as peer support, educational workshops or use of e-resources. The European Academy of Allergy and Clinical Immunology Task Force on Allergic Diseases in Adolescents and Young Adults has undertaken this systematic review to review the literature on interventions for improving self-management and wellbeing in adolescents and young adults with allergic conditions, including asthma, urticaria/angioedema and atopic dermatitis. This and a related systematic review on the challenges faced by this age group¹⁵ will be used as the basis of a guideline to support the management of adolescents and young adults with allergic conditions.

METHODS

The protocol for this systematic review has been registered in Prospero (CRD42018104868) and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist has been used to guide reporting.

Search strategy

The search strategy was developed to retrieve articles reporting interventions designed to improve self-management and wellbeing in adolescents and young adults with allergic conditions including asthma, urticaria/angioedema and atopic dermatitis. The search strategy was developed on OVID MEDLINE (see Supplementary files) and then adapted for the other databases. The following databases were searched: Cochrane Database of Systematic Reviews, MEDLINE (OVID), Embase (OVID), Psycinfo, Clinicaltrials.gov, Clinical Trials Register (www.clinicaltrialsregister.eu), Current controlled trials (www.controlled-trials.com) and Australian and New Zealand Clinical Trials Registry (<http://www.anzctr.org.au>). Databases were searched from inception to March 30, 2018; an updated search

was run on February 10, 2019. Additional references were located through searching the references cited by the identified studies and systematic reviews and through discussion with experts in the field.

Inclusion criteria

Studies conducted on adolescents or young adults (aged 11 to 25 years) with allergic conditions (asthma, food allergy, allergic rhinoconjunctivitis, atopic dermatitis, chronic urticaria and/or angioedema, allergic gastrointestinal disease, complex multisystem allergic disease). Included study designs were: controlled trial of an intervention (with two or more groups); randomised controlled trial. Study outcomes included psychological, social and behavioural issues, adherence, skills needed for coping, self-care, deprivation, disease control and symptoms.

Exclusion criteria

The following were excluded: abstracts, reviews, discussion papers, non-research letters, editorials and animal experiments plus studies where children, adolescent and/or adult data were presented together with no subgroup analyses. Studies that did not report an intervention, studies reporting interventions involving a medication or ones only reporting the use of exhaled nitric oxide to manage conditions were also excluded.

Study selection

All references were de-duplicated in Ovid before being uploaded into the systematic review software Rayyan. Study titles and abstracts were independently checked by two reviewers according to the above selection criteria and categorised as: included, not included or unsure. Any discrepancies were resolved through discussion and, if necessary, a third reviewer (RK or GR) was consulted. Full text copies of potentially relevant studies were reviewed by two reviewers for eligibility with discrepancies again resolved through discussion and, if necessary, a third reviewer (RK or GR). A table of studies excluded with reasons can be found in Supplementary Table S1.

Quality assessment strategy

Quality assessments were independently carried out on each study by two reviewers using the Cochrane Risk of Bias Tool for Randomised Controlled Trials¹⁶. Any discrepancies were resolved by discussion or a third reviewer (RK or GR).

Data extraction, analysis and synthesis

Data were extracted onto a customized data extraction sheet independently by two reviewers and any discrepancies were resolved by discussion or by a third reviewer (RK or GR). Descriptive summary with summary data tables were produced and a narrative synthesis of the data was undertaken. Meta-analysis could not be undertaken due to the heterogeneity of methods and measurements used.

RESULTS

Description of Studies

A total of 30 papers were included in the final dataset reporting data from 27 studies (Figure 1). A summary of study characteristics can be found in Table 1 and a summary of findings across studies can be found in Table 2. The majority of studies had small sample sizes; the range was 28 to 455 with a mean of

139.39 participants. Interventions were of 4 main types: psychological (k=9); E-health (k=8); educational (k=4); peer led (k=5); there was k=1 intervention which focused on breathing re-training. All interventions were for adolescents and young adults with asthma, there were no interventions meeting the criteria for any other allergic condition. The majority of studies incorporated follow-up which ranged from 2 weeks to 12 months. Studies were conducted in the USA (k=17); Netherlands (k=2); Iran (k=2); Australia (k=2); Jordan (k=1); Canada (k=1); UK (k=1); and Germany (k=1).

Quality Ratings

Papers were rated for risk of bias. Eleven were found to have a low risk, 11 a moderate risk and 8 a high risk (see Table 1). Risk ratings for each component of the risk assessment tool can be found in Supplementary Table S2. Most studies were rated low for selection and reporting bias, but high for performance bias.

Psychological Interventions

Twelve papers reporting on nine studies explored the impact of psychological interventions on adolescents with asthma¹⁷⁻²⁸. Eight papers were from the USA, three from Iran and one from Germany. All but two of the studies were randomised controlled trials; Hempel et al¹⁷ employed a non-randomised controlled design and Hemati et al¹⁸⁻¹⁹ conducted alternate allocation to intervention or control group. Participants were recruited from asthma clinics, inpatient clinics or hospital^{17,18,19,20,21}, schools²²⁻²⁴ or were identified by review of medical records by clinicians²⁵⁻²⁸.

Interventions focused on the management of stress, anxiety and/or depression^{17-20,28}, improvement of coping or problem-solving skills and self-efficacy^{21,23,24}. Interventions also used cognitive behavioural^{22,23,25-27} or motivational interviewing methods²¹ to improve health outcomes. All interventions included an element of asthma education. Control groups generally received usual care or were on a wait-list, although some received alternatives such as teaching on problem solving²⁰, family support²⁵⁻²⁷ or information on asthma^{21,24}.

Outcome measures included quality of life^{19,21,23,24}, self-esteem¹⁸, coping¹⁷, social support²³, self-efficacy^{23,24}, mood^{19,28}, asthma knowledge^{19,24,25} and maladaptation behaviours²⁰. A range of health outcomes such as adherence^{21,22,25-27}, medication use and number of hospitalisations^{23,24,26}, sleep²² and asthma symptoms and lung function^{21,24,26,28} were also measured.

Two papers reported findings from an 8-week interventional study based on Orem's Self-Care Model^{18,19} focusing on self-care needs and reduction of stress and anxiety, which produced a significant improvement in self-esteem and quality of life in the intervention group compared to the control group. The same research group also reported on a similar intervention using the Roy Adaptation Model which focuses on identifying and changing maladaptive behaviours in managing health²⁰. Their intervention was delivered over 6 weeks with a 2-month follow-up and resulted in a significant reduction in maladaptation behaviours in the intervention group compared to the control group. The clinical relevance of these impacts is not clear as effect sizes and minimal clinical important differences are not reported.

Three papers reported findings from a prospective randomised controlled trial using Multisystemic Therapy for African American adolescents with moderately to severe poorly controlled asthma²⁵⁻²⁷. This therapy incorporates cognitive behavioural therapy to promote behavioural changes and coping skills, delivered at home over six months. Adherence, asthma knowledge, asthma symptoms and hospitalisations were found to significantly improve in the intervention compared to the control group²⁵⁻²⁷, with a per protocol analysis showing a medium effect on adherence²⁷. Asthma knowledge and device skill knowledge was still improved six months later²⁵. Again, the clinical significance is not clear.

Five studies focused on coping skills, problem-solving training or management of asthma using either cognitive behavioural strategies^{17,22,23,24} or motivational interviewing²¹. Two of the studies found quality of life to significantly improve in the intervention group compared to the control group although this did not reach the minimal clinically important difference at the group level^{21,23}. Self-efficacy improved²³, asthma symptoms significantly reduced²¹ and sleep and a sense of responsibility for carrying medication improved²². Hampel et al.¹⁷ found significant improvements in emotion and problem-focused coping strategies from pre- to post-treatment in the intervention groups. In comparison Velsor-Friedrich et al.²⁴ found no differences in the intervention or control group for quality of life, self-efficacy, coping or asthma health outcomes with both improving over time. One study focused on reduction of negative affect using emotional disclosure²⁸ and found significant improvements in the intervention group compared to the control group.

In summary, a number of studies have examined the impact of a range of psychological interventions in adolescents with asthma. Compared to a controlled group, they have been found to improve a range of health outcomes. There is a lack of replication and it is unclear whether the magnitude of any of the health impacts are clinically significant.

E-Health Interventions

Eight studies used e-health interventions²⁹⁻³⁶; seven studies from the United States and one from the Netherlands. All studies were randomized controlled trials, although three were just pilot studies²⁹⁻³¹. Participants were recruited from rural and suburban paediatric clinics or outpatients²⁹⁻³⁴, emergency departments³⁵ or high schools³⁶.

Interventions consisted of the use of computer web-based applications^{31,33,35,36}, telecommunication compressed videos^{32,34} or the use of mobile applications^{29,30}. Bynum et al.³² designed an experimental study with random assignment of participants to a telepharmacy counselling group or control group. The intervention consisted of a compressed video telecommunication with a pharmacist to review and instruct on metered dose inhaler technique. Similar to this, Sleath et al.³⁴ designed a pragmatic trial in which adolescents watched a video on an iPad and then completed an asthma question prompt list. Two other randomized controlled trials evaluated internet-based self-management³³ and the Puff-city-web-based computer-tailored intervention^{35,36}. One of the pilot studies was a block-randomized controlled study to assess the impact of a personal health application-web based system called MyMediHealth which sent medication reminders via text²⁹. Perry et al.³⁰ piloted a novel smartphone-based personalized asthma action plan; Rhee et al.³¹ piloted a computer assisted decision making programme with tailored counselling.

Across studies, control groups either received usual care^{29,33,34}, written instructions^{30,32} or education sessions (e.g. sessions link to asthma website or a sham CD ROM)^{31,35,36}. Outcome measures for studies included: asthma control^{29,30,33}; self-efficacy^{29,30}; quality of life^{29,33}; user satisfaction^{30,32} and clinical

symptoms^{35,36}. Most outcome follow-ups were assessed at 6 months^{30,31,35,36} or 1 year^{33,35,36}. However, for three studies the evaluation post-intervention was shorter (1st day - 4 weeks)^{29,32,34}.

E-health interventions were significantly related to improved study outcomes for the intervention group compared to the control group in most studies, especially among those meeting criteria for moderate-severe asthma³⁶, and adolescents with uncontrolled asthma^{30,33}. Significant improvements were seen in inhaler technique³², in asking questions about asthma medication, triggers and environmental control³⁴, adherence²⁹, quality of life^{29,33}, asthma control³³ and reduced clinical symptoms at 12-month follow-up³⁶. However, asthma self-efficacy scores significantly improved in just one study²⁹ as did user satisfaction³⁰. Asthma control did not improve in four studies^{29,30,35,36} although Perry et al.³⁰ found a significant improvement in a sub-group who did not have well-controlled asthma. Again, there were no clear clinically significant improvements in health outcomes.

General educational Interventions

Four studies assessed educational interventions³⁷⁻⁴⁰; one from the UK, one from the Netherlands, one from Canada and one from the USA. All were randomized controlled trials and included group sessions focusing on asthma prevention and management³⁷⁻³⁹, individual coaching sessions³⁷ and nurse-led asthma clinics^{39,40}. Participant identification and intervention delivery was school-based^{37,40}, community-based³⁸, and in an outpatient setting³⁹. One study recruited urban ethnic minority teens³⁷. Control groups were randomized either to normal care^{37,39,40}, or a less active form of intervention including basic spirometry and revision of inhaler technique³⁸.

All of the general education interventions focused on outcomes relating to asthma knowledge, symptom identification, symptom prevention and asthma management. They demonstrated significantly improved knowledge of asthma and inhaler technique^{37,40}, reduction in night-time symptoms and school absences³⁷ amongst the intervention group compared to the control group. Longevity of this positive impact varied. One study focused in particular on attitudes and self-efficacy with regards to asthma, demonstrating only improved self-reported adherence amongst the intervention group after 2 years³⁹, however Cowie et al.³⁸ reported no differences between intervention and control group six months post intervention.

Three studies assessed the impact educational interventions had on quality of life^{37,38,40}. Results were mixed, with one study demonstrating a statistically (but not clinically) significant improvement in quality of life amongst the intervention group 12 months post-intervention³⁷, one showed a non-significant trend in overall quality of life and significant improvements for symptom related and emotional quality of life³⁸ and one found no effects on quality of life⁴⁰. Three of the interventions focused on healthcare use and two demonstrated a reduction in acute medical visits amongst the intervention group^{37,38}, whilst the third study focused on asthma review clinic attendance, demonstrating an increased attendance amongst the intervention group⁴⁰.

Peer-Led Interventions

Five studies assessed peer-led interventions for asthma⁴¹⁻⁴⁵; two studies from Australia, one from Jordan and two from the USA. Two used a cluster-randomized design^{41,42}; and three used a randomized controlled design⁴³⁻⁴⁵. Participants were recruited from high schools in Jordan⁴¹, rural high schools in Australia^{42,43}, or an asthma day camp in the USA^{44,45}.

The intervention utilised in three of the five papers was the Triple A (Adolescent Asthma Action) programme⁴¹⁻⁴³ and was compared to standard practice. In two studies^{44,45} a peer-led camp based on the Power Breathing Programme was compared to an adult led camp. In two studies the effect of the intervention was measured after 3 months^{41,42}, and in two studies outcomes were measured at 3, 6 and 9 months^{44,45}. In one study measurements were performed 1-2 months prior and after the intervention with no long-term follow-up⁴³.

Four of the five studies measured quality of life using asthma-specific quality of life scales; three found that quality of life significantly improved in the intervention group compared to the control group^{41,42,44}, while one study showed no change in quality of life⁴³. For two studies, the magnitude of the group change in quality of life was greater than the minimal clinical important difference^{41,44}. Rhee et al.⁴⁴ found the intervention to be more beneficial to adolescents of male gender, low family income and non-white participants while Shah et al.⁴² showed the effect of the intervention was greatest in females.

Shah et al.⁴² measured school absenteeism and found it decreased in the intervention group whilst asthma attacks in school increased in control group. An 80-82% reduction in acute office visits in the peer-led group was found in the study by Rhee et al.⁴⁵ and this group were 4-5 times more likely to use school clinics due to asthma. Al-Sheyab et al.⁴¹ measured self-efficacy to resist smoking and knowledge of asthma self-management and found this improved compared to the control group. Gibson et al.⁴³ also showed an improvement in asthma knowledge in students with asthma and peers at the intervention schools. The impact on asthma control was only assessed by Rhee et al.,⁴⁴ who found no difference in FEV1 between intervention and control group.

Relaxation and breathing re-training

One study assessed the effectiveness of relaxation and breathing re-training⁴⁶. The intervention consisted of practice in diaphragmatic breathing, asthma-specific guided imagery and progressive muscle relaxation over two sessions of 30 minutes, a month apart, plus a compact disk to use at home. Control participants had two sessions of educational material on asthma only. Both groups improved over time and there was no significant difference between intervention and control group for quality of life, asthma control or anxiety.

DISCUSSION

This systematic review aimed to review the literature on interventions for improving self-management and wellbeing in adolescents and young adults with asthma and allergic conditions. Thirty papers reporting data from 27 studies met the inclusion criteria, all for adolescents and young adults with asthma, with no interventions meeting the criteria for any other allergic condition. Interventions were varied and included those incorporating psychological elements such as cognitive behavioural therapy or motivational interviewing; peer-led interventions in schools or asthma camps; e-health interventions using smart phones or computers; and general educational interventions led by health care professionals. A large range of outcome variables were measured including quality of life, self-esteem and self-efficacy, coping skills, mood, asthma adherence, asthma knowledge, symptoms and hospital visits. Across interventions, improvements were generally seen for intervention groups compared to control groups in a number of outcome measures, however the quality of the studies varied greatly.

Overall effectiveness across interventions

All but four of the interventions reported significantly better outcomes for the intervention group compared to the control group for at least one outcome measure. Psychological outcomes such as quality of life, self-esteem, self-efficacy, use of social support, coping and mood all improved. Clinical outcomes such as asthma symptoms, hospital visits, adherence, device technique and asthma knowledge were also shown to improve. Velsor-Friedrich et al.'s²⁴ coping-skills training intervention, Bignall et al.'s⁴⁶ breathing re-training intervention, Joseph et al.'s³⁵ computer tailored intervention and an educational intervention by van Es et al.³⁹ reported no differences, with both intervention and control groups improving over time. This may be due to the participants and setting for Velsor-Friedrich et al.²⁴ (low income urban adolescents in a community setting) and to the low participant numbers for the other studies. Overall therefore, it appears that taking part in an intervention as an adolescent or young adult with asthma may provide some benefits in terms of psychological and/or clinical outcomes.

Psychological outcomes

Quality of life was measured by studies in each category of intervention and reported in 15 out of the 30 papers in this review but only ten papers reported improved quality of life in the intervention groups compared to the control groups. In only two studies, employing peer-led interventions, was this a clinically important group increase^{41,44}. Adolescents receiving psychological interventions generally reported better quality of life than controls with the notable exception of the intervention reported by Velsor-Friedrich et al.²⁴. For E-Health interventions two of the three papers measuring quality of life reported improvements and similarly for educational interventions, two of the three papers reported improvements. For peer-led interventions, out of four papers measuring quality of life, just Gibson et al.⁴³ reported no significant improvements in the intervention group. Not all studies reporting non-significant findings were small feasibility or pilot studies but many of these studies included participants who were from low income

backgrounds, ethnic minority groups or had severe asthma where you may expect to see improvements in the control groups due to being recruited into a study.

Self-efficacy was measured by seven studies and found to significantly improve in the intervention group in four of these. Those not reporting improvements were small pilot studies and thus may not have been fully powered to detect differences. The only other psychological outcome reported by more than one study was mood, which was found to improve in the intervention group in two studies but not in the breathing re-training study by Bignall et al.⁴⁶.

Although it is difficult to make comparisons across intervention types and measures, the general trend across studies is an improvement in psychological outcomes for adolescents and young adults with asthma. Further work is needed with fully powered trials for asthma and other allergic conditions that focus on assessing for clinically important improvements in self-efficacy and other endpoints.

Clinical outcomes

Most studies in this review measured clinical outcomes. The majority of studies that measured device technique, sleep and adherence reported significant improvements in the intervention groups compared to control groups. The majority of studies measuring asthma knowledge and symptom improvement also reported significant improvements in the intervention groups. It is not clear whether these improvements are clinically relevant as we do not know the size of effects reported. Findings for hospitalisation, self-reported asthma control and FEV₁ were more equivocal. So, while there are encouraging results, there is currently limited evidence for efficacy for key contemporary, patient-centred endpoints of asthma control and exacerbations.

Limitations of studies in this review

There are limitations of the studies in this review, which could in part explain the varied results. Quality ratings showed that the majority of studies had either a moderate or high risk of bias. This was for a number of reasons including small sample sizes, lack of information on randomisation, no blinding of participants to intervention group, incomplete outcome data, use of unvalidated outcome measures and a lack of information about control groups. There was also a lack of information on the content of the intervention for many papers and publication of an intervention protocol would be useful. It was difficult to ascertain whether findings had clinical importance due to the use of poorly validated endpoints with no information about minimal clinically important differences or effect sizes. It was also not possible to run a meta-analysis due to variability in the outcome measures used for any intervention type. The diagnosis of asthma varied from questionnaire-based criteria to clinical criteria including spirometry. Lastly, there are other factors that need to be taken into consideration such as how the intervention fits in with the structure of the health system, the training provided to health workers delivering the interventions, whether more than

one intervention is required, the best age to initiate such interventions (perhaps in the pre-adolescent years) and how much more motivated trial participants are likely to be compared to routine clinic patients.

Policy implications and recommendations

Policy reports across Europe have an emphasis on integrated care and one of the key components of this is self- management^{47,48}. This systematic review is timely to help commissioners and policy makers understand the context for this important and often overlooked age group of adolescents and young adults. Population health approaches are also being supported in policy and these aim to promote improvements in both the physical and mental outcomes whilst addressing health inequities across a population⁴⁹. The King's fund report 'A vision for population health: towards a healthier future' considers four pillars of population health: 'wider determinants of health, health behaviours and lifestyles, places and communities that people live in, and an integrated care system'⁴⁹.

It is clear that although the results of the systematic review so far are promising we should be investing in further research to support self- management and patient-centred care in order for integrated care to be truly realised. The aim of this is to achieve better quality care, improved patient experience and lower costs, thus supporting a more sustainable health system. This will also involve an understanding of relevant behavioural and cultural approaches and an investment in education for both health care staff and patients. However, we do need to be mindful that many interventions are complex, time-consuming and expensive and so cost-effective interventions that are feasible to implement are needed.

Conclusions

Although significant improvements were seen across all intervention types, many studies in this review were small feasibility or pilot studies and none for allergic conditions other than asthma met the inclusion criteria. Large, longitudinal, interventional studies carried out across the range of allergic conditions, particularly for food allergy and atopic dermatitis, are required to strengthen the evidence base. These need to focus on interventions where there is preliminary evidence, for example the peer-led interventions. Studies need to utilise well validated outcomes and outcome measures that are patient-centred, disease specific where possible, and provide information about the clinical importance of results.

ACKNOWLEDGEMENTS

We would like to acknowledge the support of EAACI in funding the development of this systematic review. We would like to thank Paula Sands for her assistance in optimising the search strategy. We thank Chrissie Jones and Antonio Nieto for providing their expert feedback on the final draft of the paper. We would also like to thank the EAACI Executive Committee for their helpful comments and suggestions.

REFERENCES

1. de Benedictis D, Bush A. The challenge of asthma in adolescence. *Pediatr Pulmonology* 2007;42:683-92.
2. de Benedictis D, Bush A. Asthma in adolescence: Is there any news? *Pediatr Pulmonology* 2017;52:129-38.
3. Marrs T, Lack G. Why do few food-allergic adolescents treat anaphylaxis with adrenaline? reviewing a pressing issue. *Pediatr Allergy Immunol* 2013;24:222-9.
4. DunnGalvin A, Gaffney A, Hourihane JOB. Developmental pathways in food allergy: a new theoretical framework. *Allergy* 2009;64:560-8.
5. Holley S, Walker D, Knibb R, Latter S, Lioffi C, Mitchell F, et al. Barriers and facilitators to self-management of asthma in adolescents: An interview study to inform development of a novel intervention. *Clin Exp Allergy* 2018;48:944-56.
6. Holley S, Morris R, Knibb R, Latter S, Lioffi C, Mitchell F, Roberts G. Barriers and facilitators to asthma self-management in adolescents: A systematic review of qualitative and quantitative studies. *Pediatr Pulmonology* 2017;52:430-42.
7. Vazquez-Ortiz M, Giner MT, Piquer M, Dominguez O, Alvaro M, Lozano J, et al. Life-threatening reactions to oral immunotherapy (OIT) in egg and cow's milk (CM) allergic teenagers. *Allergy: European J Allergy Clin Immunol* 2014;33rd Congress of the European Academy of Allergy and Clinical Immunology. Copenhagen Denmark. Conference Publication: 69, Suppl. 99; 278.
8. Turner PJ, Gowland MH, Sharma V, Lerodiakonou D, Harper N, Garcez T, et al. Increase in anaphylaxis-related hospitalizations but no increase in fatalities: an analysis of United Kingdom national anaphylaxis data, 1992-2012. *J Allergy Clin Immunol* 2015;135:956-63.
9. van Asperen P. Deaths from childhood asthma, 2004–2013: what lessons can we learn? *Med J Australia* 2015;202:125-6.
10. Wolfe I, Thompson M, Gill P, Tamburlini G, Blair M, van den Briel A, et al. Health services for children in western Europe. *The Lancet* 2013;381:1224-34.
11. Ferro MA, Van Lieshout RJ, Scott JG, Alati R, Mamun AA, Dingle K. Condition-specific associations of symptoms of depression and anxiety in adolescents and young adults with asthma and food allergy. *J Asthma* 2016;53:282-8.

12. Walker S, Khan-Wasti S, Fletcher M, Cullinan P, Harris J, Sheikh A. Seasonal allergic rhinitis is associated with a detrimental effect on examination performance in United Kingdom teenagers: case-control study. *J Allergy Clin Immunol* 2007;120:381-7.
13. Nguyen CM, Koo J, Cordoro KM. Psychodermatologic effects of atopic dermatitis and acne: a review on self-esteem and identity. *Pediatr Dermatology* 2016;33:129-35.
14. Mortz C, Andersen K, Dellgren C, Barington T, Bindslev-Jensen C. Atopic dermatitis from adolescence to adulthood in the TOACS cohort: prevalence, persistence and comorbidities. *Allergy* 2015;70:836-45.
15. Vazquez-Ortiz M, Angier E, Blumchen K, Comberiati P, Duca B, DunnGalvin A, et al. Understanding the challenges faced by adolescents and young adults with allergic conditions: a systematic review. *Allergy*, under review.
16. Higgins JPT, Altman DG, Gotzsche P, Juni P, Moher D, Oxman AD, et al. The Cochrane Collaboration's tool for assessing risk of bias in randomised trials. *Brit Med J* 2011;343:d5928.
17. Hampel P, Rudolph H, Stachow R, Petermann F. Multimodal patient education program with stress management for childhood and adolescent asthma. *Patient Education Counselling* 2003;49:59-66.
18. Hemati Z, Sadat Mosaviasl F, Abasi S, Ghazavi Z, Kiani D. Effect of Orem's Self-Care Model on self-esteem of adolescents with asthma referred to an asthma and allergy clinic in Isfahan. *Tanaffos* 2015;14:232-237.
19. Hemati Z, Shakerian B, Shirani F, Sadat Mosaviasl F, Kiani D. Effect of Orem Self-care Model on quality of life in adolescents with asthma. *J Compr Ped* 2017;8:e59343.
20. Alimohammadi N, Maleki B, Abbasi S, Shakerian B, Hemati Z. The effect of adaptation training on controlling maladaptation behaviors in adolescents with asthma Based on Roy Adaptation Model. *Tanaffos* 2018;17:103-109.
21. Seid M, D'Amico EJ, Varni JW, Munafo JK, Britto MT, Kercksmar CM, et al. The *In Vivo* adherence intervention for at risk adolescents with asthma: report of a randomized pilot trial. *J Pediatr Psychol* 2012;37:390-403.

22. Bruzzese J-M, Unikel L, Gallagher R, Evans D, Colland V. Feasibility and impact of a school-based intervention for families of urban adolescents with asthma: result from a randomized pilot trial. *Fam Proc* 2008;47:95-113.
23. Srof BJ, Velsor-Friedrich B, Penckofer S. The effects of coping skills training among teens with asthma. *Western J Nursing Res* 2012;34:1043-1061.
24. Velsor-Friedrich B, Militello LK, Richards MH, Harrison PR, Gross IM, Romero E, et al. Effects of coping-skills training in low-income urban African-American adolescents with asthma. *J Asthma* 2012;49:372-379.
25. Ellis DA, King P, Naar-King S. Mediators of treatment effects in a randomized clinical trial of Multisystemic Therapy-Health Care in adolescents with poorly controlled asthma: Disease knowledge and device use skills. *J Pediatr Psychol* 2016;41:522-530.
26. Naar S, Ellis D, Cunningham P, Pennar AL, Lam P, Brownstein NC, Bruzzese J-M. Comprehensive community-based intervention and asthma outcomes in African American adolescents. *Pediatrics* 2018;142:e20173737.
27. Naar-King S, Ellis D, King PS, Lam P, Cunningham P, Secord E, Burzzese J-M. Multisystemic therapy for high-risk African American adolescents with asthma: a randomised clinical trial. *J Consulting Clin Psychol* 2014;82:536-545.
28. Warner LJ, Lumley MA, Casey RJ, Pierantoni W, Salazar R, Zoratti EM, et al. Health effects of written emotional disclosure in adolescents with asthma: a randomised controlled trial. *J Pediatr Psychol* 2006;31:557-568.
29. Johnson KB, Patterson BL, Ho YX, Chen Q, Nian H, Davison CL, et al. The feasibility of text reminders to improve medication adherence in adolescents with asthma. *J Am Med Inform Assoc.* 2016;23:449-55.
30. Perry TT, Marshall A, Berlinski A, Rettiganti M, Brown RH, Randle SM, et al. Smartphone-based vs paper-based asthma action plans for adolescents. *Ann Allergy Asthma Immunol* 2017;118:298-303.
31. Rhee H, Hollen PJ, Belyea MJ, Sutherland MA. Decision-making program for rural adolescents with asthma: a pilot study. *J Pediatr Nurs* 2008;23:439-50.

32. Bynum A, Hopkins D, Thomas A, Copeland N, Irwin C. The effect of telepharmacy counselling on metered-dose inhaler technique among adolescents with asthma in rural Arkansas. *Telemed J E Health*. 2001;7:207-17.
33. Rikkers-Mutsaerts ERVM, Winters AE, Bakker MJ, van Stel HF, van der Meer V, de Jongste JC, et al. Internet-based self-management compared with usual care in adolescents with asthma: a randomized controlled trial. *Pediatr Pulmonol*. 2012;47:1170-9.
34. Sleath B, Carpenter DM, Davis SA, Watson CH, Lee C, Loughlin CE, et al. Improving youth question-asking and provider education during pediatric asthma visits. *Patient Educ Couns* 2018;101:1051-1057.
35. Joseph CLM, Mahajan P, Stokes-Buzzelli S, Johnson DA, Duffy E, Williams R, et al. Pilot study of a randomized trial to evaluate a web-based intervention targeting adolescents presenting to the emergency department with acute asthma. *Pilot and Feasibility Studies* 2018;4:5.
36. Joseph CLM, Ownby DR, Havstad SL, Saltzgaber J, Considine S, Johnson D, et al. Evaluation of a web-based asthma management intervention program for urban teenagers: reaching the hard to reach. *J Adolesc Health* 2013;52:419-26.
37. Bruzzese J-M, Sheares BJ, Vincent DJ, Du Y, Sadeghi H, Levison MJ, Mellins RB, et al. Effects of a school-based intervention for urban adolescents with asthma. A controlled trial. *Am J Respir Crit Care Med*; 2011;183:998-1006.
38. Cowie RL, Underwood MF, Little CB, Mitchell I, Spier S, Ford GT. Asthma in adolescents: a randomized, controlled trial of an asthma program for adolescents and young adults with severe asthma. *Can Respir J* 2002;9:253-259.
39. Van Es SM, Nagelkerke AF, Colland VT, Scholten RJPM, Bouter LM. An intervention programme using the ASE model aimed at enhancing adherence in adolescents with asthma. *Patient Educ Couns* 2001;44:193-203.
40. Salisbury C, Francis C, Rogers C, Parry K, Thomas H, Chadwick S, et al. A randomised controlled trial of clinics in secondary schools for adolescents with asthma. *Brit J Gen Prac* 2002;52:988-996.
41. Al-sheyab N, Gallagher R, Crisp J, Shah, S. Peer-led education for adolescents with asthma in Jordan: a cluster-randomized controlled trial. *Pediatrics* 2011;129:e106-112.

42. Shah S, Peat JK, Mazurski EJ, Wang H, Sindhusake D, Bruce C, et al. Effect of peer led programme for asthma education in adolescents: cluster randomised controlled trial. *Brit Med J* 2001;322:583-5.
43. Gibson PG, Shah S, Mamoon HA. Peer-led asthma education for adolescents: impact evaluation. *J Adol Health* 1998;22:66-72.
44. Rhee H, Belyea MJ, Hunt JF, Brasch J. Effects of a peer-led asthma self-management program for adolescents. *Archives Pediatr Adol Med* 2011;165:513-9.
45. Rhee H, Pesis-Katz I, Xing J. Cost benefits of a peer-led asthma self-management program for adolescents. *J Asthma* 2012;49:606-13.
46. Bignal WJR, Luberto CM, Cornette AF, Haj-Hamed M, Cotton S. Breathing retraining for African-American adolescents with asthma: a pilot study of a school-based randomized controlled trial. *J Asthma*. 2015;52:889-896.
47. Agache I, Annesi-Maesano I, Bonertz A, Branca F, Cant A, Fras Z, Ingenrieth F, Namazova-Baranova L, Odemyr M, Spanevello A, Vieths S. Prioritizing research challenges and funding for allergy and asthma and the need for translational research—The European Strategic Forum on Allergic Diseases. *Allergy*. 2019 May 9.
48. World Health Organization. Health 2020. A European policy framework and strategy for the 21st century (2013). (<http://www.euro.who.int/en/publications/abstracts/health-2020.-a-european-policy-framework-and-strategy-for-the-21st-century-2013>, accessed 28th December 2019)
49. A vision for population health: Towards a healthier future. Kings fund 2018. (<https://www.kingsfund.org.uk/publications/vision-population-health>, accessed 28th December 2019)

Table 1. Study characteristics ordered by type of intervention and risk of bias ratings

Author, year, country	Population, number, and setting	Measures	Intervention	Analysis	Authors' results / conclusions	Risk of bias
Psychological Interventions						
1.Alimo-hammadi et al., 2018, Iran	N=64 from asthma and allergy clinic with moderate to severe asthma; randomly allocated to intervention and control group; 11-21 years old; mean age 15.8 experimental; 14.8 control group	Questionnaire based on Roy's adaptation model. Before intervention and after 2 months.	Six weeks with six two-hour sessions; 2 months follow up. Sessions run by physicians, nurse and psychologists on causes of asthma, asthma knowledge, ways to prevent symptoms, managing anxiety and depression, dietary advice. Were called once a week for 2 months. Control group receiving teaching and problem solving by physician in regular visits.	Paired t test Independent t test Mann-Whitney ANOVA Chi-square	Mean score of maladaptation behaviours significantly reduced in intervention group after training ($p<0.001$); no difference in control group. Significant differences between intervention and control groups across all domains of maladaptive behaviours after intervention.	Moderate
2.Bruzzese et al., 2008, USA	N=24 families; 1 child with asthma and 1 parent from each family; mean age children 12.9 years 13 male, 11 female.	Asthma symptoms. Symptom prevention and asthma attack management completed by students; caregivers reported on children's behaviour;	It's a Family Affair Intervention; behavioural intervention based on CBT. Students: 6 group sessions on prevention and management on asthma. Caregivers: 5 group sessions teaching	One-tailed ANCOVA controlling for baseline comparing intervention and control group at 2 month follow-up.	Improvement in caregivers solving problems with children $p<0.05$; rated children more responsible for remembering to carry medication $p<0.05$; children	Moderate

Author, year, country	Population, number, and setting	Measures	Intervention	Analysis	Authors' results / conclusions	Risk of bias
	Setting: city public school. N=12 randomised to intervention group; N=12 to control group.	Asthma Responsibility Questionnaire. Parent-Adolescent Relationship Questionnaire.	child-rearing skills to support the youth's autonomy and asthma self-management. Control group received no treatment.		reported more steps to prevent asthma symptoms $p<0.05$, reduction in nights awakened $p<0.01$. No difference in daytime symptoms.	
3.Ellis et al., 2016 ¹ , USA	N=167 12-16 year olds. Intervention N=84; comparison N=86 African-American, moderate-severe asthma; home based delivery	Asthma knowledge (Family Asthma Management System Scale, Asthma Knowledge scale and Medication Adherence subscale) Device use skills (Equipment skills check-list	Multisystemic Therapy-Health Care (MST-HC therapy adapted for youths with poor asthma self-management); weekly sessions over 6 months versus in home family support. Control: weekly supportive family counselling for 6 months	Differences in asthma knowledge and device use skills assessed immediately after and then 6 months post completion of intervention using linear mixed models and t-test.	Asthma knowledge improved over time in intervention group ($p < 0.05$), unchanged in control group. Device skills knowledge improved over time in intervention group, declined in control group ($p<0.1$). Asthma knowledge and device use skills better in intervention group 6 months post treatment ($p<0.5$).	Low
4.Hampel et	N=68 participants aged	General satisfaction with	Cognitive stress management training	Factorial ANOVA to	Improvement in emotion and	High

Author, year, country	Population, number, and setting	Measures	Intervention	Analysis	Authors' results / conclusions	Risk of bias
al., 2003 Germany	8-16years from inpatient asthma clinics; analysis split by age group: 8-10, 11-13, 14-16 years	health; German Coping Questionnaires. Measures taken before, immediately after and 6 months after the intervention.	versus educational programme without stress management.	compare treatment and control group across different age groups. Friedman Rank, Wilcoxon and Mann-Whitney U-tests to assess long-term effects at follow-up.	problem focused-coping strategies from pre- to post-treatment in treatment group in 14-16 year olds ($p<0.05$)	
5.Hemati et al., 2015 ² Iran	N=64 adolescents with asthma recruited from hospital; N=32 to control and N=32 to intervention. Mean age 14.15 years in intervention; 15.21 years in control group	Coopersmith Self-Esteem Inventories. Measures taken before and 2 months after intervention.	Semi-experimental study; 8 two-hour sessions based on Orem's self-care model and self-care needs delivered by the researcher. Focused on self-care and reduction of stress and anxiety	Independent and paired samples t-tests.	Difference in mean score of self-esteem between intervention and control group after training ($p<0.05$); Increase in self-esteem in intervention group post training ($p<0.05$) but not in control group.	High
6. Hemati et al., 2017 ²		Questionnaire based on Orem's Self-Care Model;		Paired t test, Independent t test,	Mean score of QoL in all domains and overall	High

Author, year, country	Population, number, and setting	Measures	Intervention	Analysis	Authors' results / conclusions	Risk of bias
Iran		QoL scale developed by Marks et al to measure QoL in adults with asthma.		Chi-square, Mann-Whitney.	significantly reduced in intervention group after training ($p < 0.05$); no difference in control group ($p > 0.05$).	
7. Naar et al., 2018 ¹ USA	N=167 African American adolescents; 12-16 years with moderate to severe persistent asthma and >- 1 inpatient hospitalization or >-2 ED visits in the last 12 months. Randomized to MST-HC (N=84) or in-home family support (N=83).	Lung function (FEV1)- primary outcome. Secondary outcome: medication adherence, symptom severity, health care use; hospitalizations and ED visits. Data taken from medical records; FAMSS and DPD completed Evaluation at baseline and after 7 and 12 months.	Multisystemic Therapy-Health Care (MST-HC therapy adapted for youths with poor asthma self-management); weekly sessions over 6 months versus in home family support.	T test, Chi-square, Linear mixed-effects models. Multiple imputation methods within the trajectory analysis. Multiple binomial regression.	Adolescents in the treatment group had greater improvement in FEV ₁ ($p = 0.01$) adherence to controller medication ($p = .004$) and frequency of asthma symptoms ($p = .03$) compared to controls. Treatment group had a greater reduction in hospitalizations but no difference in ED visits.	Low
8.Naar-King et al., 2014 ¹ USA		Asthma Family Management System Scale (a clinical interview); medication		T-tests and chi-squares; mixed models controlling	ITT analysis – intervention group more likely to improve medication adherence and	Low

Author, year, country	Population, number, and setting	Measures	Intervention	Analysis	Authors' results / conclusions	Risk of bias
		adherence daily phone diary; lung function. Measures taken at baseline and 7 months post treatment		for gender, age, family income, N of treatment sessions, single-parent household. Intent to treat and per protocol analysis	FEV1. PP analysis – intervention had medium effect on adherence and small to medium effect on FEV1 and child response to asthma symptoms and exacerbations	
9.Seid et al., 2012, USA	N=28 12-18 year olds with moderate-severe asthma (N=14 in control group, N=14 in intervention group). Outpatient setting.	Participant motivation, adherence barriers, asthma symptoms and HRQOL: PedsQL	Education, in-person motivational interviewing and problem-solving skills training (2 sessions 1 week apart); phone with tailored text messages. Control: asthma education and phone without tailored text messages. Intervention lasted 1month, with follow-up then and one month later.	Comparison between time points using Wilcoxon rank-sum and repeated measures analysis of variance.	At 1 and 3 months, asthma symptoms (Cohen's d's=0.40, 0.96) and HRQOL (Cohen's d's=0.23, 1.25) had clinically meaningful medium to large effect size improvement in the intervention group.	Moderate
10.Srof et al., 2012, USA	N=39 14 to 18 year olds with asthma from 3 midwestern high	Asthma Belief Survey for self-efficacy; Revised Personal Resource	Coping skills training based on cognitive behaviour strategy. One session per week for five weeks.	ANCOVA to compare treatment and control group	Treatment group scored sig higher on self-efficacy (p<0.001), activity related QoL	Moderate

Author, year, country	Population, number, and setting	Measures	Intervention	Analysis	Authors' results / conclusions	Risk of bias
	schools	Questionnaire for social support; PAQLQ asthma QoL; peak exp flow rate; diary for symptoms; medication use Post-test measures 6 weeks after end of intervention.	Control group – usual care.	and to compare pre- and post-scores for treatment group, controlling for baseline scores	($p=0.05$), social support ($p<0.001$) than control group. Pre- to post-treatment improvement in treatment group for self-efficacy ($p<0.001$) and QoL ($p=.02$)	
11.Velsor-Friedrich et al., 2012 USA	N=137 African American adolescents with asthma from 5 high schools	Parent asthma self-care questionnaires; Asthma self-care; Asthma QoL; Knowledge About Asthma; Asthma self-efficacy; Coping frequency/efficacy; FEV ₁ , FVC, PEFR, number of symptom days; ED visits; hospitalisation. Measures taken at baseline, 2 months (immediately after intervention), 6 and 12	Randomised controlled trial of a coping skills intervention compared with standard asthma education	Multiple regression; ANOVA	Both groups improved over time. No significant differences in groups in relation to QoL, knowledge, self-efficacy, symptoms days and school absences.	Moderate

Author, year, country	Population, number, and setting	Measures	Intervention	Analysis	Authors' results / conclusions	Risk of bias
		months				
12.Warner et al., 2006 USA	N=50 adolescents aged 12-17yrs with asthma and parents, randomised to each group.	Mood ratings; essay ratings; Asthma Sum Scale (for asthma symptoms); PANAS for children; Child Behaviour Check List; Functional Disability Inventory; lung function. Measures taken at baseline, 1 and 2 months after the intervention.	Written emotional disclosure: write for 3 days about stressful events or control topics – how you manage your time	Factorial ANOVA and ANCOVA; regression analyses	Improvement in positive affect and internalizing problems in intervention versus control group ($p<0.01$). Decreased asthma symptoms and functional disability in intervention group in those with baseline elevations. No differences in FEV ₁	Moderate
E-Health interventions						
1.Bynum et al., 2001, USA	N=49 rural adolescents aged 12-19 years with asthma; intervention N=24, control N=25. 69% female. Local health clinic setting	MDI technique and patient satisfaction. MDI technique checklist completed before, immediately after and 2-4 weeks post intervention. Evaluation form to assess	Compressed video telecommunication (telepharmacy) with a pharmacist to review and instruct on MDI technique. Control: written instructions on MDI technique.	ANOVA, chi-square, <i>t</i> -test	From pre-test to follow-up the telepharmacy counselling group showed more improvement in MDI technique than control group ($p=0.001$). No	High

Author, year, country	Population, number, and setting	Measures	Intervention	Analysis	Authors' results / conclusions	Risk of bias
		participant satisfaction completed 2-4 weeks later.			significant difference between telepharmacy group and control group in satisfaction scores.	
2.Johnson et al., 2016, USA	N=89 12-17 year olds; N=46 in intervention group, N=43 in control group with current asthma diagnosis. Outpatient setting	Medication adherence, Asthma Control Test, Perceptions of Asthma medication survey, Self-efficacy scale, Illness management scale.	MyMediHealth personal health application- web based system that sends medication reminders via text. Used for 3 weeks. Control: Online educational materials about asthma medication management	Wilcoxon and Pearson tests used to assess change in adherence, self-efficacy, ACT and QoL ITT analysis	Intervention improved adherence in past 7 days (p=0.01), improved self-efficacy (p=0.016), and QoL (p=0.037) compared to control group. No effect on ACT.	Low
3.Joseph et al., 2013, USA	N=422 Urban, African-American 9 th -12 th grade students, with any asthma severity. N=204 in intervention group; N=218 in control group.	Symptom free days, restricted activity, missed school; ED visits and hospitalization	Puff-city- web-based, computer-tailored intervention. Initial survey and 4 online sessions within 180 days. Novel intervention. Control: 4 asthma education sessions.	Outcome comparison at 12 month follow-up analysed by binomial regression or Chi-squared/ Wilcoxon	Intervention group reported reduced symptom days at 12 month follow-up (aRR 0.8, 95% CI 0.6-1.0, p= 0.019). No difference in ED visits/ hospitalization. For moderate-severe asthmatics- greater	High

Author, year, country	Population, number, and setting	Measures	Intervention	Analysis	Authors' results / conclusions	Risk of bias
	School based				effects seen on symptom reduction (aRR 0.6, 95% CI 0.5-0.9, p = 0.013.	
4. Joseph et al., 2018 USA	N=121 13-19 year olds attending ED with acute asthma. N=65 in treatment group, 86% African American. ED initiated setting	Primary outcome: ED visits at 12 months. Secondary: asthma control as measured by the ACT, functional status, quality of life, behaviour change	Puff-city- web-based, computer-tailored intervention. 4 education sessions plus a booster. Control group: standard care + access to existing asthma informational websites	Wilcoxon test and adjusted OR.	33.8% of treatment teens had made an ED visit, versus 46.4% of control teens, OR = 0.53 (0.24–1.15), p = 0.15. No secondary endpoints were statistically significant.	Low
5. Perry et al., 2017 USA	N=34 12-17 year olds with asthma (using a controller device). N=17 in intervention, N=17 in control group Outpatient based	ACT, self-efficacy scores after 6 months	Novel smartphone based personalized asthma action plan, including symptoms diary, medication reminders. Not validated Control: paper Action-plan and paper symptom diary	Wilcoxon rank-sum test	Improvement in ACT seen in intervention group when stratified for “uncontrolled” asthma (p= 0.04). No improvement seen in control group or well-controlled asthmatics. No improvement in self-efficacy scores.	High
6 Rikkers-	N=90 12-18 year olds	Primary end-point: PAQLQ,	Internet based self-management	Linear mixed	At 3 months, PAQLQ	Low

Author, year, country	Population, number, and setting	Measures	Intervention	Analysis	Authors' results / conclusions	Risk of bias
Mutsaerts et al., 2012, Netherlands	with poorly controlled asthma; N=46 intervention, N=44 in control group. Outpatient setting	secondary outcome asthma control questionnaire, FEV ₁ , daily ICS dose, exacerbation and symptom-free days Outcomes assessed at baseline, 3 months, 1 year.	education (web-based and face to face), weekly ACQ and FEV ₁ reporting, followed by tailored electronic action plan + usual care for 1 year Control: Usual care.	effects modelling used for difference in PAQLQ and ACQ over time.	improved in intervention compared to control group (p=0.02). No difference at 12 months. At 3 months ACQ improved more in intervention than control group (p<0.01). No difference at 12 months.	
7.Rhee et al., 2008 USA	N=41 adolescents age 14-20. Intervention N=20; control N=21 with current asthma diagnosis. Rural outpatient setting	Participant reported decision making quality scale; Risk Motivation Questionnaire, assessment of drug use	Computer assisted decision making programme- tailored counselling and two modules delivered on computer- lasting 1 hour. Boosters sent at 2 and 4 months Control: Watched a sham CD ROM on study skills.	Mixed general linear model at 6 months post-intervention.	No significant group differences over time for decision making scores. Decreased smoking and drug use motivation scores seen in intervention group at 6 months (p<0.02).	High
8.Sleath et al., 2018 USA	N=359 English or Spanish speaking adolescents aged 11-	Demographic variables; N of questions asked	Pragmatic randomised controlled trial; asthma question prompt list with video intervention vs usual care	Chi-square; t-tests	Intervention group more likely to ask 1 or more questions about medication,	Low

Author, year, country	Population, number, and setting	Measures	Intervention	Analysis	Authors' results / conclusions	Risk of bias
	17 years with asthma; N=185 intervention; N=174 controls. Paediatric clinic setting				triggers and environmental control than control group	
Educational interventions						
1. Bruzzese et al., 2011 USA	N=345 Urban teens (average age 15) with moderate-severe asthma; N=175 intervention, N=170 control; 68% female. School setting	Symptom frequency (over last 2 weeks), QOL (using PAQLQ) and asthma self-management indices; secondary outcomes- activity restriction (past 2 weeks), school absence, asthma medical management and health care use. 6 and 12 month follow-up	ASMA (Asthma Self-management for Adolescents) developed by authors. Three group sessions + individual coaching sessions held weekly over 8 weeks for participants. Their medical providers received academic detailing. Controls: normal care	Regression analysis of asthma self-management indices, activity restriction, QoL and health-care use	Intervention group reported better self-management than controls at 6 and 12 months ($p < 0.0001$), better self-efficacy, improved use of controller medication ($p = 0.006$) and increase use of a written treatment plan, reduced asthma symptoms ($p = 0.003$), reduced night waking/school absence, reduction in acute medical	Low

Author, year, country	Population, number, and setting	Measures	Intervention	Analysis	Authors' results / conclusions	Risk of bias
					visits (p = 0.0002).	
2.Cowie et al., 2002, Canada	N=93 15-20 yr olds who had attended ED with asthma. At 6 month follow up N=29 in intervention group, N=33 in control. Community setting.	Primary: ED attendance in 6 months following intervention. Secondary: asthma quality of life and severity	Young Adult Action programme- 2 visits. Completed questionnaires (asthma severity and QoL), spirometry, received asthma education and medical review. Control: Attended an appointment to complete questionnaire and spirometry + revision of inhaler technique	Chi Square Fisher's exact test, t-test, Kruskal-Wallis	Both groups showed improvement in asthma impact and ED attendance. Symptom and emotional QoL improved in intervention group compared to control group (p<0.05).	High
3.Salisbury et al., 2002, UK	N=455 Secondary school children with asthma; N=157 in school clinic arm, N=151 practice care arm; N=142 control school. School/ primary care setting.	Primary outcome: PAQLQ (QoL scale), level of symptoms and proportion of patients with a review consultation in 6 months	Nurse led asthma clinic in school, 1 and 6 month follow-up. Control: GP review of asthma (practice care group)- normal care. Control school group- similar school with no asthma clinic running.	Logistic regression, ordinal regression and analysis of co-variance.	More pupils in intervention group attended an asthma review compared to controls (p<0.001), no difference in symptoms or QoL scores. Intervention group had higher inhaler technique scores (p<0.001).	Low

Author, year, country	Population, number, and setting	Measures	Intervention	Analysis	Authors' results / conclusions	Risk of bias
4. Van Es et al., 2001. Netherlands	N=112 11-18 yr olds with asthma; N=58 intervention; N=54 control. Outpatient setting	Attitude- social influence- self efficacy model (ASE) variables including adherence, self efficacy, positive and negative attitudes, social influence	Usual paediatrician led care (4 monthly) with added discussion of asthma management zone system, PEF results discussion plus visits to asthma nurse for further education with written information; 3x 90 minutes group sessions to discuss coping with asthma. Control group: paediatrician led care (4 monthly visit) no asthma nurse input.	Comparisons of ASE variables responses using t-tests.	After one year of intervention, no difference was seen for any variables between the groups, at 2 years self-reported adherence was higher in the intervention group (p=0.05).	Moderate
Peer-led interventions						
1. Al-Sheyab et al., 2011 Jordan	4 high schools in Jordan. N=24 peer leaders in year 11; N=92 year 10s; N=148 years 8 and 9.	ISAAC questionnaire for asthma symptoms and severity; PAQLQ; self-efficacy sub-scale of the Self-Administered Nicotine	Cluster randomised controlled trial. Peer-led education programme: Triple A Adolescent Asthma Action Programme. Year 11s delivered education to year 10s who presented	Mixed models to assess intervention effect; adjusted for baseline covariates: gender, English	Intervention group reported better total QoL and QoL sub-domains; self-efficacy to resist smoking; knowledge of asthma self-management	Low

Author, year, country	Population, number, and setting	Measures	Intervention	Analysis	Authors' results / conclusions	Risk of bias
	N=132 in intervention group; N=129 in control group	Dependence Scale; Asthma Knowledge Consumer Questionnaire. Measures taken at baseline and 3 months after the intervention.	brief skits to years 8 and 9	proficiency, N of recent wheezing episodes	compared to control group, all $p < 0.05$	
2.Gibson et al., 1998 Australia	N=62 in intervention schools and N=30 in comparison school; Girls' high schools in areas of low SES and large non-English speaking community	Asthma Knowledge Questionnaire; Asthma Attitude Questionnaire; Asthma Symptoms Questionnaire; Asthma QoL Questionnaire (AQLQ) Pre-test measures 1-2 months prior; post-test measures 1-2 months after the intervention.	Asthma education Triple A programme; Year 11s instructed Year 10s who developed asthma health messages and performed them to the student body.	T-tests used to look at knowledge between intervention and control schools at survey 2. Bonferroni adjusted p-values used.	Improvement in asthma knowledge in students with asthma and peers ($p < 0.0001$); no change in the comparison school.	Moderate
3.Rhee et al., 2011, USA	N=112 13-17 year olds with asthma; N=59 in intervention, N=53 in	Child attitude toward health scale PAQLQ scale	Use of peer leaders - trained 16-20 year olds with asthma (novel scheme, training adapted from Power	Linear mixed model repeated measures analysis of	Improvement in overall attitudes in both groups and in quality of life over	Moderate

Author, year, country	Population, number, and setting	Measures	Intervention	Analysis	Authors' results / conclusions	Risk of bias
	control group. Asthma day camp setting	FEV ₁ and FEV ₁ /FVC. Participant completed questionnaire at baseline, immediately post camp and then 3,6,9 months after camp. Spirometry at baseline and 9 months.	Breathing programme). One day camp (3 sessions within day) with monthly phone contact for 8 months. Control: use of healthcare professionals instead of peer leaders to run a similar camp (comparable content and structure)	variance.	time(p=.002); intervention group higher quality of life at 9 months (p=.008). No improvement in % predicted FEV ₁ or FEV ₁ /FVC in either group.	
4.Rhee et al., 2012 USA	N=91 adolescents with asthma aged 13-17years in a peer led (N=46) or adult led (N=45) asthma self-management	Asthma associated health-care services utilisation: hospitalisations; visits at ED; asthma specialist; primary care; scheduled; school. Measures taken at baseline, immediately after, 3, 6, 9 months after intervention.	A camp-based asthma programme based on the Power Breathing programme led by peer leaders with asthma vs adults	Binomial regression models controlling for SES.	Acute office visits reduced by 80-82% in peer led group at 3 and 9 month follow-ups. Peer-led group 4-5x more likely to use school clinics.	Moderate
5.Shah et al., 2001 Australia	N=272 students with asthma from two school years in 6 rural	Quality of life (PAQLQ); school absenteeism, asthma attacks, lung function.	Cluster randomised controlled trial. Triple A Programme: educational programme for peers.	N needed to treat analysis. 2 way ANOVAs; Chi-sq	QoL increased in intervention versus control group, adjusted for year and sex (p=.01).	Low

Author, year, country	Population, number, and setting	Measures	Intervention	Analysis	Authors' results / conclusions	Risk of bias
	Australia High Schools Mean age 12.5; 15.5yrs	Measures taken at baseline and 3 months after end of the intervention.		analyses, McNemar's test, Wicoxon Signed Rank	Number NTT was 8. Improvements in activities and emotions QoL. School absenteeism decreased in intervention group only; asthma attacks in school sig increased for year 10 only.	
Breathing re-training intervention						
1.Bignall et al., 2015 USA	N=33 12-17 yr olds with asthma. N=15 intervention, N=18 control. 66% female, all African-American. School-based.	ACT; PedsQL for quality of life; STAI for state and trait anxiety; Peak-flow and FEV ₁	(1) diaphragmatic breathing, (2) asthma-specific guided imagery and (3) progressive muscle relaxation. Developed by authors- novel, non-validated 2 sessions of 30 minutes a month apart, plus CD to use at home.	ANOVA- four per variable (effect of group, time, pre-post intervention and group by time). Qualitative analysis of acceptability of	Both groups significantly improved in ACT (p=0.001); quality of life (p=0.0030); anxiety (p=0.01). No effect on FEV ₁ or peak flow. No significant effect of group on any outcome but trend towards significant	Moderate

Author, year, country	Population, number, and setting	Measures	Intervention	Analysis	Authors' results / conclusions	Risk of bias
			Control- 2 sessions a month apart- educational material on asthma only.	intervention	improvement in ACT with intervention.	

ACT: Asthma Control Test; ACQ: Asthma Control Questionnaire; ED: Emergency Department; FEV₁: forced expiratory volume in 1 second; FVC: Forced vital capacity; ICS: Inhaled corticosteroids; ITT: Intention to treat; PAQLQ: Pediatric Asthma Quality of Life Questionnaire; PEF: Peak flow reading; PP: Per protocol; MDI: Metered dose inhaler; NTT: Needed to treat; QoL: Quality of life

Table 2. A comparison of study outcomes across intervention types

Author, year, intervention	HRQoL	Mood	Coping	Self-esteem	Self-efficacy	Maladaptation behaviour	Device technique	Asthma knowledge	Sleep problems	Symptoms	Adherence	ACT	FEV ₁	Hospitalisation	Asking question /decision making
Psychological Interventions															
1.Alimohammadi et al., 2018, psycho-education						↓***									
2.Bruzzese et al., 2008, CBT (It's a Family Affair Intervention)									↓**		↑*				
3.Ellis et al., 2016, Multisystemic Therapy-Health Care							↑**	↑*							
4.Hampel et al., 2003, cognitive stress management training			↑*1												
5,6.Hemati et al., 2015, Hemati et al., 2017, Orem's self-care model	↑***	↑**		↑**				↑**2							
7,8. Naar et al., 2018; Naar-King et al., 2014, Multisystemic Therapy-Health Care										↓*	↑*		↑*	↓*	
9.Seid et al., 2012, motivational interviewing	↑*									↓*					
10.Srof et al., 2012, CBT	↑*				↑*										
11.Velsor-Friedrich et al., 2012, CBT	↔				↔			↔		↔					
12.Warner et al., 2006, written emotional disclosure		↑*								↓*			↔		

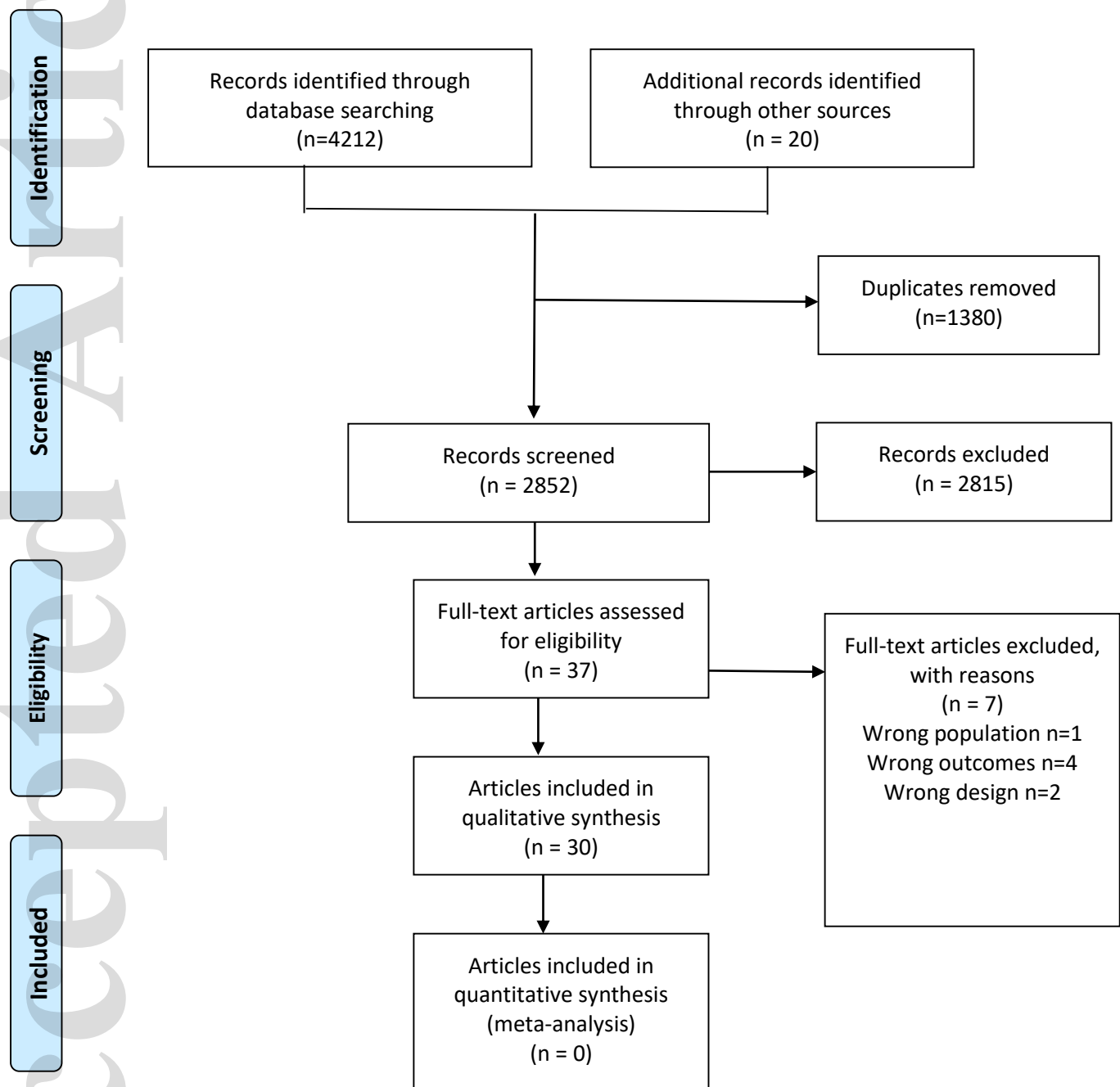
Author, year, intervention	HRQoL	Mood	Coping	Self-esteem	Self-efficacy	Maladaptation behaviour	Device technique	Asthma knowledge	Sleep problems	Symptoms	Adherence	ACT	FEV ₁	Hospitalisation	Asking question /decision making
E-Health interventions															
1. Bynum et al., 2001, telepharmacy							↑***								
2. Johnson et al., 2016, MyMediHealth	↑*				↑*						↑*	↔			
3. Joseph et al., 2013, Puff-city-web-intervention										↓***		↔		↔	
4. Joseph et al., 2018, Puff-city-web-intervention	↔											↔		↔	
5. Perry et al., 2017, smart phone action plan					↔							↔ ³			
6. Rikkers-Mutsaerts et al., 2012, web-based education	↑* ₁									↔		↑* ₄	↔		
7. Rhee et al., 2008, computer assisted action plan															↔
8. Sleath et al., 2018, asthma question prompt list															↑*
Educational interventions															
1. Bruzzese et al., 2011, Asthma Self-management for Adolescents	↑**				↑**		↑*		↓*	↓*				↓*	
2. Cowie et al., 2002, Young Adult Action programme	↔													↔	
3. Salisbury et al., 2002, nurse led school asthma clinic	↔						↑***	↑*		↔					
4. Van Es et al., 2001, paediatrician education					↔						↔				

Author, year, intervention	HRQoL	Mood	Coping	Self-esteem	Self-efficacy	Maladaptation behaviour	Device technique	Asthma knowledge	Sleep problems	Symptoms	Adherence	ACT	FEV ₁	Hospitalisation	Asking question /decision making
Peer-led interventions															
1.Al-Sheyab et al., 2011, Triple A programme	↑*				↑*			↑*							
2.Gibson et al., 1998, Triple A programme	↔							↑*							
3.Rhee et al., 2011, adapted from Power Breathing programme	↑*												↔		
4.Rhee et al., 2012, Power Breathing programme														↓**5	
5.Shah et al., 2001, Triple A programme	↑*														
Breathing re-training intervention															
1.Bignall et al., 2015, diaphragmatic breathing, relaxation	↔	↔											↔		

↓: reduction; *:p<0.05; **:p<0.01; ***p<0.005; bold ↑: change larger than minimally clinical significant difference; ↔: no difference; HRQoL: health related quality of life. ACT:

Asthma control test. CBT: cognitive behavioural therapy. FEV₁: forced expiratory flow in 1 second. ¹: short term only; ²: within group comparison only; ³: ACT improved in those uncontrolled at baseline; ⁴: only at 3 months, no difference at 12 months; ⁵ acute office visits

Figure 1. PRISMA figure demonstrating literature excluded and examined in systematic review



1 **A systematic review of the effectiveness of interventions to improve self-management for**
2 **adolescents and young adults with allergic conditions**

3 Rebecca C Knibb¹, Cherry Alviani^{2,3}, Teresa Garriga-Baraut^{4,5}, Charlotte G Mortz⁶, Marta Vazquez-Ortiz⁷,
4 Elizabeth Angier⁸, Katerina Blumchen⁹, Pasquale Comberiati^{10,11}, Bettina Duca⁷, Audrey DunnGalvin^{12,13},
5 Claudia Gore¹⁴, Valerie Hox¹⁵, Britt Jensen⁶, Helena Pite^{16,17}, Alexandra F Santos¹⁸⁻²¹, Silvia Sanchez-
6 Garcia²², M Hazel Gowland²³, Frans Timmermans²⁴, Graham Roberts^{2,3,25}

7
8 **Affiliations:**

- 9 1. Department of Psychology, School of Life and Health Sciences, Aston University, Birmingham, UK
10 2. University of Southampton Faculty of Medicine, Southampton, UK
11 3. The David Hide Asthma and Allergy Research Centre, St Mary's Hospital, Isle of Wight, UK
12 4. Unitat d'Allergologia Pediàtrica, Hospital Universitari Vall d'Hebron, Barcelona, Spain.
13 5. Grup d'Investigació "Creixement i Desenvolupament", Institut de Recerca de l'Hospital Universitari Vall
14 d'Hebron (VHIR), Barcelona, Spain.
15 6. Department of Dermatology and Allergy Centre, Odense Research Centre for Anaphylaxis (ORCA),
16 Odense University Hospital, University of Southern Denmark, Odense, Denmark
17 7. Department of Paediatrics, Faculty of Medicine, Imperial College London, UK
18 8. Primary Care and Public Health, Faculty of Medicine, University of Southampton, UK
19 9. Department of Paediatric and Adolescent Medicine, Paediatric Pneumology, Allergology and Cystic
20 Fibrosis, University Hospital Frankfurt, Frankfurt am Main, Germany
21 10.
22 Department of Clinical and Experimental Medicine, Section of Paediatrics, University of Pisa, 56126 Pisa,
23 Italy
24 11. Department of Clinical Immunology and Allergology, I.M. Sechenov First Moscow State Medical
25 University, 119991 Moscow, Russia.
26 12. Applied Psychology and Paediatrics and Child Health, University College Cork, Cork, Ireland, Paediatrics
27 13. Child Infectious Diseases, First Moscow State Medical University, Russia.

- 28 14. Claudia Gore: Paediatric Allergy, St Mary Hospital, London, UK
- 29 15. Department of Otorhinolaryngology, Head and Neck Surgery, University Hospitals Saint-Luc, Brussels,
- 30 Belgium.
- 31 16. Allergy Center, CUF Descobertas Hospital and CUF Infante Santo Hospital, Lisbon, Portugal
- 32 17. CEDOC, Chronic Diseases Research Center, NOVA Medical School/Faculdade de Ciências Médicas,
- 33 Universidade Nova de Lisboa, Lisbon, Portugal
- 34 18. Department of Women and Children's Health (Paediatric Allergy), School of Life Course Sciences,
- 35 Faculty of Life Sciences and Medicine, King's College London, London, United Kingdom
- 36 19. Peter Gorer Department of Immunobiology, School of Immunology and Microbial Sciences, King's
- 37 College London, London, UK
- 38 20. Children's Allergy Service, Guy's and St Thomas' Hospital, London, UK
- 39 21. Asthma UK Centre in Allergic Mechanisms of Asthma, London, UK
- 40 22. Allergy Department, Hospital Infantil Universitario del Niño Jesús, Madrid, Spain
- 41 23. Allergy Action, St Albans, UK
- 42 24. Nederlands Anafylaxis Netwerk – European Anaphylaxis Taskforce, Dordrecht, The Netherlands
- 43 25. NIHR Southampton Biomedical Research Centre, University Hospital Southampton NHS Foundation
- 44 Trust, Southampton, UK

45

46 **Address for correspondence:**

47 Professor Graham Roberts, Paediatric Allergy and Respiratory Medicine, University Child Health (MP803),
48 University Hospital, Southampton NHS Foundation Trust, Tremona Road, Southampton SO16 6YD, UK.
49 Tel.: +44 (0) 2380796160 E-mail: g.c.roberts@soton.ac.uk

50

51

52 **Online supplement**

53 **Contents:**

Title and authors	1
Contents	3
Appendix 1 - Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist	4
Appendix 2: Search strategy	7
Table S1. Papers excluded at the second stage with reasons	12
Table S2. Quality ratings for included papers using the Cochrane Risk of Bias Tool for Randomised Controlled Trials	38

Appendix 1 - Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	Title page
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	Abstract
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	Introduction
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	Inclusion criteria
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	Methods
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	Methods - Inclusion criteria
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	Methods – search strategy
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Methods – search strategy
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	Methods – study

			selection
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	Methods – data extraction
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	Table 1
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	Methods – quality assessment
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	NA
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	NA

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	NA
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	None
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	Figure 1
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Results – description of studies
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	Results –

			quality ratings
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	Table 1
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	NA
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	NA
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	None
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	Discussion
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	Discussion
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	Discussion
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	Acknowledgements

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

54
55
56
57
58

59 **Appendix 2: Search strategy**

60

61 MEDLINE & EMBASE (OVID)

62

63 *Participants*

64 1. Adolescent/

65 2. adolescen*.tw.

66 3. teen*.tw.

67 4. youth.tw.

68 5. Young Adult/

69 6 young adj3 adult*.tw

70 7. emerging adult*.tw

71 8. 1 or 2 or 3 or 4 or 5 or 6 or 7

72

73 *Diseases*

74 9. asthma*.tw

75 10. exp Asthma/

76 11. allerg*.tw

77 12. Hypersensitivmul*.tw

78 13. food allergy.tw

79 14. anaphyla*.tw

80 15. (atopic or disseminated) adj (dermatiti*)

81 16. Dermatitis, Atopic/

82 17. eczema*.tw

83 18. exp Eczema/

84 19. urticaria* or hives

85 20. exp Urticaria/

86 21. allergic adj rhiniti*

87 22. rhinoconjunctivitis*

88 23. exp Rhinitis, Allergic/

89 24. rhinosinusitis.tw

90 25. angioedema.tw

91 26. exp Angioedema/

92 27. exp Dermatitis, contact/

93 28. exp Hypersensitivity/

94 29. multisystem allergic disease.tw
 95 30. 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25
 96 or 26 or 27 or 28 or 29
 97
 98 *Interventions*
 99 63. emphathy.tw
 100 64. Empathy/
 101 65. "patient-focused".ti,ab
 102 66. "patient-centered".ti,ab
 103 67. "patient-centred".ti,ab
 104 68. education.tw
 105 69. exp health education/
 106 70. Patient Education as Topic/
 107 71. patient information.tw
 108 72. training.tw
 109 73. intervention.tw
 110 74. counselling.tw
 111 75. exp Counseling/
 112 76. motivational interview*.tw
 113 77. empowerment.tw
 114 78. "expert patient".ti,ab
 115 79. simulation.tw
 116 80. vignette*.ti,ab
 117 81. role play.tw
 118 82. Psychodrama/
 119 83. peer support.tw
 120 84. exp Peer group/
 121 85. support group.tw
 122 86. exp Self-Help Groups/
 123 87. gamification.tw
 124 88. apps.tw
 125 89. Mobile Applications/
 126 90. internet.tw
 127 91. exp Internet/
 128 92. mobile phone* or cell phone* or text* or smartphone* or smart phone*.tw

129 93. exp Cell Phone/
 130 94. social media.tw
 131 95. school* or university* or college*.tw
 132 96. Schools/ or Universities/
 133 97. device or iPad* or tablet* or handheld device*.tw
 134 98. exp Computers, Handheld/
 135 99. communication.tw
 136 100. transition clinic.tw
 137 101. Transition to adult care/ or Transitional care/
 138 102. 63 or 64 or 65 or 66 or 67 or 68 or 69 or 70 or 71 or 72 or 73 or 74 or 75 or 76 or 77 or 78 or
 139 79 or 80 or 81 or 82 or 83 or 84 or 85 or 86 or 87 or 88 or 89 or 90 or 91 or 92 or 93 or 94 or 95 or
 140 96 or 97 or 98 or 99 or 101
 141
 142 Combine all
 143 Combine all
 144 108. 8 and 30 and 102
 145
 146 Cochrane library
 147 (Adolescen* or teen* or youth) and (asthma* or allerg* or hypersensitive* or food allergy or
 148 anaphyla* or atopic dermatitis or eczema or urticaria* or hives or allergic rhiniti* or angioedema)
 149 and (Emphathy or patient-focused or patient-centered or patient-centred or education or patient
 150 information or training or intervention or counselling or motivational interview* or empowerment or
 151 expert patient or simulation vignette* or role play or psychodrama or peer support or support group
 152 or self-help groups or gamification or apps or mobile applications or internet or mobile phone* or
 153 cell phone* or text* or smartphone* or smart phone* or social media or school* or university* or
 154 college* or device or iPad* or tablet* or handheld device* or computers or communication or
 155 transition clinic or transitional care)
 156
 157 Clinicaltrials.gov
 158 Condition or disease: asthma* or allerg* or hypersensitive* or food allergy or anaphyla* or atopic
 159 dermatitis or eczema or urticaria* or hives or allergic rhiniti* or angioedema
 160 Other terms: (Emphathy or patient-focused or patient-centered or patient-centred or education or
 161 patient information or training or intervention or counselling or motivational interview* or
 162 empowerment or expert patient or simulation vignette* or role play or psychodrama or peer support
 163 or support group or self-help groups or gamification or apps or mobile applications or internet or

164 mobile phone* or cell phone* or text* or smartphone* or smart phone* or social media or school* or
 165 university* or college* or device or iPad* or tablet* or handheld device* or computers or
 166 communication or transition clinic or transitional care)
 167 Children 1-17 years
 168 Interventional studies
 169
 170 Clinical Trials Register (www.clinicaltrialsregister.eu)
 171 (asthma* or allerg* or hypersensitive* or food allergy or anaphyla* or atopic dermatitis or eczema
 172 or urticaria* or hives or allergic rhiniti* or angioedema) and (Emphathy or patient-focused or
 173 patient-centered or patient-centred or education or patient information or training or intervention or
 174 counselling or motivational interview* or empowerment or expert patient or simulation vignette* or
 175 role play or psychodrama or peer support or support group or self-help groups or gamification or
 176 apps or mobile applications or internet or mobile phone* or cell phone* or text* or smartphone* or
 177 smart phone* or social media or school* or university* or college* or device or iPad* or tablet* or
 178 handheld device* or computers or communication or transition clinic or transitional care)
 179 Adolescent
 180
 181 Current controlled trials (www.controlled-trials.com)
 182 Age: Adolescence or adolscent or teenage or youth
 183 Condition: asthma or allergic or allergy or hypersensitivity or food allergy or anaphylaxis or atopic
 184 dermatitis or eczema or urticaria or hives or allergic rhinitis or angioedema
 185 Intervention: Emphathy or patient-focused or patient-centered or patient-centred or education or
 186 patient information or training or intervention or counselling or motivational interview* or
 187 empowerment or expert patient or simulation vignette or role play or psychodrama or peer support
 188 or support group or self-help groups or gamification or apps or mobile applications or internet or
 189 mobile phone or cell phone or text or smartphone or smart phone or social media or school or
 190 university or college or device or iPad or tablet or handheld device or computers or communication
 191 or transition clinic or transitional care
 192
 193 Australian and New Zealand Clinical Trials Registry (<http://www.anzctr.org.au>)
 194 Age: children <18 years
 195 Health condition: asthma or allergy or hypersensitivity or food allergy or anaphylaxis or eczema or
 196 allergic rhinitis
 197 Intervention: Emphathy or patient-focused or patient-centered or patient-centred or education or
 198 patient information or training or intervention or counselling or motivational interview* or

199 empowerment or expert patient or simulation vignette or role play or psychodrama or peer support
200 or support group or self-help groups or gamification or apps or mobile applications or internet or
201 mobile phone or cell phone or text or smartphone or smart phone or social media or school or
202 university or college or device or iPad or tablet or handheld device or computers or communication
203 or transition clinic or transitional care
204

205 **Table S1. Papers excluded at the second stage with reasons**

206

Publication	Reason for exclusion
Abramson NW, et al. Frequency and correlates of overweight status in adolescent asthma. Journal of Asthma. 2008;45(2):135-139.	Wrong outcome
Adamia N, et al. Psycho-Emotional Characteristics of the Adolescents with Allergic Rhinitis. Georgian Medical News. 2015(243):38-42.	Wrong population
Adeniyi FB, et al. Weight loss interventions for chronic asthma. Cochrane Database Syst Rev. (7):CD009339.	Systematic review
Ahnert J, et al. [Systematic literature review on interventions in rehabilitation for children and adolescents with asthma bronchiale]. Rehabilitation. 2010;49(3):147-159.	Systematic review
Al Qufaidi R, et al. Effect of asthma on the quality of life of Saudi adolescents. Allergy: European Journal of Allergy and Clinical Immunology. 2014:33rd Congress of the European Academy of Allergy and Clinical Immunology. Copenhagen Denmark. Conference Publication:69 (SUPPL. 99): pp 211.	Abstract only
Alkhawaldeh A, et al. Assessment of Northern Jordanian adolescents' knowledge and attitudes towards asthma. Nursing Children and Young People. 2017;29(6):27-31.	Wrong population
Almomani BA, et al. The effectiveness of clinical pharmacist's intervention in improving asthma care in children and adolescents: Randomized controlled study in Jordan. Patient Education & Counseling. 2017;100(4):728-735.	Wrong population
Al-sheyab NA, et al. Effectiveness of a peer-led education program for adolescents with asthma in Jordanian schools. American Journal of Respiratory and Critical Care Medicine. 2010:American Thoracic Society International Conference, ATS 2010. New Orleans, LA United States. Conference Publication: 2181.	Abstract only
Al-Sheyab NA, et al. Feasibility of a peer-led, school-based asthma education programme for adolescents in Jordan. Eastern Mediterranean Health Journal. 2012;18(5):468-473.	Wrong design
Altay N, et al. Using Orem's self-care model for asthmatic adolescents. Journal for Specialists in Pediatric Nursing: JSPN. 2013;18(3):233-242.	Wrong design
Altman M, et al. Interviewing adolescents with asthma: Are we doing enough? Journal of Allergy and Clinical Immunology. 2013:2013 Annual Meeting of the American Academy of Allergy, Asthma and Immunology, AAAAI 2013. San Antonio, TX United States. (2012 SUPPL. 2011) pp AB2236.	Abstract only
Ando T, et al. Combined program with computer-based learning and peer education in early adolescents with asthma: A pilot study. Journal of Allergy and Clinical Immunology. 2016:2016 Annual Meeting of the American Academy of Allergy, Asthma and Immunology, AAAAI 2016. Los Angeles, CA United States. Conference Publication: (2012 SUPPL. 2011) pp AB2157.	Abstract only

Publication	Reason for exclusion
Applebaum MA, et al. Perception of transition readiness and preferences for use of technology in transition programs: Teens' ideas for the future. <i>International Journal of Adolescent Medicine and Health</i> . 2013;25(2):119-125.	Wrong population
Aragao LJ, et al. Quality of life in asthmatics - concordance among children, adolescents, and their parents. <i>Revista Paulista de Pediatria</i> . 2012;30(1):13-20.	Wrong design
Arevalo LC, et al. Understanding the contextual effect of ethnicity: A multilevel analysis on ethnic differences in asthma treatment among Swedish adolescents. <i>European Journal of Epidemiology</i> . 2013:EuroEpi 2013 and NordicEpi 2013: Non-Communicable Disease Epidemic: Epidemiology in Action. Aarhus Denmark. Conference Publication: (2011 SUPPL. 2011) pp S2066.	Abstract only
Awoyinka IA, et al. Perception of asthma control in overweight inner-city teens. <i>Journal of Allergy and Clinical Immunology</i> . 2011:2011 American Academy of Allergy, Asthma and Immunology, AAAAI Annual Meeting. San Francisco, CA United States. Conference Publication: 2127 (2012 SUPPL. 2011) pp AB2267.	Abstract only
Bae J, et al. Modifying effect of suicidal ideation on the relationship between asthma and cigarette use behaviors among Korean adolescents. <i>Journal of Adolescent Health</i> . 2011:Society for Adolescent Health and Medicine, SAHM 2011 Annual Meeting. Seattle, WA United States. Conference Publication: (2012 SUPPL. 2011) pp S2018-S2019.	Abstract only
Bakour C, et al. Sleep duration and asthma in adolescents and young adults. <i>Sleep</i> . 2016:30th Annual Meeting of the Associated Professional Sleep Societies, LLC, SLEEP 2016. Denver, CO United States. Conference Publication: (SUPPL. 2011) pp A2329-A2330.	Abstract only
Barakat LP, et al. Perceived barriers and benefits to participation in medical and psychosocial clinical trials for youth with sickle cell disease and youth with asthma and their caregivers. <i>American Journal of Hematology</i> . 2011;86:E31-E32.	Wrong outcome
Barreira P, et al. Patterns of asthma control perception and level of knowledge about the disease in a population of adolescents and young asthmatic adults. <i>Allergy: European Journal of Allergy and Clinical Immunology</i> . 2012:31st Congress of the European Academy of Allergy and Clinical Immunology. Geneva Switzerland. Conference Publication: (var.pagings). 67 (SUPPL. 96) (pp 456).	Abstract only
Barreira P, et al. Quality of life assessment and evaluation of patient attitudes regarding the disease in a population of asthmatic adolescents and young adults. <i>Allergy: European Journal of Allergy and Clinical Immunology</i> . 2012:31st Congress of the European Academy of Allergy and Clinical Immunology. Geneva Switzerland. Conference Publication: 67 (SUPPL. 96) pp 456.	Abstract only
Barthel D, et al. Predictors of health-related quality of life in chronically ill children and adolescents over time. <i>Journal of Psychosomatic Research</i> . 2018;109:63-70.	Wrong population
Basso RP, et al. Relationship between exercise capacity and quality of life in adolescents with asthma. <i>Jornal Brasileiro De Pneumologia: Publicacao Oficial Da Sociedade Brasileira De Pneumologia E Tisiologia</i> . 2013;39(2):121-127.	Wrong population
Beggs S, et al. Swimming training for asthma in children and adolescents aged 18 years and under. <i>Cochrane Database Syst Rev</i> . (4):CD009607.	Systematic review

Publication	Reason for exclusion
Bendzewicz R, et al. Adolescent perceptions of asthma and recommendations for care and messaging. Journal of Adolescent Health. 2011:Society for Adolescent Health and Medicine, SAHM 2011 Annual Meeting. Seattle, WA United States. Conference Publication: 2048 (2012 SUPPL. 2011) pp S2022.	Abstract only
Bergstrom KS, et al. Health related quality of life and sense of coherence in adolescents with asthma. European Respiratory Journal. 2011:European Respiratory Society Annual Congress 2011. Amsterdam Netherlands. Conference Publication: 2038 (SUPPL. 2055).	Abstract only
Bergstrom SE, et al. Adolescents with asthma: consequences of transition from paediatric to adult healthcare. Respiratory Medicine. 2010;104(2):180-187.	Wrong outcome
Bertalli N, et al. Cross cultural comparisons of Irish and Australian children and teens living with food allergy: The schoolnuts study. Journal of Allergy and Clinical Immunology. 2011:2011 American Academy of Allergy, Asthma and Immunology, AAAAI Annual Meeting. San Francisco, CA United States. Conference Publication: (2012 SUPPL. 2011) pp AB2238.	Abstract only
Bertolace M et al. Association between obesity and asthma among teenagers. Sao Paulo Medical Journal = Revista Paulista de Medicina. 2008;126(5):285-287.	Wrong outcome
Bhogal S, et al. Written action plans for asthma in children. Cochrane Database Syst Rev. (3):CD005306.	Systematic review
Boyd H, et al. Assessing and addressing mental wellbeing in adolescents and their parents with multisystem allergic disease; A pilot study. Clinical and Experimental Allergy. 2017:2017 Annual Meeting of the British Society for Allergy and Clinical Immunology. United Kingdom. 2047 (2012) pp 1698.	Abstract only
Britto MT, et al. Improving outcomes for underserved adolescents with asthma. Pediatrics. 2014;133(2):e418-427.	Wrong design
Britto MT, et al. Pilot and feasibility test of adolescent-controlled text messaging reminders. Clinical Pediatrics. 2012;51(2):114-121.	Wrong design
Brody JL, et al. Enrolling adolescents in asthma research: adolescent, parent, and physician influence in the decision-making process. Journal of Asthma. 2009;46(5):492-497.	Wrong outcome
Bruzzese JM, et al. Barriers to seeking medical care among urban adolescents with undiagnosed asthma. American Journal of Respiratory and Critical Care Medicine. 2013:American Thoracic Society International Conference, ATS 2013. Philadelphia, PA United States. Conference Publication: 2187.	Abstract only
Bruzzese JM, et al. Feasibility and preliminary outcomes of a school-based intervention for inner-city, ethnic minority adolescents with undiagnosed asthma. Patient Education & Counseling. 2011;85(2):290-294.	Wrong population
Bruzzese JM, et al. Immediate efficacy of a school-based intervention for urban adolescents with undiagnosed asthma: A randomized control trial. American Journal of Respiratory and Critical Care Medicine. 2014:American Thoracic Society International Conference, ATS 2014. San Diego, CA United States. Conference Publication: 2189.	Abstract only

Publication	Reason for exclusion
Bruzzese JM, et al. The development, usability and acceptability of an online self-management intervention for adolescents with uncontrolled asthma. <i>American Journal of Respiratory and Critical Care Medicine</i> . 2017;195.	Abstract only
Bruzzese JM, et al. The role of family functioning and asthma-related anxiety on prevention and management of asthma in urban early adolescents with uncontrolled asthma. <i>American Journal of Respiratory and Critical Care Medicine</i> . 2012:American Thoracic Society International Conference, ATS 2012. San Francisco, CA United States. Conference Publication: 2185.	Abstract only
Brzyski P, et al. Health-related quality of life (HRQoL) in adolescent and young adult patients treated with specific venom immunotherapy (VIT): A multicenter study. <i>Allergy: European Journal of Allergy and Clinical Immunology</i> . 2009:28th Congress of the European Academy of Allergy and Clinical Immunology Abstract Book. Warszawa Poland. Conference Publication: 64 (SUPPL. 90) pp 40.	Abstract only
Burbank AJ, et al. Mobile-based asthma action plans for adolescents. <i>Journal of Asthma</i> . 2015;52(6):583-586.	Wrong design
Burg GT, et al. The Tempest: Difficult to Control Asthma in Adolescence. <i>The Journal of Allergy & Clinical Immunology in Practice</i> . 2018;6(3):738-748.	Wrong design
Bush JS, et al. Risk factors for depression in rural adolescents with asthma. <i>Journal of Allergy and Clinical Immunology</i> . 2015;1:AB244.	Abstract only
Calpe S, et al. App development for monitoring the ARCA (Asthma Research Children and Adolescent) cohort. <i>Quality of Life Research</i> . 2017:24th Annual Conference of the International Society for Quality of Life Research, ISOQOL 2017. United States. 2026 (2011 Supplement 2011) pp 2072-2073.	Abstract only
Campanha SMA, et al. The impact of speech therapy on asthma and allergic rhinitis control in mouth breathing children and adolescents. <i>Jornal de Pediatria</i> . 2010;86(3):202-208.	Wrong population
Carlson S, et al. Self-reported racial/ethnic discrimination and bronchodilator response in African American youth with asthma. <i>PLoS ONE</i> . 2017;12(6).	Wrong population
Carpenter DM, et al. Adolescent, caregiver, and provider preferences for an asthma self-management app. <i>Journal of Adolescent Health</i> . 2015:2015 Annual Meeting of the Society for Adolescent Health and Medicine, SAHM 2015. Los Angeles, CA United States. Conference Publication: 2056 (2012 SUPPL. 2011) pp S2085.	Abstract only
Carpenter DM, et al. Exploring the theoretical pathways through which asthma app features can promote adolescent self-management. <i>Translational Behavioral Medicine</i> . 2016;6(4):509-518.	Wrong design
Carroll K. Socioeconomic status, race/ethnicity, and asthma in youth. <i>American Journal of Respiratory and Critical Care Medicine</i> . 1180;188(10):1180-1181.	Wrong design
Carroll WD, et al. Parent misperception of control in childhood/adolescent asthma: the Room to Breathe survey. <i>European Respiratory Journal</i> . 2012;39(1):90-96.	Wrong population

Publication	Reason for exclusion
Carter JS, et al. A prospective comparison of moderating relationships among stressors, hopelessness, and internalizing symptoms in low-income urban youth with asthma. <i>Journal of urban health : bulletin of the New York Academy of Medicine</i> . 2012;89(4):598-613.	Wrong population
Carvalho RM, et al. Exhaled nitric oxide and quality of life in asthmatic teenagers. <i>World Allergy Organization Journal</i> . 2015:3rd WAO International Scientific Conference, WISC 2014. Rio de Janeiro Brazil. Conference Publication: (var.pagings). 2018 (SUPPL. 2011).	Abstract only
Cates CJ, et al. Combination formoterol and budesonide as maintenance and reliever therapy versus current best practice (including inhaled steroid maintenance), for chronic asthma in adults and children. <i>Cochrane Database Syst Rev</i> . (4):CD007313.	Systematic review
Cevik Guner U, et al. Impact of symptom management training among asthmatic children and adolescents on self-efficacy and disease course. <i>Journal of Asthma</i> . 2015;52(8):858-865.	Wrong population
Cheung WK, et al. Children and adolescents living with atopic eczema: an interpretive phenomenological study with Chinese mothers. <i>Journal of Advanced Nursing</i> . 2012;68(10):2247-2255.	Wrong population
Chisolm DJ, et al. What makes teens start using and keep using health information web sites? A mixed model analysis of teens with chronic illnesses. <i>Telemedicine Journal & E-Health</i> . 2011;17(5):324-328.	Wrong design
Choi SH, et al. Impacts of adolescents' allergic rhinitis on school achievement and quality of life. <i>Journal of Allergy and Clinical Immunology</i> . 2014:2014 Annual Meeting of the American Academy of Allergy, Asthma and Immunology, AAAAI 2014. San Diego, CA United States. Conference Publication: 2133 (2012 SUPPL. 2011) pp AB2132.	Abstract only
Chong CS, et al. The associations of poor asthma control with lifestyle habits, stress levels and quality of life in singaporean adolescent patients. <i>Pediatric Pulmonology</i> . 2014:13th International Congress on Pediatric Pulmonology. Bruges Belgium. Conference Publication: 49 (SUPPL. 37) pp S50.	Abstract only
Cibella F, et al. The burden of rhinitis and rhinoconjunctivitis in adolescents. <i>Allergy, Asthma and Immunology Research</i> . 2014;7(1):44-50.	Wrong design
Cichocka-Jarosz E, et al. Quality of life in parents of children and adolescents after systemic sting reaction. <i>Allergy: European Journal of Allergy and Clinical Immunology</i> . 2014:33rd Congress of the European Academy of Allergy and Clinical Immunology. Copenhagen Denmark. Conference Publication: 69 (SUPPL. 99) pp 115.	Abstract only
Clutter MO, et al. Parental depressive symptoms, adolescent decision making competence, and adolescent asthma quality of life. <i>American Journal of Respiratory and Critical Care Medicine</i> . 2015:American Thoracic Society International Conference, ATS 2015. Denver, CO United States. Conference Publication: 2191.	Abstract only

Publication	Reason for exclusion
Clutter MO, et al. The roles of self-efficacy and smoking beliefs in quit attempts and intentions among adolescent daily smokers with and without asthma. American Journal of Respiratory and Critical Care Medicine. 2011:American Thoracic Society International Conference, ATS 2011. Denver, CO United States. Conference Publication: 2183.	Abstract only
Cotton S, et al. Spirituality and religiosity in urban adolescents with asthma. Journal of Religion & Health. 2012;51(1):118-131.	Wrong outcome
Crowder SJ, et al. Illness representations and self-management behaviors of african american adolescents with asthma. American Journal of Respiratory and Critical Care Medicine. 2013:American Thoracic Society International Conference, ATS 2013. Philadelphia, PA United States. Conference Publication: 2187.	Abstract only
Cunningham M, et al. Health related quality of life in food allergic teenagers from the West of Scotland. Clinical and Experimental Allergy. 2015:2015 Annual Meeting of the British Society for Allergy and Clinical Immunology. United Kingdom. 2045 (2012) pp 1892-1893.	Abstract only
Cushing A, et al. Feasibility of a novel mHealth management system to capture and improve medication adherence among adolescents with asthma. Patient Preference and Adherence. 2271;10.	Wrong design
Dahlen E, et al. Factors associated with concordance between parental-reported use and dispensed asthma drugs in adolescents: findings from the BAMSE birth cohort. Pharmacoepidemiology & Drug Safety. 2014;23(9):942-949.	Wrong outcome
Dahlen E, et al. Medicine use and disease control among adolescents with asthma. European Journal of Clinical Pharmacology. 2016;72(3):339-347.	Wrong outcome
Danansuriya M, et al. Impact of asthma on health related quality of life of adolescents in a District of Sri Lanka. European Respiratory Journal. 2015:European Respiratory Society Annual Congress 2015. Amsterdam Netherlands. Conference Publication: 2046 (SUPPL. 2059).	Abstract only
Dantas FM, et al. Mothers impose physical activity restrictions on their asthmatic children and adolescents: an analytical cross-sectional study. BMC Public Health. 2014;14:287.	Wrong population
Davidson NA, et al. Educating adolescents at risk of anaphylaxis (the ERA study). Allergy: European Journal of Allergy and Clinical Immunology. 2015:34th Congress of the European Academy of Allergy and Clinical Immunology. Barcelona Spain. Conference Publication: (var.pagings). 70 (SUPPL. 101) (pp 155).	Abstract only
Davoodi P, et al. Characteristics of adolescents with undiagnosed asthma in rural counties in Georgia. Journal of Allergy and Clinical Immunology. 2014:2014 Annual Meeting of the American Academy of Allergy, Asthma and Immunology, AAAAI 2014. San Diego, CA United States. Conference Publication: 2133 (2012 SUPPL. 2011) pp AB2016.	Abstract only
De Simoni A, et al. What do adolescents with asthma really think about adherence to inhalers? Insights from a qualitative analysis of a UK online forum. BMJ Open. 2017;7(6).	Wrong population

Publication	Reason for exclusion
Devillier P, et al. Comparison of outcome measures in allergic rhinitis in children, adolescents and adults. <i>Pediatric Allergy & Immunology</i> . 2016;27(4):375-381.	Wrong outcome
Dos Reis RP, et al. Children and adolescents out-of-hospital asthma deaths in Brazil. <i>World Allergy Organization Journal</i> . 2017:2017 World Allergy Organization Symposium on Hot Topics in Allergy: Pediatric and Regulatory Aspects. Italy. 2010 (Supplement 2012) (no pagination).	Abstract only
Drew S, et al. 'I-witnessing': A visual storytelling technique for researching self, health, and chronic condition self-management in adolescents. <i>Journal of Adolescent Health</i> . 2009;44(2):S32.	Wrong population
Duncan CL, et al. Developing pictorial asthma action plans to promote self-management and health in rural youth with asthma: A qualitative study. <i>Journal of Asthma</i> . 2017.	Wrong design
Duncan CL, et al. Efficacy of a parent-youth teamwork intervention to promote adherence in pediatric asthma. <i>Journal of Pediatric Psychology</i> . 2013;38(6):617-628.	Wrong population
DunnGalvin A, et al. Preliminary Development of the Food Allergy Coping and Emotions Questionnaires for Children, Adolescents, and Young People: Qualitative Analysis of Data on IgE-Mediated Food Allergy from Five Countries. <i>Journal of Allergy and Clinical Immunology: In Practice</i> . 2018;6(2):451-456.	Wrong design
D'Urso C, et al. Food-allergic adolescents at risk for anaphylaxis: A randomized controlled study of supervised injection to improve comfort with epinephrine self-injection. <i>Journal of Allergy and Clinical Immunology</i> . 2017:Annual Meeting of the American Academy of Allergy, Asthma and Immunology, AAAAI 2017. United States. 2139 (2012 Supplement 2011) pp AB2129.	Abstract only
Eakin M, et al. Efficacy of motivational interviewing on adherence among urban early adolescents with asthma. <i>American Journal of Respiratory and Critical Care Medicine</i> . 2011:American Thoracic Society International Conference, ATS 2011. Denver, CO United States. Conference Publication: 2183 (2011 Meeting).	Abstract only
Eaton CK, et al. Different Demands, Same Goal: Promoting Transition Readiness in Adolescents and Young Adults With and Without Medical Conditions. <i>Journal of Adolescent Health</i> . 2017;60(6):727-733.	Wrong population
Eccleston C, et al. Psychological interventions for parents of children and adolescents with chronic illness. <i>Cochrane Database Syst Rev</i> . (4):CD009660.	Systematic review
Eddington AR, et al. An experimental examination of stress reactivity in adolescents and young adults with asthma. <i>Children's Health Care</i> . 2012;41(1):16-31.	Wrong outcome
Ellis DA, et al. Effects of family treatment on parenting beliefs among caregivers of youth with poorly controlled asthma. <i>Journal of Developmental & Behavioral Pediatrics</i> . 2014;35(8):486-493.	Wrong design
Ersser SJ, et al. Psychological and educational interventions for atopic eczema in children. <i>Cochrane Database Syst Rev</i> . (1):CD004054.	Systematic review

Publication	Reason for exclusion
Farin E, et al. Change of health status after rehabilitation of children and adolescents. Do children/adolescents with obesity, bronchial asthma, atopic eczema and hyperkinetic disorders benefit from inpatient rehabilitation? <i>Monatsschrift fur Kinderheilkunde</i> . 2012;160(2):135-145.	Not in English
Farooqui N, et al. Acceptability of an interactive asthma management mobile health application for children and adolescents. <i>Annals of Allergy, Asthma, & Immunology</i> . 2015;114(6):527-529.	Wrong design
Fedele DA, et al. Applying Interactive Mobile health to Asthma Care in Teens (AIM2ACT): Development and design of a randomized controlled trial. <i>Contemporary Clinical Trials</i> . 2018;64.	Wrong design
Ferro MA, et al. Maternal psychological distress mediates the relationship between asthma and physician visits in a population-based sample of adolescents. <i>Journal of Asthma</i> . 2015;52(2):170-175.	Wrong outcome
Ferro MA, et al. Self-concept among youth with a chronic illness: A meta-analytic review. <i>Health Psychology</i> . 2013;32(8):839-848.	Wrong population
Fieten K, et al. A personalized integrative multidisciplinary treatment program (PIM) for atopic children and adolescents with difficult to treat atopic dermatitis. <i>Pediatric Dermatology</i> . 2017:17th Annual Meeting of the European Society for Pediatric Dermatology, ESPD 2017. Spain. 2034 (Supplement 2012) pp S2047.	Abstract only
Fink-Wagner AH, et al. Incentives and enablers to improve asthmatic adolescents' adherence to treatment. <i>Allergy: European Journal of Allergy and Clinical Immunology</i> . 2016:35th Annual Congress of the European Academy of Allergy and Clinical Immunology, EAACI 2016. Austria. 2071 (Supplement 2102) pp 2281.	Abstract only
Fiorino EK, et al. Asthma self-management and responsibility in early adolescents. <i>American Journal of Respiratory and Critical Care Medicine</i> . 2011:American Thoracic Society International Conference, ATS 2011. Denver, CO United States. Conference Publication: 2183 (2011 MeetingAbstracts).	Abstract only
Fisch SM, et al. Experiences, expectations, and fears of adolescents with epilepsy or bronchial asthma. <i>European Journal of Pediatrics</i> . 2018;177(10):1451-1457.	Wrong design
Fong AT, et al. Bullying and quality of life in children and adolescents with food allergy. <i>Journal of Paediatrics and Child Health</i> . 2017;53(7):630-635.	Wrong design
Fong AT, et al. Bullying in Australian children and adolescents with food allergies. <i>Allergy: European Journal of Allergy and Clinical Immunology</i> . 2017:36th Annual Congress of the European Academy of Allergy and Clinical Immunology, EAACI 2017. Finland. 2072 (Supplement 2103) pp 2234.	Abstract only
Gagnon J, et al. Social media modulation of mood and anxiety in adolescents with chronic visible skin conditions. <i>European Psychiatry</i> . 2016:24th European Congress of Psychiatry, EPA 2016. Madrid Spain. Conference Publication: 2033 (SUPPL.) pp S2351.	Abstract only

Publication	Reason for exclusion
Gallagher JL, et al. Creation of an mHealth decision tree support program for epinephrine auto-injector (EAI) administration training of adolescents. <i>Journal of Allergy and Clinical Immunology</i> . 2017:Annual Meeting of the American Academy of Allergy, Asthma and Immunology, AAAAI 2017. United States. 2139 (2012 Supplement 2011) pp AB2176.	Abstract only
Gallagher M, et al. Attitudes to adrenaline auto-injectors in uk adolescents at risk of anaphylaxis. <i>Allergy: European Journal of Allergy and Clinical Immunology</i> . 2009:28th Congress of the European Academy of Allergy and Clinical Immunology Abstract Book. Warszawa Poland. Conference Publication: 64 (SUPPL. 90) pp 34.	Abstract only
Gallop K, et al. The Health-Related Quality of Life Burden of Peanut Allergy in Adults, Adolescents and Children in the Uk. <i>Value in Health</i> .21:S419.	Abstract only
Garcia-Esteba R, et al. Systematic review of the usefulness of exhaled nitric oxide in management of childhood and adolescence asthma. <i>Allergy: European Journal of Allergy and Clinical Immunology</i> . 2011:30th Congress of the European Academy of Allergy and Clinical Immunology. Istanbul Turkey. Conference Publication: 66 (SUPPL. 94) pp 667.	Abstract only
Geryk LL, et al. Exploring youth and caregiver preferences for asthma education video content. <i>Journal of Asthma</i> . 2016;53(1):101-106.	Wrong population
Gibson-Scipio W, et al. Goals, beliefs, and concerns of urban caregivers of middle and older adolescents with asthma. <i>Journal of Asthma</i> . 2013;50(3):242-249.	Wrong population
Gowan J, et al. Asthma: Long-term management in adults and adolescents. <i>Australian Journal of Pharmacy</i> . 1146;96(1146):38-47.	Wrong design
Greenley RN, et al. Self-reported quality of life among inner-city youth with asthma: an empirical examination of the PedsQL 3.0 Asthma Module. <i>Annals of Allergy, Asthma, & Immunology</i> . 2008;100(2):106-111.	Wrong design
Guarnaccia S, et al. Evaluation of a diagnostic therapeutic educational pathway for asthma management in youth. <i>Pediatric Allergy and Immunology</i> . 2018;29(2):180-185.	Wrong design
Guglani L, et al. Effect of depressive symptoms on asthma intervention in urban teens. <i>Annals of Allergy, Asthma, & Immunology</i> . 2012;109(4):237-242.e232.	Wrong design
Guglani L, et al. Exploring the impact of elevated depressive symptoms on the ability of a tailored asthma intervention to improve medication adherence among urban adolescents with asthma. <i>Allergy, Asthma and Clinical Immunology</i> . 2013;9(1).	Wrong design
Guglani L, et al. Impact of teen depression on the effectiveness of school based self-management educational intervention for urban teens with asthma. <i>American Journal of Respiratory and Critical Care Medicine</i> . 2012:American Thoracic Society International Conference, ATS 2012. San Francisco, CA United States. Conference Publication: 2185 (MeetingAbstracts).	Abstract only

Publication	Reason for exclusion
Guney Kocabas E, et al. Psychiatric comorbidity, quality of life, treatment compliance and social support in children and adolescents with asthma. <i>Neuropsychiatrie de l'Enfance et de l'Adolescence</i> . 2012:20th World Congress of the International Association for Child and Adolescent Psychiatry and Allied Professions, IACAPAP 2012. Paris France. Conference Publication: 2060 (2015 SUPPL. 2011) pp S2236.	Abstract only
Halterman JS, et al. A pilot study to enhance preventive asthma care among urban adolescents with asthma. <i>Journal of Asthma</i> . 2011;48(5):523-530.	Wrong design
Halwani R, et al. Risk factors hindering asthma symptom control in Saudi children and adolescents. <i>Pediatrics International</i> . 2017;59(6):661-668.	Wrong population
Hammersley V, et al. Cluster randomised controlled trial of an educational intervention for hayfever in adolescents: Issues in estimating the intraclass correlation coefficient. <i>Allergy: European Journal of Allergy and Clinical Immunology</i> . 2010:29th Congress of the European Academy of Allergy and Clinical Immunology, EAACI. London United Kingdom. 65 (SUPPL. 92) pp 142.	Abstract only
Hammersley VS, et al. Adolescent seasonal allergic rhinitis and the impact of health-care professional training: cluster randomised controlled trial of a complex intervention in primary care. <i>NPJ Primary Care Respiratory Medicine</i> . 2014;24:14012.	Wrong outcome
Hammersley VS, et al. Protocol for the adolescent hayfever trial: cluster randomised controlled trial of an educational intervention for healthcare professionals for the management of school-age children with hayfever. <i>Trials [Electronic Resource]</i> . 2010;11:84.	Wrong design
Han CH, et al. Association of asthma and sleep insufficiency among South Korean adolescents: analysis of web-based self-reported data from the Korean youth risk behavior web-based survey. <i>Journal of Asthma</i> . 2019:1-9.	Wrong outcome
Harris KM, et al. School-based self management interventions for asthma in children and adolescents: A mixed methods systematic review. <i>Cochrane Database of Systematic Reviews</i> . 2015;4(13).	Systematic review
Harris RF, et al. Psychosocial dysfunction in children and adolescents with eosinophilic esophagitis. <i>Journal of Pediatric Gastroenterology & Nutrition</i> . 2013;57(4):500-505.	Wrong population
Harris RF, et al. Psychosocial functioning in children and adolescents with eosinophilic esophagitis (EoE) and their families. <i>Journal of Allergy and Clinical Immunology</i> . 2011;127(2):AB106.	Abstract only
Haze KA, et al. Building patient relationships: a smartphone application supporting communication between teenagers with asthma and the RN care coordinator. <i>CIN: Computers, Informatics, Nursing</i> . 2013;31(6):266-271; quiz 272-263.	Wrong design
Hedman L, et al. Asthma is associated with lower quality of life among teenaged girls but not boys. <i>European Respiratory Journal</i> . 2015:European Respiratory Society Annual Congress 2015. Amsterdam Netherlands. Conference Publication: 2046 (SUPPL. 2059).	Abstract only

Publication	Reason for exclusion
Hieftje K, et al. Electronic media-based health interventions promoting behavior change in youth: a systematic review. JAMA Pediatrics. 2013;167(6):574-580.	Systematic review
Holling H, et al. [Personal, familial and social resources and health-related quality of life in children and adolescents with chronic conditions]. Bundesgesundheitsblatt, Gesundheitsforschung, Gesundheitsschutz. 2008;51(6):606-620.	Wrong population
Hoon Han C, et al. Associations between asthma and body weight misconceptions among South Korean adolescents: Nationwide cross-section study. <i>Journal of Asthma</i> . 2019:1-8.	Wrong outcome
Howard S, et al. Exploring the attitudes of adolescents with asthma towards monitoring and sharing of data on their inhaler use. European Respiratory Journal. 2015:European Respiratory Society Annual Congress 2015. Amsterdam Netherlands. Conference Publication: 2046 (SUPPL. 2059).	Abstract only
Howard S, et al. See I told you I was taking it! - Attitudes of adolescents with asthma towards a device monitoring their inhaler use: Implications for future design. Applied Ergonomics. 2017;58:224-237.	Wrong design
Ibarra Guerrero A, et al. Comparison of physical activity and quality of life among adolescents with mild intermittent asthma and healthy at the General Hospital Putla of Guerrero, Oaxaca. Allergy: European Journal of Allergy and Clinical Immunology. 2010:29th Congress of the European Academy of Allergy and Clinical Immunology, EAACI. London United Kingdom. Conference Publication: 65 (SUPPL. 92) pp 360.	Abstract only
Infante EM. Correlation between severity of allergic rhinitis and impairment of quality of life in allergic adolescents. World Allergy Organization Journal. 2012:22nd World Allergy Congress. Cancun Mexico. Conference Publication: 25 (SUPPL. 22) pp S192-S193.	Abstract only
Ismail M, et al. Psychiatric comorbidity and the effect at adherence in a population of atopic adolescent0s out-patient clinic patients. Allergy: European Journal of Allergy and Clinical Immunology. 2014:33rd Congress of the European Academy of Allergy and Clinical Immunology. Copenhagen Denmark. Conference Publication: 69 (SUPPL. 99) pp 576.	Abstract only
Ismail NE, et al. Asthma severity, emotional and functional disturbances (quality of life) among outpatient asthmatic adolescents in a tertiary care public Hospital. Respiriology. 2012:17th Congress of the Asian Pacific Society of Respiriology. Hong Kong Hong Kong. Conference Publication: 17 (SUPPL. 12) pp 13.	Abstract only
Jackman H, et al. A pilot study to develop a website that adolescent patients can use to help live with food allergy or asthma. Clinical and Experimental Allergy. 2013:2013 Annual Meeting of the British Society for Allergy and Clinical Immunology. Telford United Kingdom. Conference Publication: 2043 (2012) pp 1468.	Abstract only
Jan T, et al. How well can adolescents assess their own asthma symptoms? Pediatric Emergency Care. 2013:American Academy of Pediatrics, AAP Section on Emergency Medicine National Conference and Exhibition 2013. Orlando, FL United States. Conference Publication: 2029 (2010) pp 1143.	Abstract only

Publication	Reason for exclusion
Jehangir W, et al. Texting for adherence to asthma medication in adolescents. Journal of Allergy and Clinical Immunology. 2013;131(2):AB133.	Abstract only
Jentzsch NS, et al. Methods of assessing adherence to inhaled corticosteroid therapy in children and adolescents: adherence rates and their implications for clinical practice. Jornal Brasileiro De Pneumologia: Publicacao Oficial Da Sociedade Brasileira De Pneumologia E Tisiologia. 2008;34(8):614-621.	Wrong design
Jernelov S, et al. Development of atopic disease and disturbed sleep in childhood and adolescence--a longitudinal population-based study. Clinical & Experimental Allergy. 2013;43(5):552-559.	Wrong outcome
Johnson KB, et al. The feasibility of text reminders to improve medication adherence in adolescents with asthma. Journal of the American Medical Informatics Association. 2016;23(3):449-455.	Wrong design
Johnson SF, et al. Qualitative studies of teen experiences living with Food-Induced Anaphylaxis (FIA): A meta-aggregation. Allergy, Asthma and Clinical Immunology. 2017:Canadian Society of Allergy and Clinical Immunology Annual Scientific Meeting 2016. Canada. 2013 (Supplement 2011).	Abstract only
Jones C, et al. To what extent can social cognition models explain adherence to self-care behaviours amongst adolescents with food allergy. Allergy: European Journal of Allergy and Clinical Immunology. 2011;66:28.	Abstract only
Jonsson M, et al. Health related quality of life among adolescents with asthma. Allergy: European Journal of Allergy and Clinical Immunology. 2014:33rd Congress of the European Academy of Allergy and Clinical Immunology. Copenhagen Denmark. Conference Publication: 69 (SUPPL. 99) pp 328.	Abstract only
Jonsson M, et al. Perceptions of daily life amongst adolescents with asthma: The struggle with ambivalence. Allergy: European Journal of Allergy and Clinical Immunology. 2016:35th Annual Congress of the European Academy of Allergy and Clinical Immunology, EAACI 2016. Austria. 2071 (Supplement 2102)pp 2355.	Abstract only
Jordan D, et al. The impact of traditional literacy and education on health literacy in adolescents with asthma. Annals of Allergy, Asthma and Immunology. 2017:2017 Annual Scientific Meeting of the American College of Allergy, Asthma and Immunology. United States. 2119 (2015 Supplement 2011) pp S2016.	Abstract only
Joseph CL, et al. Factors associated with nonresponse to a computer-tailored asthma management program for urban adolescents with asthma. Journal of Asthma. 2010;47(6):667-673.	Wrong design
Joseph CL, et al. Feasibility of web-based asthma education for urban teenagers: Intervention compliance and computer access. American Journal of Respiratory and Critical Care Medicine. 2010:American Thoracic Society International Conference, ATS 2010. New Orleans, LA United States. Conference Publication: 2181 (2011 Meeting Abstracts).	Abstract only
Kew KM, et al Lay-led and peer support interventions for adolescents with asthma. Cochrane Database Syst Rev.4:CD012331.	Systematic review

Publication	Reason for exclusion
Kew KM, et al. Cognitive behavioural therapy (CBT) for adults and adolescents with asthma. Cochrane Database of Systematic Reviews. 2016;9(21).	Systematic review
Kew KM, et al. Combination formoterol and budesonide as maintenance and reliever therapy versus combination inhaler maintenance for chronic asthma in adults and children. Cochrane Database Syst Rev. (12):CD009019.	Systematic review
Kew KM, et al. Home telemonitoring and remote feedback between clinic visits for asthma. Cochrane Database Syst Rev. (8):CD011714.	Systematic review
Kew KM, et al. Shared decision-making for people with asthma. Cochrane Database Syst Rev.10:CD012330.	Systematic review
Klinnert M, et al. Impact of eosinophilic esophagitis (EoE) on quality of life (qol) for youth and their families. Journal of Allergy and Clinical Immunology. 2011:2011 American Academy of Allergy, Asthma and Immunology, AAAAI Annual Meeting. San Francisco, CA United States. Conference Publication: 2127 (2012 SUPPL. 2011) pp AB2110.	Abstract only
Klyucharova A, et al. Psychological status of adolescents with atopic asthma. Allergy: European Journal of Allergy and Clinical Immunology. 2015;70:123.	Abstract only
Knibb R, et al. Knowledge of the causes and management of food allergy is poor in children and adolescents with and without food allergy. Clinical and Experimental Allergy. 2015:2015 Annual Meeting of the British Society for Allergy and Clinical Immunology. United Kingdom. 2045 (2012) pp 1894.	Abstract only
Knibb RC, et al. 'Their tummys don't really suit that Food': Children and young teenagers' understanding of food allergy. Allergy: European Journal of Allergy and Clinical Immunology. 2015;70:514.	Abstract only
Koinis Mitchell D, et al. The Association Between Asthma and Sleep in Urban Adolescents With Undiagnosed Asthma. Journal of School Health. 2015;85(8):519-526.	Wrong population
Kolmodin MacDonell K, et al. The Detroit Young Adult Asthma Project: Pilot of a Technology-Based Medication Adherence Intervention for African-American Emerging Adults. Journal of Adolescent Health. 2016;59(4):465-471.	Wrong population
Kosse RC, Bouvy ML, et al. mhealth intervention to support asthma self-management in adolescents: The adapt study. Patient Preference and Adherence. 2017;11.	Wrong design
Koster ES, et al. "I just forget to take it" - New media for asthma self-management: Assessment of teenagers' preferences. Pharmacoepidemiology and Drug Safety. 2015:31st International Conference on Pharmacoepidemiology and Therapeutic Risk Management. Boston, MA United States. Conference Publication: 24 (SUPPL. 31) pp 509-510.	Abstract only
Krietsch KN, et al. Subjective bedtime variability predicts objective sleep onset latency among youth with Asthma. Sleep. 2015:29th Annual Meeting of the Associated Professional Sleep Societies, LLC, SLEEP 2015. Seattle, WA United States. Conference Publication: 2038 (SUPPL. 2011) pp A2372-A2373.	Abstract only

Publication	Reason for exclusion
Lagercrantz B, et al. Factors of importance for transition: Experiences of living with allergy from adolescent and a parenting perspective. <i>Allergy: European Journal of Allergy and Clinical Immunology</i> .73:684.	Abstract only
Lam PH, et al. One size does not fit all: Links between shift-and-persist and asthma in youth are moderated by perceived social status and experience of unfair treatment. <i>Development & Psychopathology</i> . 2018;30(5):1699-1714.	Wrong population
Langenberg J, et al. Factors associated with the burden of treatment of the epinephrine autoinjector in food allergic adolescents. <i>Allergy: European Journal of Allergy and Clinical Immunology</i> . 2011:30th Congress of the European Academy of Allergy and Clinical Immunology. Istanbul Turkey. Conference Publication: 66 (SUPPL. 94) pp 688.	Abstract only
Lasmar L, et al. Factors related to lower adherence rates to inhaled corticosteroids in children and adolescents: a prospective randomized cohort study. <i>Journal of Tropical Pediatrics</i> . 2009;55(1):20-25.	Wrong population
Lau M, et al. Racial/ethnic disparities among us adolescents in medical and oral health, access, and use of services: What are the trends over time? <i>Journal of Adolescent Health</i> . 2011;1:S30-S31.	Abstract only
Lawless C, et al. Sleep hygiene in adolescents with asthma. <i>Journal of Asthma</i> . 2018:1-9.	Wrong outcome
Lebovidge JS, et al. Assessment of psychological distress among children and adolescents with food allergy. <i>Journal of Allergy & Clinical Immunology</i> . 2009;124(6):1282-1288.	Wrong population
Lee CH, et al. Inappropriate self-medication among adolescents and its association with lower medication literacy and substance use. <i>PLoS ONE</i> . 2017;12(12).	Wrong population
Lee H, et al. Environmental factors, health behaviors, and psychosocial aspects of allergic diseases in Korean adolescents. <i>Allergy: European Journal of Allergy and Clinical Immunology</i> .73:169-170.	Abstract only
Lee KS, et al. Allergic diseases affect the subjective sense of well-being in Korean adolescents. <i>Journal of Allergy and Clinical Immunology</i> . 2017:Annual Meeting of the American Academy of Allergy, Asthma and Immunology, AAAAI 2017. United States. 2139 (2012 Supplement 2011) pp AB2056.	Abstract only
Lester MR. Depression symptoms and substance abuse in adolescents with asthma. <i>Pediatrics</i> . 2008;122:S214-S215.	Abstract only
Letourneau N, et al. Impact of online support for youth with asthma and allergies: pilot study. <i>Journal of Pediatric Nursing</i> . 2012;27(1):65-73.	Wrong design
Leyton AL, et al. Asthma and physical activity in adolescents: A cross sectional analysis. <i>Journal of Allergy and Clinical Immunology</i> . 2012:2012 Annual Meeting of the American Academy of Allergy, Asthma and Immunology, AAAAI 2012. Orlando, FL United States. Conference Publication: 2129 (2012 SUPPL. 2011) pp AB2040.	Abstract only
Liccardi G, et al. Anxiety and asthma in youth. Is a stress-induced increased cholinergic tone the possible link? <i>Pediatric Pulmonology</i> .53(2):128-129.	Not an original publication
Lin A, et al. Risk factors for non-adherence in adolescents with food allergy. <i>Journal of Investigative Medicine</i> . 2013;61:671.	Unable to access full text

Publication	Reason for exclusion
Lopes S, et al. Adolescence, atopic disease and quality of life: A comparative study. <i>Allergy: European Journal of Allergy and Clinical Immunology</i> . 2013;68:623.	Abstract only
Lopez WL, et al. The relation between parental psychological distress and adolescent anxiety in youths with chronic illnesses: The mediating effect of perceived child vulnerability. <i>Children's Health Care</i> . 2008;37(3):171-182.	Wrong population
Louis-Jacques J, et al. Caring for teens with chronic illness: Risky business? <i>Current Opinion in Pediatrics</i> . 2011;23(4):367-372.	Wrong design
Luna-Pech JA, et al. Effect of a nutritional assessment program on disease control and quality of life in obese asthmatic adolescents. <i>Annals of Allergy, Asthma and Immunology</i> . 2010:2010 Annual Meeting of the American College of Allergy, Asthma and Immunology. Phoenix, Arizona United States. Conference Publication: 2105 (2015) pp A2041.	Abstract only
Maatta H, et al. Childhood chronic physical condition, self-reported health, and life satisfaction in adolescence. <i>European Journal of Pediatrics</i> . 1197;172(9):1197-1206.	Wrong population
MacAdam C, et al. What to teenagers think about their autoinjectors? <i>Clinical and Experimental Allergy</i> . 2011:2011 Annual Meeting of the British Society for Allergy and Clinical Immunology, BSACI 2011. Nottingham United Kingdom. Conference Publication: 2041 (2012) pp 1852.	Abstract only
Macca C, et al. Control of asthma and its relationship to quality of life in adolescents. <i>World Allergy Organization Journal</i> . 2012:22nd World Allergy Congress. Cancun Mexico. 25 (SUPPL. 22) pp S125.	Abstract only
MacDonell KK, et al. The detroit young adult asthma project: Feasibility and acceptability of a multi-component, technology-based intervention targeting adherence to controller medication. <i>American Journal of Respiratory and Critical Care Medicine</i> . 2015:American Thoracic Society International Conference, ATS 2015. Denver, CO United States. Conference Publication: 2191.	Abstract only
Mak KK, et al. The associations of asthma symptoms with active and passive smoking in Hong Kong adolescents. <i>Respiratory Care</i> . 2012;57(9):1398-1404.	Wrong population
Mammen J, et al. Adolescent asthma self-management: A concept analysis and operational definition. <i>Pediatric, Allergy, Immunology, and Pulmonology</i> . 2012;25(4):180-189.	Abstract only
Mammen JR, et al. Changes in asthma self-management knowledge in inner city adolescents following developmentally sensitive self-management training. <i>Patient Education and Counseling</i> . 2017.	Wrong design
Mammen JR, et al. Mixed-methods content and sentiment analysis of adolescents' voice diaries describing daily experiences with asthma and self-management decision-making. <i>Clinical & Experimental Allergy</i> . 2018;16:16.	Wrong outcome

Publication	Reason for exclusion
Mantakos SM, et al. The relation between negative life events and asthma morbidity in inner city adolescents with asthma. American Journal of Respiratory and Critical Care Medicine. 2010:American Thoracic Society International Conference, ATS 2010. New Orleans, LA United States. Conference Publication: 2181.	Abstract only
Martin M, et al. What really happens in the home: The medication environment of urban, minority youth. Journal of Allergy and Clinical Immunology. 2014:2014 Annual Meeting of the American Academy of Allergy, Asthma and Immunology, AAAAI 2014. San Diego, CA United States. Conference Publication: 2133 (2012 SUPPL. 2011) pp AB2073.	Abstract only
Martin MA, et al. Results from a community-based trial testing a community health worker asthma intervention in Puerto Rican youth in Chicago. Journal of Asthma. 2015;52(1):59-70.	Wrong population
Martinez CD. Protocol to improve the clinical condition of children and adolescents with asthma. VacciMonitor. 2010;19:105-106.	Wrong design
Martos LA, et al. Food security and nutrition in the teenage: Current situation and future perspective. Revista Espanola de Nutricion Comunitaria. 2017:International Congress of Food Safety and Nutrition 2016. Portugal. 2023 (Supplement 2011) pp 2024.	Abstract only
Maslow GR, et al. Young adult outcomes of children growing up with chronic illness: an analysis of the National Longitudinal Study of Adolescent Health. Archives of Pediatrics & Adolescent Medicine. 2011;165(3):256-261.	Wrong outcome
Mathias SD, et al. Adaptation and validation of the Urticaria Patient Daily Diary for adolescents. Allergy & Asthma Proceedings. 2012;33(2):186-190.	Wrong design
Matsunaga NY, et al. Evaluation of quality of life according to asthma control and asthma severity in children and adolescents. Jornal Brasileiro De Pneumologia: Publicacao Oficial Da Sociedade Brasileira De Pneumologia E Tisiologia. 2015;41(6):502-508.	Wrong population
Matterne U, et al. Is the impact of atopic disease on children and adolescents' health related quality of life modified by mental health? Results from a populationbasedcross-sectional study. Experimental Dermatology. 2011:38th Annual Meeting of the Arbeitsgemeinschaft Dermatologische Forschung, ADF 2011. Tuebingen Germany. Conference Publication: 2020 (2012) pp 2173.	Abstract only
McCallum GB, et al. Culture-specific programs for children and adults from minority groups who have asthma. Cochrane Database Syst Rev.8:CD006580.	Systematic review
McWilliam VL, et al. Self-reported adverse food reactions and anaphylaxis in the SchoolNuts study: A population-based study of adolescents. Journal of Allergy and Clinical Immunology. 2018;141(3):982-990.	Wrong outcome
Molzon ES, et al. Depression, Anxiety, and Health-Related Quality of Life in Adolescents and Young Adults With Allergies and Asthma. Journal of Asthma and Allergy Educators. 2011;2(6):288-294.	Wrong population

Publication	Reason for exclusion
Morillo Argudo DA, et al. Quality of life among ecuatorian adolescents with food allergy determined by skin test reactivity and serum ige levels. Annals of Nutrition and Metabolism. 2017:21st International Congress of Nutrition, ICN 2017. Argentina. 2071 (Supplement 2012) pp 2842.	Abstract only
Morton RW, et al. Investigating the feasibility of text message reminders to improve adherence to nebulized medication in children and adolescents with cystic fibrosis. Patient Preference and Adherence. 2017;11.	Wrong population
Mosnaim G, et al. A tailored mobile health intervention to improve adherence and asthma control in minority adolescents. The Journal of Allergy & Clinical Immunology in Practice. 2015;3(2):288-290.e281.	Wrong population
Mosnaim G, et al. The use of coping peer support and MP3 technology to improve adherence to inhaled corticosteroids among low-income minority adolescents. Journal of Allergy and Clinical Immunology. 2013;1:AB133.	Abstract only
Mosnaim GS, et al. Evaluation of the Fight Asthma Now (FAN) program to improve asthma knowledge in urban youth and teenagers. Annals of Allergy, Asthma, & Immunology. 2011;107(4):310-316.	Wrong population
Mosnaim GS, et al. Use of MP3 players to increase asthma knowledge in inner-city African-American adolescents. International Journal of Behavioral Medicine. 2008;15(4):341-346.	Wrong population
Mosnaim GS, et al. Using MP3 technology to increase adherence to inhaled steroids among inner city African American teenagers. Journal of Allergy and Clinical Immunology. 2009:2009 American Academy of Allergy, Asthma and Immunology (AAAAI) Annual Meeting. Washington, DC United States. Conference Publication: 2123 (2002 SUPPL. 2001) pp S2213.	Abstract only
Mulvaney SA, et al. Assessing adolescent asthma symptoms and adherence using mobile phones. Journal of Medical Internet Research. 2013;15(7):e141.	Wrong design
Muzzolon M, Carvalho VOD. Risk for mental disorders in children and adolescents with atopic dermatitis. Pediatric Dermatology. 2017:13th World Congress of Pediatric Dermatology. United States. 34 (Supplement 11) (pp S111).	Abstract only
Namazova-Baranova L, et al. Cognitive function in adolescents with persistent allergic rhinitis. Allergy: European Journal of Allergy and Clinical Immunology. 2013:European Academy of Allergy and Clinical Immunology and World Allergy Organization World Allergy and Asthma Congress 2013. Milan Italy. Conference Publication: 2068 (SUPPL. 2097) pp 2625.	Abstract only
Navaratnam P, et al. Patient adherence and asthma control in adolescent/young adult mild asthma patients treated with inhaled corticosteroids. Annals of Allergy, Asthma and Immunology. 2009:2009 Annual Scientific Meeting of the American College of Allergy, Asthma and Immunology, ACAAI. Miami, FL United States. Conference Publication: 2103 (2005 SUPPL. 2003) pp A2064.	Abstract only
Newman K, et al. Attitudes of adolescents with food allergies: A systematic review. Clinical and Experimental Allergy. 2017:2017 Annual Meeting of the British Society for Allergy and Clinical Immunology. United Kingdom. 2047 (2012) pp 1685-1686.	Abstract only

Publication	Reason for exclusion
Nguyen HP, et al. Effects of educational interventions for self-management of asthma in children and adolescents: An updated systematic literature review and meta-analysis. Value in Health. 2011:16th Annual International Meeting of the International Society for Pharmacoeconomics and Outcomes Research, ISPOR 2011. Baltimore, MD United States. Conference Publication: 2014 (2013) pp A2143.	Abstract only
Nickels A, et al. Innovations in technology: social media and mobile technology in the care of adolescents with asthma. Current Allergy & Asthma Reports. 2012;12(6):607-612.	Wrong design
Nogueira K, et al. The association between common mental disorders, sleep problems and quality of life in adolescents with asthma. Allergy: European Journal of Allergy and Clinical Immunology. 2011:30th Congress of the European Academy of Allergy and Clinical Immunology. Istanbul Turkey. Conference Publication: 66 (SUPPL. 94) pp 555.	Abstract only
Nogueira KT, et al. Quality of life among asthmatic adolescents: Evaluation of asthma severity, co morbidity and lifestyle. Annals of Allergy, Asthma and Immunology. 2011;107(5):A34.	Abstract only
O'Keefe C, et al. Are you a penpal?-exploring behaviours and factors associated with carrying adrenaline autoinjectors in adolescents and their parents. Clinical and Experimental Allergy. 2012:2012 Annual Meeting of the British Society for Allergy and Clinical Immunology. Nottingham United Kingdom. Conference Publication: 2042 (2012) pp 1862.	Abstract only
Olaniyan T, et al. A prospective cohort study on ambient air pollution and respiratory morbidities including childhood asthma in adolescents from the western Cape Province: study protocol. BMC Public Health. 2017;17(1):712.	Wrong design
Olsen E, et al. Risk factors for admission in teenagers (14-17) with asthma seeking care in an urban emergency department. Academic Emergency Medicine. 2017:2017 Annual Meeting of the Society for Academic Emergency Medicine, SAEM 2017. United States. 2024 (Supplement 2011) pp S2169.	Abstract only
Otim ME, et al. Building evidence for peer-led interventions: assessing the cost of the Adolescent Asthma Action program in Australia. Australian Journal of Primary Health. 2015;21(4):438-443.	Wrong design
Padgett S, et al. Peer relations among youth with IgE-mediated allergic disease and eosinophilic esophagitis. Journal of Allergy and Clinical Immunology. 2017:Annual Meeting of the American Academy of Allergy, Asthma and Immunology, AAAAI 2017. United States. 2139 (2012 Supplement 2011) pp AB2148.	Abstract only
Patel PJ, et al. Assessing subjective and objective measures of asthma control in an inner city pediatric and adolescent population. Annals of Allergy, Asthma and Immunology. 2015:2015 Annual Meeting of the American College of Allergy, Asthma and Immunology. San Antonio, TX United States. Conference Publication: 2115 (2015 SUPPL. 2011) pp A2022.	Abstract only
Patel PJ, et al. Assessing Transition Readiness in Adolescents and Young Adults with Asthma on Omalizumab. <i>Journal of Allergy and Clinical Immunology</i> .143:AB92.	Abstract only
Paudyal P, et al. Written emotional disclosure for asthma. Cochrane Database Syst Rev. (5):CD007676.	Systematic review

Publication	Reason for exclusion
Pecorelli G, et al. 'ioEasma', an integrative framework for addressing the relationship between asthma control and mental health issues in children and adolescent. <i>Allergy: European Journal of Allergy and Clinical Immunology</i> . 2014;69:518.	Abstract only
Pena-Robichaux V, et al. Text messages as a reminder aid and educational tool in adolescents and adults with atopic dermatitis: A pilot study. <i>Journal of the American Academy of Dermatology</i> . 2010:68th Annual Meeting of the American Academy of Dermatology, AAD. Miami, FL United States. Conference Publication: 62 (63 SUPPL. 61) pp AB10.	Abstract only
Perosa GB, et al. Quality of life of asthmatic children and adolescents: relation to maternal coping. <i>Revista Paulista de Pediatria</i> . 2013;31(2):145-151.	Wrong population
Perron BE, et al. Endemic asthma inhaler abuse among antisocial adolescents. <i>Drug & Alcohol Dependence</i> . 2008;96(1):22-29.	Wrong population
Perry TT, et al. Utilization and outcomes associated with mobile-based asthma action plans compared to paper asthma action plans among adolescents. <i>Journal of Allergy and Clinical Immunology</i> . 2016:2016 Annual Meeting of the American Academy of Allergy, Asthma and Immunology, AAAAI 2016. Los Angeles, CA United States. Conference Publication: 2137 (2012 SUPPL. 2011) pp AB2100.	Abstract only
Petermann F, et al. [Self management in chronically ill adolescents: development of a short questionnaire]. <i>Rehabilitation</i> . 2009;48(4):228-237.	Wrong design
Petrilla C, et al. The association between chronic disease and smoking beliefs and behaviors in African American young adult smokers. <i>Ethnicity & Disease</i> . 2014;24(4):488-494.	Wrong population
Pfleger A, et al. Spirometry and multiple breath nitrogen washout (MBNW) before and after cold dry air challenge (CACH) in children and adolescents with asthma. <i>European Respiratory Journal</i> . 2015:European Respiratory Society Annual Congress 2015. Amsterdam Netherlands. Conference Publication: 2046 (SUPPL. 2059).	Abstract only
Philipp AT, et al. Adolescent asthmatics' use of the internet and other management strategies. <i>Journal of Allergy and Clinical Immunology</i> . 2016:2016 Annual Meeting of the American Academy of Allergy, Asthma and Immunology, AAAAI 2016. Los Angeles, CA United States. Conference Publication: 2137 (2012 SUPPL. 2011) pp AB2099.	Abstract only
Pillai S, et al. Differences in asthma management behaviors among urban early adolescents of foreign born caregivers compared to those of us born caregivers. <i>American Journal of Respiratory and Critical Care Medicine</i> . 2012:American Thoracic Society International Conference, ATS 2012. San Francisco, CA United States. Conference Publication: 2185.	Abstract only
Pinquart M, et al. Anxiety in children and adolescents with chronic physical illnesses: A meta-analysis. <i>Acta Paediatrica, International Journal of Paediatrics</i> . 1069;100(8):1069-1076.	Wrong population

Publication	Reason for exclusion
Polloni L, et al. Self-esteem among food allergic adolescents: A multidimensional preliminary analysis. Allergy: European Journal of Allergy and Clinical Immunology. 2012:31st Congress of the European Academy of Allergy and Clinical Immunology. Geneva Switzerland. Conference Publication: 67 (SUPPL. 96) pp 503.	Abstract only
Posadzki P, et al. Automated telephone communication systems for preventive healthcare and management of long-term conditions. Cochrane Database Syst Rev.12:CD009921.	Systematic review
Ravens-Sieberer U, et al. Predictors of self-reported health-related quality of life according to the EQ-5D-Y in chronically ill children and adolescents with asthma, diabetes and juvenile arthritis: Longitudinal results. Quality of Life Research. 2017:24th Annual Conference of the International Society for Quality of Life Research, ISOQOL 2017. United States. 2026 (2011 Supplement 2011) pp 2078-2079.	Abstract only
Rayens MK, et al. Cultural differences in parent-adolescent agreement on the adolescent's asthma-related quality of life. Pediatric Nursing. 2011;37(6):311-319, 321.	Wrong design
Razi CH, et al. Knowledge and attitudes of adolescents towards asthma: questionnaire results before and after a school-based education program. International Archives of Allergy & Immunology. 2011;156(1):81-89.	Wrong design
Rhee H, et al. Evaluating the Validity of an Automated Device for Asthma Monitoring for Adolescents: Correlational Design. Journal of Medical Internet Research. 2015;17(10):e234.	Wrong design
Rhee H, et al. Evaluation of a peer-led asthma self-management program and benefits of the program for adolescent peer leaders. Respiratory Care. 2012;57(12):2082-2089.	Wrong design
Riekert KA, et al. The development of a motivational interviewing intervention to promote medication adherence among inner-city, African-American adolescents with asthma. Patient Education & Counseling. 2011;82(1):117-122.	Wrong design
Rikkers-Mutsaerts N, et al. Internet-based self-management in adolescents with asthma: The role of education, monitoring and symptom perception. European Respiratory Journal. 2014:European Respiratory Society Annual Congress 2014. Munich Germany. 2044 (SUPPL. 2058).	Abstract only
Rivkina V, et al. Understanding risk-taking behavior in adolescents with food allergy. Journal of Allergy and Clinical Immunology. 2015:2015 Annual Meeting of the American Academy of Allergy, Asthma and Immunology, AAAAI 2015. Houston, TX United States. Conference Publication: 2135 (2012 SUPPL. 2011) pp AB2139.	Abstract only
Rizzo J, et al. Exercise-induced bronchospasm is not associated with low physical activity levels in asthmatic adolescents. Allergy: European Journal of Allergy and Clinical Immunology. 2011:30th Congress of the European Academy of Allergy and Clinical Immunology. Istanbul Turkey. Conference Publication: 66 (SUPPL. 94) pp 45.	Abstract only
Roberts CA, et al. Adolescent, caregiver, and friend preferences for integrating social support and communication features into an asthma self-management app. Journal of Asthma. 2016;53(9):948-954.	Wrong design

Publication	Reason for exclusion
Rodriguez AP, et al. Medication adherence in children and adolescents with asthma in medellin-Colombia. Cross-sectional study. Pediatric Pulmonology. 2016:11th SOLANEP International Congress, 15th Cystic Fibrosis Latinamerican Congress and 15th Brazilian Congress of Pediatric Pulmonology. Brazil. 51 (Supplement 42) pp S17-S18.	Abstract only
Romano-Zelekha O, et al. Adolescent versus parent reports on asthma and asthma symptoms. Pediatric Pulmonology. 2017;52(2):154-159.	Wrong design
Ross NL, et al. Food allergic teens: Education, anaphylaxis and concerns. Allergy, Asthma and Clinical Immunology 10 (2) (no pagination), 2014. 2014:A44.	Abstract only
Sage A, et al. Assessing the usability of a youth-centered asthma management and medication tracking mobile app. Respiriology. 2017;22:114.	Wrong design
Salema NM, et al. Click, capture, converse: Using photography to elicit adolescents' views regarding asthma management. International Journal of Pharmacy Practice. 2010:Health Services Research and Pharmacy Practice Conference 2010. Manchester United Kingdom. Conference Publication: 2018 (SUPPL. 2011) pp 2012.	Abstract only
Scheewe S, et al. Acupuncture in children and adolescents with bronchial asthma: A randomized controlled trial. Deutsche Zeitschrift fur Akupunktur. 2008;51(2):8-12.	Wrong design
Schreier HM, et al. Prospective associations between coping and health among youth with asthma. Journal of Consulting & Clinical Psychology. 2008;76(5):790-798.	Wrong population
Seo J, et al. Suicide idea and depressive symptom in Korean adolescent with allergic disease. Neuropsychiatrie de l'Enfance et de l'Adolescence. 2012;60(5):S173.	Abstract only
Shah S, et al. Using focus groups to inform the design of a behavioral controlled trial to improve adherence to asthma controller medications among low-income African American adolescents. Journal of Allergy and Clinical Immunology. 2011:2011 American Academy of Allergy, Asthma and Immunology, AAAAI Annual Meeting. San Francisco, CA United States. Conference Publication: 2127 (2012 SUPPL. 2011) pp AB2149.	Abstract only
Shanovich KK, et al. Adolescent attitudes towards asthma in an overweight inner-city population. Journal of Allergy and Clinical Immunology. 2011:2011 American Academy of Allergy, Asthma and Immunology, AAAAI Annual Meeting. San Francisco, CA United States. Conference Publication: 2127 (2012 SUPPL. 2011) pp AB2218.	Abstract only
Simons E, et al. At what age should children and teenagers be able to recognize anaphylaxis and self-inject epinephrine? Journal of Allergy and Clinical Immunology. 2012:2012 Annual Meeting of the American Academy of Allergy, Asthma and Immunology, AAAAI 2012. Orlando, FL United States. Conference Publication: 2129 (2012 SUPPL. 2011) pp AB2179.	Abstract only
Singh PKR, et al. Knowledge of bronchial asthma in parents/caregivers of adolescent asthma patients. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2015;6(3):516-520.	Wrong population

Publication	Reason for exclusion
Slattery MJ, et al. Joint influences of atopic dermatitis severity, inflammatory biomarkers, and quality of life on adolescent depression and anxiety. Brain, Behavior, and Immunity. 2010:17th Annual Meeting of the PsychoNeuroImmunology Research Society - PsychoNeuroImmunology: Crossing Disciplines to Combat Disease, PNIRS 2010. Dublin Ireland. Conference Publication: 2024 (SUPPL. 2011) pp S2054.	Abstract only
Sleath B, et al. Acceptance of a pre-visit intervention to engage teens in pediatric asthma visits. Patient Education and Counseling. 2005;100(11):2005-2011.	Wrong design
Sleath B, et al. The development of an educational video to motivate teens with asthma to be more involved during medical visits and to improve medication adherence. Journal of Asthma. 2016;53(7):714-719.	Wrong design
Smidt AC, et al. Development and validation of skindex-teen, a quality-of-life instrument for adolescents with skin disease. Archives of Dermatology. 2010;146(8):865-869.	Wrong design
Smita S, et al. Inter-Professional Learning to Educate Disadvantaged Youth about Asthma and Smoking. Turkish Archives of Pediatrics. 2013:10th International Congress on Adolescent Health. (10th). Turkey. 148 (Suppl 132) pp 119.	Abstract only
Social stigma stops adolescents from using inhalers for asthma. Vol 292017.	Not an original publication
Sole D, et al. Asthma in children and adolescents in Brazil: contribution of the International Study of Asthma and Allergies in Childhood (ISAAC). Revista Paulista de Pediatria. 2014;32(1):114-125.	Wrong outcome
Sommer I, et al. A qualitative study of food choice behaviour of teenagers with and without food allergies. Clinical and Experimental Allergy. 2012:2012 Annual Meeting of the British Society for Allergy and Clinical Immunology. Nottingham United Kingdom. Conference Publication: 2042 (2012) pp 1849.	Abstract only
Srof BJ, et al. The effects of coping skills training among teens with asthma. Western Journal of Nursing Research. 2012;34(8):1043-1061.	Wrong design
Stensgaard A, et al. Risk perception in adolescents/young adults with peanut allergy, their family and friends in everyday life - Using the new 'Colours of Risks', a web-based communication tool. Allergy: European Journal of Allergy and Clinical Immunology. 2016:35th Annual Congress of the European Academy of Allergy and Clinical Immunology, EAACI 2016. Austria. 2071 (Supplement 2102) pp 2078.	Abstract only
Stewart M, et al. Online Support Intervention for Adolescents With Asthma and Allergies: Ingredients and Insights. Journal of Asthma and Allergy Educators. 2011;2(6):306-317.	Wrong design
Strickland O, et al. Applying adolescent health equity to school and community healthcare: Community outreach and rally for engaged aggregate in health care (co-reach) initiative. 2018.	Abstract only

Publication	Reason for exclusion
Strinnholm A, et al. To face fear: A qualitative study of adolescents' experiences of double-blind, placebo-controlled food challenges. Allergy: European Journal of Allergy and Clinical Immunology. 2015:34th Congress of the European Academy of Allergy and Clinical Immunology. Barcelona Spain. 70 (SUPPL. 101) pp 386.	Abstract only
Stukus DR, et al. Improved education and self-management in children and adolescents with asthma using a personalized smartphone application. Journal of Allergy and Clinical Immunology. 2014;133(2):AB156.	Abstract only
Sundell K, et al. Quality-of-life in adolescents with asthma. Allergy: European Journal of Allergy and Clinical Immunology. 2010:29th Congress of the European Academy of Allergy and Clinical Immunology, EAACI. London United Kingdom. Conference Publication: 65 (SUPPL. 92) pp 209.	Abstract only
Surdu C, et al. Low compliance to therapy in teenagers with asthma. Allergy: European Journal of Allergy and Clinical Immunology. 2009:28th Congress of the European Academy of Allergy and Clinical Immunology Abstract Book. Warszawa Poland. Conference Publication: 64 (SUPPL. 90) pp 434.	Abstract only
Svavarsdottir EK, et al. Icelandic and United States families of adolescents with asthma: predictors of health-related quality of life from the parents' perspective. Journal of Clinical Nursing. 2011;20(1):267-273.	Wrong design
Szeftler SJ, et al. Management of asthma based on exhaled nitric oxide in addition to guideline-based treatment for inner-city adolescents and young adults: a randomised controlled trial. Lancet. 2008;372(9643):1065-1072.	Wrong outcome
Talati AD, et al. Qualitative analysis of barriers to adherence to asthma controller medications among low income Urban African American adolescents. Journal of Allergy and Clinical Immunology. 2010:2010 Annual Meeting of the American Academy of Allergy, Asthma and Immunology, AAAAI. New Orleans, LA United States. 2125 (2012 SUPPL. 2011) pp AB2130.	Abstract only
Terpstra JL, et al. An intervention to increase caregiver support for asthma management in middle school-aged youth. Journal of Asthma. 2012;49(3):267-274.	Wrong design
Thompson LA, et al. Meaningful Use of a Confidential Adolescent Patient Portal. Journal of Adolescent Health. 2016;58(2):134-140.	Wrong design
Tiggelman D, et al. Moderating effect of gender on the prospective relation of physical activity with psychosocial outcomes and asthma control in adolescents: a longitudinal study. Journal of Asthma. 2014;51(10):1049-1054.	Wrong outcome
Tseng TJ, et al. A randomized control trial of an asthma self-management program for adolescents in Taiwan: A study protocol. Contemporary Clinical Trials Communications. 2017;8.	No intervention
Unruh CR, et al. Food allergy education: Teen learning preferences. Allergy, Asthma and Clinical Immunology 10 (2) 2014. 2014:A65.	Abstract only

Publication	Reason for exclusion
Vale S, et al. 250 k: A youth allergy awareness project by the national allergy strategy. Internal Medicine Journal. 2017:28th Annual Conference of the Australasian Society of Clinical Immunology and Allergy, ASCIA 2017. New Zealand. 2047 (Supplement 2015) pp 2020.	Abstract only
Valerio MA, et al. Examining health literacy and asthma outcomes in an urban adolescent population. American Journal of Respiratory and Critical Care Medicine. 2012:American Thoracic Society International Conference, ATS 2012. San Francisco, CA United States. 2185.	Abstract only
Van De Ven MO, et al. Asthma-specific predictors of smoking onset in adolescents with asthma: a longitudinal study. Journal of Pediatric Psychology. 2009;34(2):118-128.	Wrong outcome
Van Der Velde JL, et al. Adolescent-parent disagreement on health-related quality of life in food allergic adolescents; Who makes the difference? Clinical and Translational Allergy. 2011:Food Allergy and Anaphylaxis Meeting 2011, FAAM 2011. Venice Italy. 2011 (SUPPL. 2011).	Abstract only
Velsor-Friedrich B, et al. Promoting self-care in African-American teens with asthma. American Journal of Respiratory and Critical Care Medicine. 2011:American Thoracic Society International Conference, ATS 2011. Denver, CO United States. Conference Publication: 2183.	Abstract only
Velsor-Friedrich BF, et al. Effects of coping skills training in low-income urban african-american adolescents with asthma. Journal of Allergy and Clinical Immunology. 2012;1:AB142.	Abstract only
Venerabile ALG, et al. Analysis of asthmatic adolescents by Gina 2015. Pediatric Pulmonology. 2016:11th SOLANEP International Congress, 15th Cystic Fibrosis Latinamerican Congress and 15th Brazilian Congress of Pediatric Pulmonology. Brazil. 51 (Supplement 42) pp S42-S43.	Abstract only
Verkleij M, et al. Behavioral problems in children and adolescents with difficult-to-treat asthma. Journal of Asthma. 2011;48(1):18-24.	Wrong population
Versteeg KM, et al. Teenagers wanting medical advice: Is MySpace the answer? Archives of Pediatrics & Adolescent Medicine. 2009;163(1):91-92.	Wrong design
Vesel T, et al. Impaired health-related quality of life in children and teenagers with food allergies. Allergy: European Journal of Allergy and Clinical Immunology. 2017:36th Annual Congress of the European Academy of Allergy and Clinical Immunology, EAACI 2017. Finland. 2072 (Supplement 2103) pp 2235.	Abstract only
Walters J, et al. Swimming training benefits children and adolescents with asthma: Results of a systematic review. Respiriology. 2013:2013 Annual Scientific Meetings of the Thoracic Society of Australia and New Zealand and the Australian and New Zealand Society of Respiratory Science. Darwin, NT Australia. 2018 (SUPPL. 2012) pp 2014.	Abstract only

Publication	Reason for exclusion
Wang X. Comparison of quality of life of adolescent and adult with persistent allergic rhinitis. <i>Allergy: European Journal of Allergy and Clinical Immunology</i> . 2010;29th Congress of the European Academy of Allergy and Clinical Immunology, EAACI. London United Kingdom. 65 (SUPPL. 92) pp 625-626.	Abstract only
Warren CM, et al. Epinephrine auto-injector carriage and use practices among US children, adolescents, and adults. <i>Annals of Allergy, Asthma, & Immunology</i> . 2018;121(4):479-491.	Wrong population
Westergren T, et al. A nested case-control study: personal, social and environmental correlates of vigorous physical activity in adolescents with asthma. <i>Journal of Asthma</i> . 2015;52(2):155-161.	Wrong design
Westergren T, et al. Adolescent boys with asthma - A pilot study on embodied gendered habits. <i>Journal of Multidisciplinary Healthcare</i> . 2012;5.	Wrong design
Wildhaber J, et al. Global impact of asthma on children and adolescents' daily lives: the room to breathe survey. <i>Pediatric Pulmonology</i> . 2012;47(4):346-357.	Wrong population
Wolf FM, et al. Educational interventions for asthma in children. <i>Cochrane Database Syst Rev</i> . 2003(1):CD000326.	Systematic review
Woods ER, et al. Evaluation of the community asthma initiative: Adolescent vs. child outcomes and GIS mapping. <i>Journal of Adolescent Health</i> . 2012;1:S83-S84.	Abstract only
Worth A, et al. Adolescents' self-management of anaphylaxis: An in-depth qualitative study. <i>Clinical and Experimental Allergy</i> . 2009;British Society for Allergy and Clinical Immunology Annual Conference 2009. Nottingham United Kingdom. 2039 (2012) pp 1956.	Abstract only
Wyrwich KW, et al. Validation of the AQLQ12+ among adolescents and adults with persistent asthma. <i>Quality of Life Research</i> . 2011;20(6):903-912.	Wrong design
Yang TO, et al. Parent support, peer support, and peer acceptance in healthy lifestyle for asthma management among early adolescents. <i>Journal for Specialists in Pediatric Nursing: JSPN</i> . 2010;15(4):272-281.	Wrong design
Yang TO, et al. Peer stress-related coping activities in young adolescents' asthma management. <i>Journal of Asthma</i> . 2009;46(6):613-617.	Wrong population
Yarbrough M, et al. SMART (Student Media-based Asthma Research Team): Engaging Adolescents to Understand Asthma in Their Communities. <i>Progress in Community Health Partnerships</i> . 2016;10(4):523-532.	Wrong design
Yi MS, et al. Illness representations among adolescents with different chronic illnesses. <i>American Journal of Hematology</i> . 2011;5th Annual Sickle Cell Disease Research and Educational Symposium and Grant Writing Institute and Annual National Sickle Cell Disease Scientific Meeting - Sickle Cell Disease: The Next Century. Hollywood, FL United States. 86 (10) pp E33.	Abstract only

Publication	Reason for exclusion
Yildiz I, et al. The effect of motivational interviewing on asthma control, self-efficacy and quality of life in adolescents with asthma. European Journal of Pediatrics. 2016:6th Congress of the European Academy of Paediatric Societies. Switzerland. 175 (111) pp 1862.	Abstract only
Yoo W, K et al. Patient-clinician mobile communication: analyzing text messaging between adolescents with asthma and nurse case managers. Telemedicine Journal & E-Health. 2015;21(1):62-69.	Wrong design
Yorke J, et al. Psychological interventions for children with asthma. Cochrane Database Syst Rev. (4):CD003272.	Systematic review

Table S2. Quality ratings for included papers using the Cochrane Risk of Bias Tool for Randomised Controlled Trials

Paper	Selection bias - Random Sequence Generation	Selection bias - Allocation concealment	Performance bias	Detection bias	Attrition bias	Reporting bias	Other bias	Overall bias
Psychological interventions								
Alimohammadi 2018	Low	Unclear	High	Unclear	Unclear	High		Moderate
Bruzzese 2008	Unclear	Unclear	High	Unclear	Low	Low		Moderate
Ellis 2016	Unclear	High	High	Low	Low	Low	Unclear	Low
Hampnel 2003	High	Unclear	High	High	High	Low		High
Hemati 2015	High	Unclear	High	High	High	High		High
Hemati 2017	High	Unclear	High	High	High	High		High
Naar 2018	Low	Unclear	Unclear	Low	Low	Low		Low
Naar-King 2014	Low	Unclear	Unclear	Low	Low	Low		Low
Seid 2012	Low	Low	High	Unclear	Low	Unclear	High	Moderate
Srof 2012	Low	Unclear	High	High	Unclear	Low		Moderate
Velsor-Frederich 2012	Unclear	Unclear	Low	High	Low	Low		Moderate
Warner 2006	Low	Unclear	Unclear	Unclear	Low	High		Moderate
E-Health Interventions								
Bynum 2001	Low	High	High	Unclear	High	Unclear	High	High
Johnson 2016	Low	Low	High	Unclear	Low	Unclear	Low	Low
Joseph 2013	Low	Low	Unclear	Low	Low	High	High	High
Joseph 2018	Low	Low	Low	Low	Low	Unclear	Unclear	Low
Perry 2017	Unclear	Unclear	High	Unclear	High	High	Unclear	High
Rikkers-Mutsaerts 2012	Low	Low	High	High	Low	Low	High	Low
Rhee 2008	Low	Unclear	Low	Unclear	Low	Unclear	High	High
Sleath 2018	Low	Low	Low	High	Low	Low		Low
Educational interventions								

Bruzzese 2011	Low	Low	High	Low	Low	High	Unclear	Low
Cowie 2002	Low	Low	High	Unclear	High	High	High	High
Salisbury 2002	Low	Low	High	Low	Low	Low	Low	Low
Van Es 2001	Low	Low	High	Unclear	Low	Low	High	Moderate
Peer-led interventions								
Al-Sheyab 2011	Low	Low	Low	Unclear	Low	Low		Low
Gibson 1998	Unclear	Low	Low	Unclear	Low	Low		Moderate
Rhee 2011	Low	Unclear	Unclear	Unclear	Low	Unclear	High	Moderate
Rhee 2012	Low	Unclear	High	Unclear	Unclear	Unclear		Moderate
Shah 2001	Low	Low	Low	High	Low	Low		Low
Breathing re-training intervention								
Bignall 2015	Low	Unclear	High	Unclear	Low	Low	High	Moderate

207