



Children and young people's self-reported experiences of asthma and self-management nursing strategies: An integrative review[☆]

H. Kemble^{a,c}, M. Foster^{a,b,c,*}, J. Blamires^{a,c}, R. Mowat^{a,c}

^a Auckland University of Technology, School of Clinical Sciences, Auckland, New Zealand

^b Edith Cowan University, School of Nursing and Midwifery, Perth, Western Australia, Australia

^c Auckland University of Technology, School of Clinical Sciences (Nursing), 90 Akoranga Drive, Northcote, Auckland 0627, New Zealand

ARTICLE INFO

Article history:

Received 5 December 2023

Revised 16 March 2024

Accepted 17 March 2024

Available online xxxx

Keywords:

Children

Asthma

Integrative review

Nursing intervention

ABSTRACT

Aim: To explore children and young people's (CYP) (5–24 years of age) self-reported experiences of asthma self-management strategies (ASMS) with nursing involvement across various settings.

Background: Childhood asthma is an increasingly significant health issue, highlighting the importance of acquiring self-management skills to optimise future health outcomes. Registered nurses play a pivotal role in delivering appropriate, personalized self-management support.

Methods: This integrative review searched four electronic databases: Cumulated Index to Nursing and Allied Health Literature via Elton B. Stephens Company, Medical Literature Analysis and Retrieval System Online (MEDLINE), Object, View and Interactive Design (OVID), and PubMed, that followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis flowchart. Included studies were critically appraised using the Joanna Briggs Institute critical appraisal tools. Braun and Clarke's thematic analysis was used to generate themes, and sub-themes.

Findings: Fifteen studies were included for review. Thematic analysis generated three themes being healthy literacy; health and wellbeing; and tools and working together.

Conclusions: Asthma continues to have negative physical, psychological, and social implications among CYP. CYP are both willing and capable of engaging in ASMS and learning self-management skills, however, continue to have unmet self-management needs.

Implications to practice: Strategies must bolster health literacy, improve physical and psychological health, and harness interactive, youth-centric, and informative tools to facilitate communication and decrease the burden of self-management. Applications pose a promising avenue for self-management support. This age group remains under-explored and future research should enable meaningful engagement with CYP to better understand their perspectives and improve strategy success.

© 2024 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

Introduction

Asthma is a chronic inflammatory disease of the airways characterised by recurrent episodes of airflow obstruction secondary to reversible bronchoconstriction and airway hyperresponsiveness, and clinically presents with symptoms of wheezing, coughing, tachypnoea, dyspnoea, and chest tightness (Beasley et al., 2020; Lizzo & Cortes, 2022). While asthma can develop at any age, it predominantly

develops during childhood due to the collective influence of multiple factors, including respiratory system development, immune system maturation, genetic predispositions, and environmental stimuli (Dharmage et al., 2019). Globally, asthma is the most common chronic condition in childhood and one of the most common chronic conditions in adulthood (Global Asthma Network, 2018). Research has highlighted that the prevalence, morbidity, and mortality of childhood asthma has increased in recent years despite evidence based advancements (Serebrisky & Wiznia, 2019). Respiratory disorders are the leading cause of paediatric hospital admissions, with asthma the third most common respiratory complaint (McDermott et al., 2018). There is a wealth of research linking recurrent asthma exacerbations with permanent airway remodelling, increasing the risk of asthma progression and development of further respiratory conditions over time (Gorrieri et al., 2016; Hough et al., 2020). Subsequently, care for an individual with

[☆] Disclosure: Mandie Foster is the editor-in-chief and Julie Blamires is an assistant editor for JPN. As authors of this paper, they did not participate in any editorial process or decision-making, which was handled by another editor.

* Corresponding author at: Auckland University of Technology, School of Clinical Sciences, Auckland, New Zealand.

E-mail addresses: mandie.foster@aut.ac.nz (M. Foster), julie.blamires@aut.ac.nz (J. Blamires), rebecca.mowat@aut.ac.nz (R. Mowat).

asthma targets relieving/controlling symptoms, preventing exacerbations, protecting pulmonary function, and maintaining quality of life (QOL) (Beasley et al., 2020). Despite this, CYP living with asthma experience higher rates of hospital admissions, school absences, limitations in daily activities, sleep disruptions, and lower QOL compared to CYP living without asthma (Kouzegaran et al., 2018; Lam et al., 2016; Mathiazhakan & Abirami, 2023). In addition, their caregivers experience increased work absences and stress, particularly associated with CYP who have poor asthma control (Kouzegaran et al., 2018; Lam et al., 2016; Mathiazhakan & Abirami, 2023). The burden of asthma significantly impacts New Zealand Māori and Australian Aboriginals often due to unfair economic conditions. These disparities arise from historical and structural factors that influence asthma development and outcomes (Barnard & Zhang, 2021; Global Asthma Network, 2018).

Self-management is a process through which individuals actively cope with their condition in the context of their daily lives (Miller et al., 2015). Self-management has become an important component of international health policy due to the increased prevalence of long-term conditions and the need to promote positive health outcomes (O'Connell et al., 2018). Subsequently, international asthma guidelines advocate for the provision of preventative asthma management education upon diagnosis (Global Initiative for Asthma, 2022). Initially, responsibility for a child's asthma management resides with their caregiver, with children and caregivers developing shared asthma decision-making as the child grows (Garnett et al., 2016). Systematic reviews have emphasised that increased engagement of CYP in asthma self-management (ASM) behaviours leads to more favourable outcomes, yet CYP tend to self-report higher ASM responsibility than their parents do of them (Dall'Oglio et al., 2021; Sonney et al., 2019). During asthma exacerbations CYP rely on caregivers to make decisions and feel unprepared to manage their asthma on their own (McClure et al., 2018). As children mature, they have greater decision-making autonomy and self-care independence, and self-management is a crucial concept as they start spending less time with caregivers and begin assuming care for themselves (Camp-Spivey et al., 2021; Rehman et al., 2020). This involves learning the ASM skills of adhering to regular medication schedules, carrying inhalers, avoiding triggers, and effectively managing the physical and emotional impact of asthma, skills that are significantly shaped by CYP's perceptions of registered nurse (RN) and caregiver expectations (Pinnock, 2015). However, many CYP perceive these expectations as solely medication compliance, and struggle to identify other ASM behaviours (Quaranta et al., 2014). Additionally, the transition from childhood to adolescence can be overwhelming for young people and marks an increase in risk-taking behaviours, autonomy assertion, and social pressures, potentially impacting their ASM (Cheng et al., 2022). As they approach adulthood, many young people have poor asthma control as a likely consequence of suboptimal ASM through childhood (Nickels-Nelson, 2019).

Supported self-management refers to the assistance healthcare professionals give patients living with a chronic disease to encourage daily decisions that improve health-related behaviours and outcomes (O'Connell et al., 2018). With CYP, this process initially includes strong family involvement (Quaranta et al., 2014). Self-management strategies are tools which promote an individual's active participation in their own health, pushing them towards greater self-determination, self-efficacy, autonomy, and health engagement (World Health Organization, 2022). Extensive evidence supports the implementation of asthma self-management strategies (ASMS) across demographic and cultural groups, placing a responsibility on healthcare professionals to facilitate the acquisition of asthma knowledge, skills (symptom monitoring, trigger avoidance, coping strategies, medication management), and collaborative development of an asthma action plan (Pinnock, 2015; Pinnock et al., 2017; Taylor et al., 2014). Research recommends that ASMS go beyond medical management and adopt a holistic, individualised approach considering the multifactorial nature of the disease (Chan et al., 2021; Sullivan & Thakur, 2020; Turnbull et al., 2020). A variety

of ASMS have been developed and may differ across multiple domains, however all aim to improve, or promote the capacity for, ASM (Hodkinson et al., 2020). ASM applications have expanded rapidly in healthcare and CYP's perspectives of them are promising (Davis et al., 2021; Peters et al., 2017), yet research has reported limited information, evidence-based principles, and even misinformation in such applications (Tinschert et al., 2017). Despite the agreement that ASMS consider the unique needs of CYP, there is a paucity in the literature regarding how ASMS are experienced by CYP.

In recent years, there has been a growing emphasis on amplifying children's voices and participation, attributed to the introduction of the United Nations Convention on the Rights of the Child and the evolving frameworks positioning CYP as active and capable participants in society (Cuevas-Parra, 2020; Lundy, 2018). Attention has been drawn to the importance of engaging CYP in health research, by focusing on their words, emotions, actions, and social interactions (Sudarsan et al., 2022). It is argued that CYP's voices are inherently embedded relationally, socially, culturally, and politically, should hold 'ethical weight' and can inform responsive nursing practices, interventions, and policies to improve the experiences and outcomes for paediatric populations (Carnevale, 2020) (pg.2). Self-reporting entails questioning CYP about their thoughts and behaviours and documenting their responses. This can be obtained in a variety of ways including age-appropriate questionnaires, diary entries, and interviews to provide qualitative and/or quantitative data as a means of measuring variables/outcomes within an experiment, or as an observational measure (Althubaiti, 2016).

Poorly controlled asthma is commonly observed by RNs and imposes a significant burden on the child, family, and healthcare system (Nurmagambetov et al., 2018). ASM exists within a social context, and fundamental to its success are the relationships of patients with their healthcare providers, primarily RNs (Grady & Gough, 2014). RNs are at the forefront of implementing self-management-based illness prevention, and it is likely RNs from various settings will care for CYP living with asthma (Grady & Gough, 2014). As one of the largest and most trusted groups of healthcare professionals, RNs have a pivotal opportunity to assist CYP in optimising their ASM throughout their childhood and adolescence to reduce disease burden and improve health and social outcomes (Blackman & Gurka, 2007; Pité et al., 2021). To bolster confidence in their patient-centred role and the evidence-based strategies they use, RNs must be knowledgeable as to how ASMS are experienced by CYP.

A plethora of literature reviews have been conducted on self-management strategies that support CYP with chronic illness or ASM in the medical, community, school, and digital context (Camp-Spivey et al., 2021; Chang et al., 2021; Turnbull et al., 2020) including CYP living with co-morbid asthma and obesity (Bayless et al., 2021), with promising insights and areas for improvement. However, these reviews focus on objective measures of the success of ASMS, as opposed to CYP's self-reported experiences. One recent systematic review by McTague et al. (2022) explored youth experiences of ASM education, however this review focused solely on education as an ASMS and only included studies whose participants were aged 15–24 years (McTague et al., 2022). To provide a more enriched understanding of the success of ASMS, there is a need for a current, comprehensive review addressing how various ASMS are experienced by CYP.

Methods

Aim: This review aims to explore CYP's self-reported experiences of asthma self-management strategies with nursing involvement across various settings.

Research question: 'What are children and young people's (5–24 years of age) self-reported experiences of asthma self-management strategies with nursing involvement across various settings?'

Design: An integrative review using thematic analysis to synthesise the findings was chosen as the appropriate methodology due to the

need for a comprehensive, current review on this topic (Braun & Clarke, 2006). Research has emphasised the importance of integrative reviews in the evidence-based practice of nursing due to its ability to synthesise findings from literature of multiple methodologies and methods, potentially allowing for clearer, more robust findings (McChesney & Aldridge, 2019). Incorporating multiple sources is crucial due to the growing access to information and the complex nature of nursing, with integrative reviews being frequently cited in documents that influence policy, practice, and public perception (Suri, 2019).

Search methods: Between January to August 2023 the databases Cumulated Index to Nursing and Allied Health Literature (CINAHL) via Elton B. Stephens Company (EBSCO), Medical Literature Analysis and Retrieval System Online (MEDLINE) via EBSCO, Object, View and Interactive Design (OVID), and PubMed, were searched using the key search terms 'strateg*' OR 'method*' OR 'technique*' OR 'intervention*' OR 'treatment*' OR 'program*' OR 'initiative*' OR 'therap*' AND 'child*' OR 'adolescent' OR 'youth' OR 'teen*' OR ('young people') OR ('young person') AND 'self-management' OR 'self-care' OR 'self-regulation' OR 'self-monitoring' AND 'asthma'.

Inclusion criteria: CYP who have asthma aged 5–24 years, based on definitions of children 5–18 years and young people 10–24 years by the World Health Organization and the United Nations (United Nations, 2013; World Health Organization, 2014). Empirical research published in peer-reviewed Journal on CYP's (5–24 years) active involvement in ASMS with nursing involvement. Research needed to be published in English language with full text access, between 2013 and 2023. All articles that met the inclusion criteria as represented in Table 1 were uploaded to Rayyan (Rayyan, 2022).

Quality appraisal: The articles that met full-text screening against the inclusion criteria were then assessed for quality using the Joanna Briggs Institute (JBI) critical appraisal checklists (Joanna Briggs Institute, 2022) as represented in Supplementary Table 1. The JBI critical appraisal checklists were used as they were freely available to reviewers, research-type-specific, and had been recently revised to reflect the current expansion of research synthesis (Barker et al., 2023; Joanna Briggs Institute, 2022). The purpose of this process was to determine the authenticity, validity, level of information, and representativeness of all included studies, ensuring methodological limitations and risk-of-bias were transparent (Barker et al., 2023). The articles were independently appraised by the first three authors. Any disagreements between scores were discussed until a mutual consensus was agreed. No studies were excluded based on a low appraisal score so to not introduce bias.

Data extraction: A data extraction table was used to compile relevant information across the studies and to promote rigor within the review (Whittemore & Knafl, 2005). This table provides an overview of the title, aim, authors, year of publication, design, participants, data collection, findings, and recommendations for each study.

Synthesis: The data were analysed using Braun and Clarke's (2006) thematic analysis: the six phases of, included familiarisation with the data (reading and underlining the main findings), populating a table with CYP's self-reported experiences for each study which were coded and grouped by similarity of meaning into categories, sub-themes, and

themes, reviewing the themes with the research team, naming the themes, and generating a report of the analysis (Braun & Clarke, 2006). This approach allows qualitative, quantitative, and mixed-method literature to be analysed by identifying and reporting patterns within a dataset, allowing for iterative comparisons across sources (Burnard et al., 2008). Applying this framework gave the research a systematic structure to enhance reliability and validity, and in turn can be better used to inform nursing practice and future research (Suri, 2019; Toronto & Remington, 2020). All steps of the analysis were reviewed by the research team which ensured emerging themes were strongly connected to the primary data.

Ethical Considerations: Ethical approval is not required for integrative reviews as an integrative review summarises past empirical or theoretical literature to provide a greater understanding of a particular phenomenon (Greenhalgh, 2019). However, ethical considerations play a prominent role in protecting human subjects (authors and participants) so ethical conduct in this review followed a systematic process (Wu et al., 2019). All literature was reviewed to ensure the included studies met ethical standards, indicated by ethical approval, informed consent, and protection of participant confidentiality. Ethical decision-making was ensured by the researchers engaging in constant discussions to address bias, subjectivity, reflexivity, and transparency (Suri, 2019). Research continues to demonstrate disparities of asthma disease burden for indigenous and minority populations, which presented cultural and political considerations for the present review (Barnard & Zhang, 2021; Global Asthma Network, 2018). It was therefore important that culturally diverse literature was included in the review.

Findings

The database search yielded a total of 2103 articles. A hand search of reference lists resulted in two further articles for review. Removal of duplicates ($n = 438$) via endnote left 1667 articles. All 1667 were screened by title and keywords which resulted in the exclusion of 1288 articles that were deemed irrelevant to the research question. Eleven articles were excluded as were unable to be sourced in full text, leaving 368 articles for title and abstract screening against the inclusion/exclusion criteria. The screening process is presented in the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) flow chart (Page et al., 2021) (Fig. 1). After reviewing the 368 articles, 11 met the inclusion criteria. A further study screening of references resulted in the inclusion of four further articles. Quality appraisal scoring for each study are presented in the Supplementary Table 1.

From the 15 included studies, thematic analysis generated three themes 1) health literacy, 2) health and wellbeing, and 3) tools and working together), six sub-themes, 12 categories, and 145 codes from 333 findings (Altay & Çavuşoğlu, 2013; Barikani et al., 2021; Cevik Guner & Celebioglu, 2015; Haze & Lynaugh, 2013; Horner et al., 2018; Isik et al., 2021; Kouba et al., 2013; McGovern et al., 2019; Nichols et al., 2020; Rasberry et al., 2014; Roberts et al., 2019; Sangnimitchaikul et al., 2022; Teufel II et al., 2018; Valizadeh et al., 2014; van Bragt et al., 2016) (Table 2).

Study and participant characteristics

In total, nine of the studies were conducted in the United States of America, two in Turkey, two in Iran, one in the Netherlands, and one in Thailand encompassing a rich set of manuscripts from developed and developing countries; however the majority of studies were from Western countries (Table 3). The various designs encompassed six randomized controlled trials (RCT) (Altay & Çavuşoğlu, 2013; Barikani et al., 2021; Cevik Guner & Celebioglu, 2015; Isik et al., 2021; Valizadeh et al., 2014; van Bragt et al., 2016), four non-RCT quantitative research (Kouba et al., 2013; McGovern et al., 2019; Rasberry et al., 2014; Sangnimitchaikul et al., 2022), three mixed methods research

Table 1
Inclusion criteria.

Inclusion Criteria
<ul style="list-style-type: none"> Published in the English language. Full text access. Published within the last 10 years (2013–2023). Primary research published in academic, peer-reviewed journals. Study participants are children and young people aged 5–24 years. Empirical research focusing on asthma self-management strategies with nursing involvement. Children or young people must be actively involved in the asthma self-management strategy. The researcher must be able to extrapolate children and young people's self-reported experiences during engagement in these strategies.

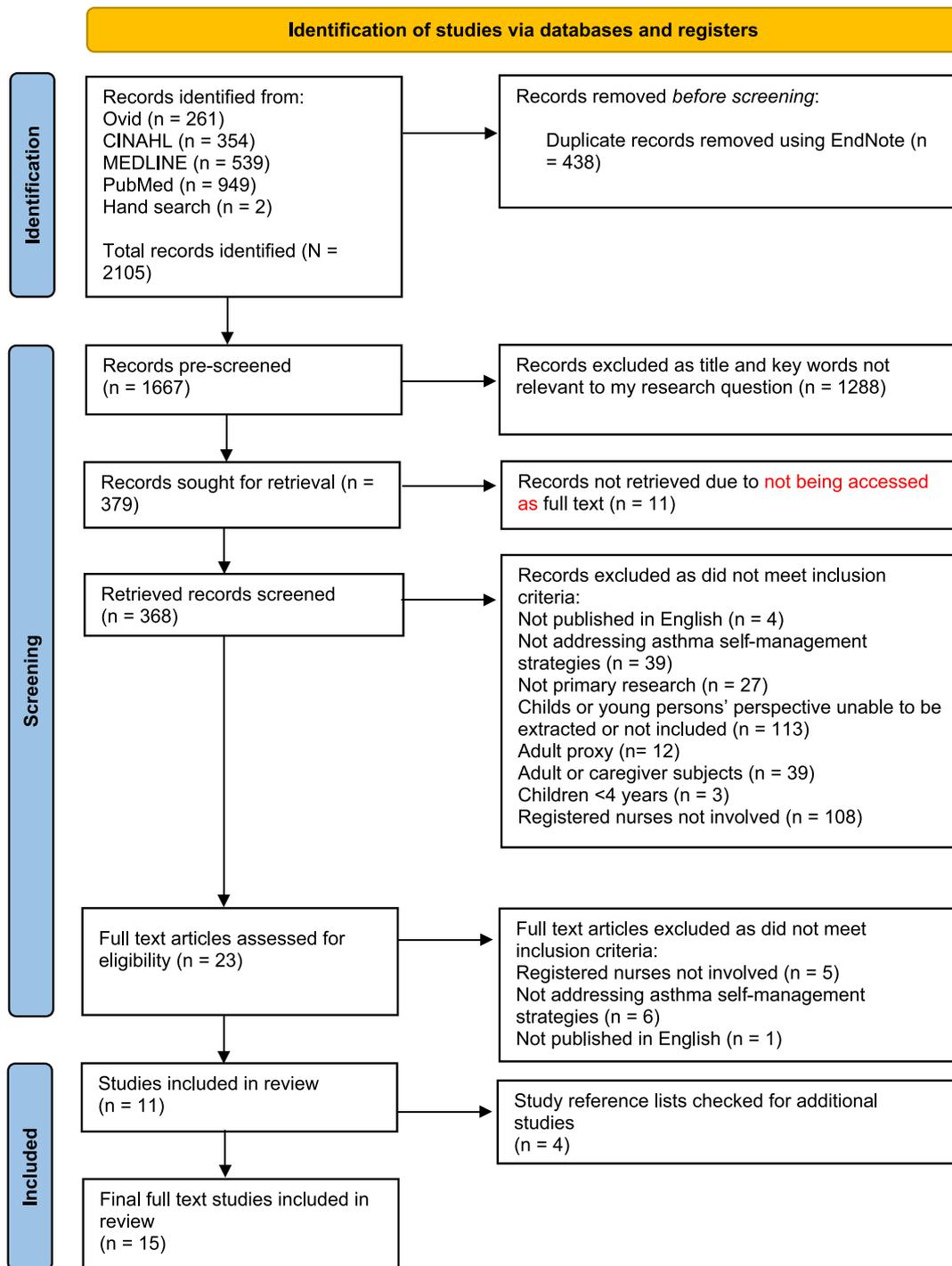


Fig. 1. PRISMA flow diagram.

(Haze & Lynaugh, 2013; Horner et al., 2018; Teufel II et al., 2018) and two qualitative research (Nichols et al., 2020; Roberts et al., 2019). The 15 studies included 1087 CYP with varying asthma severity: five studies included participants with general asthma (Altay & Çavuşoğlu, 2013; Horner et al., 2018; Isik et al., 2021; Rasberry et al., 2014; van Bragt et al., 2016), one included participants with moderate/severe asthma (Valizadeh et al., 2014), one included participants with mild/moderate persistent asthma (Haze & Lynaugh, 2013), one included participants with moderate/severe persistent asthma (Barikani et al., 2021), four included participants with mild/moderate/severe persistent asthma (Kouba et al., 2013; McGovern et al., 2019; Roberts et al., 2019; Sangnimitchaikul et al., 2022), one included participants with asthma/

bronchiolitis asthma (Cevik Guner & Celebioglu, 2015), and two included participants with high-risk asthma (Nichols et al., 2020; Teufel II et al., 2018). ASMS were implemented face-to-face (Altay & Çavuşoğlu, 2013; Barikani et al., 2021; Cevik Guner & Celebioglu, 2015; Horner et al., 2018; Isik et al., 2021; Kouba et al., 2013; McGovern et al., 2019; Rasberry et al., 2014; Sangnimitchaikul et al., 2022; Valizadeh et al., 2014), through e-health (Haze & Lynaugh, 2013; Nichols et al., 2020; Roberts et al., 2019; Teufel II et al., 2018), or both (van Bragt et al., 2016). JBI critical appraisal scores ranged from 7 to 10 (RCTs), 5–9 (quantitative research) and 6–9 (qualitative research) (Supplementary Table 1). Study and participant characteristics are presented in Table 3.

Table 2
Thematic analysis and representative quotes.

Themes	Sub-theme	Categories	Codes (n = number of codes)	Representative Quotes
Health Literacy	Preventing and managing exacerbation	Asthma attacks	Uncontrolled asthma attacks, self-efficacy in the prevention of asthma attacks, self-efficacy in the management of asthma attacks, management of asthma attacks, my allergies and emergency plan feature may improve asthma attack response, awareness about attack symptoms, and understanding how to treat attacks (n = 7).	<p>'... intervention, the rates of asthma attack management increased in both groups; though, there was a statistically significant difference between the two groups regarding these values' – Barikani et al., 2021, p. 120.</p> <p>'There was a significant difference in children's self-efficacy for asthma self-management pre-intervention (M 17.10, SD 5.20) to post-intervention (M 21.07, SD 4 > 16) (P = 0.001)' – Barikani et al., 2021, p. 120.</p> <p>'Post-test evaluation revealed that the experimental group reported fewer asthma attacks following more regular use of preventative and rescue medications (p < 0.05)' – Cevik Guner & Celebioglu, 2015, p. 862.</p> <p>'One participant stated that they liked the feature because the specific information users entered helped adolescents know what to do if their 'allergies cause something to do with your asthma' and they have an allergic reaction" – Roberts et al., 2019, p. 778.</p> <p>'There was a significant difference in children's medication adherence pre-intervention (M 3.77, SD 0.80) to post-intervention (M 4.62, SD 0.50) (P = 0.001)' – Barikani et al., 2021, p. 120.</p> <p>'You have your 'emergency asthma meds' and your 'my allergy meds' and you could know which ones the emergency meds and which ones are your emergency meds so it like gives you which one is like very important and which ones to take on a regular, regular basis' – Roberts et al., 2019, p. 778.</p> <p>'The overall controller medication adherence was 30%' – Teufel II et al., 2018, p. 7.</p> <p>'...it reminds me to stop whatever I'm doing and go take my medicine', 'you can learn how to take your medicine better so that it'll work better', and 'I prefer the app because you could actually do it by yourself' – Nichols et al., 2020, p. 8.</p> <p>'One teenager commented that before participating in the pilot, he was unaware that he had an RN care coordinator' – Haze & Lynaugh, 2013, p. 269.</p> <p>'Contrary to hypotheses, no significant mean differences were observed in asthma knowledge, F (2, 44) = 2.43, p = 0.09' – Kouba et al., 2013, p. 242–243.</p> <p>'...it'd be really nice maybe if it (the self-management application) could give you tips for using the triggers ... That would be cool to actually have some information that you can pull out of the app to help you' – Roberts et al., 2019, p. 777.</p> <p>'I loved it because we learned more about asthma', 'I learned how to control my asthma and anger' and 'the need to take asthma seriously' – McGovern et al., 2019, p. 9–10.</p>
		Medication	Medication adherence, beliefs about the necessity of taking drugs, concerns about taking drugs, use of preventer medication, use of rescue medication, wanted inhaler provision, app enhances autonomy through self-management of medication administration, capturing inhaler use, my allergies and emergency plan' feature increases medication knowledge, 'time to take medications' feature as a fun reminder, 'time to take medications' feature needs an alert reminder, medication adherence, and app helps track and remember medications (n = 13).	
	Education and self-management	Knowledge	Awareness of healthcare support, asthma knowledge, learnt asthma management knowledge, liked asthma education, learnt to take asthma seriously, asthma illness representations, want additional information about triggers and trigger management in asthma trigger feature, want more feedback from results of the self-check quiz feature, asthma-related problems, cigarette smoke as an asthma related problem, and asthma trigger feature improve asthma trigger awareness (n = 11).	
		Self-care	Adolescent self-care responsibility, parental self-care responsibility, self-care related to medicine usage, self-care related to PEF meter usage, self-care related to applying an asthma action plan, self-care related to keeping a daily follow-up schedule, self-care related to protecting against triggering factors, physical capability to perform own self-care, problems related to self-care, self-care relating to nursing diagnosis, asthma self-management measured by asthma control, asthma control, asthma self-efficacy, asthma self-care, asthma self-management, PFM usage, asthma management self-efficacy, self-efficacy, and actions to improve management (n = 19).	<p>'At the last home visit, the number of adolescents in the experimental group assuming responsibility for their own treatments had significantly increased, and the number of adolescents whose parents' assumed responsibility for their treatment had significantly decreased compared with the first visit' – Altay & Çavuşoğlu, 2013, p. 237.</p> <p>'There were no significant differences after the intervention in children's asthma self-management from week 0 (M 44.40, SD 9.24) to 13 weeks (M 50.00, SD 10.81) (t = 1.42, P = 0.19) post intervention' – Horner et al., 2018, p. 6.</p> <p>'44.3% (n = 31) of students with poorly controlled asthma at baseline had well-controlled asthma at follow-up; however, the remaining 55.7% of students with poorly controlled asthma at baseline remained classified as having poorly controlled asthma at follow-up. Of students with well-controlled asthma at baseline, 82.5% had well-controlled asthma at follow-up, while 17.5% (n = 22) had poorly controlled asthma at follow-up' – Rasberry et al., 2014, p. 11.</p> <p>'There was a significant difference in children's self-efficacy pre-intervention (M 2.67, SD 0.82) to post-intervention (M 4.45, SD 0.03) (P < 0.001)' – Valizadeh et al., 2014, p. 126.</p> <p>'Post-test evaluation revealed that the experimental group reported significantly fewer physical limitations in daily motions, and fewer asthma attacks following physical activity (p < 0.05)' – Cevik Guner & Celebioglu, 2015, p. 862.</p> <p>'If it's something really active, I can't do it as much as everybody else does ... I tried to join the dance team, but some of the stuff they do ... they do a lot of stuff ... so I'll get tired faster than everybody else' – Nichols et al., 2020, p. 7.</p> <p>'There were significant differences after the intervention in</p>
Health and Wellbeing	Active Living	Physical activity	Quality of life regarding activity limitations, physical activity self-efficacy, asthma morbidity in relation to asthma attacks following physical activity, and physical activity limitations (n = 4).	

Table 2 (continued)

Themes	Sub-theme	Categories	Codes (n = number of codes)	Representative Quotes
		Daily activities	Interruption of daily activities, ability to engage in daily activities, school absences, physical limitations in daily motions, and emergency service visits (n = 5).	<p>children's quality of life regarding activity limitations from week 0 (M 20.40, SD 4.55) to 13 weeks (M 10.00, SD 5.74) (t 5.32, P < 0.001) post intervention' – Horner et al., 2018, p. 6.</p> <p>'Sometimes at PE [physical education], when we're like running around and I was in the corridor, my lungs started to hurt' – Nichols et al., 2020, p. 7.</p> <p>'School absences, emergency room visits and hospitalizations significantly decreased following completion of the training program' – Cevik Guner & Celebioglu, 2015, p. 864.</p> <p>'There were no statistically significant differences in mean absences between the treatment group ($\mu = 1.33, SD = 1.57$) and the control group ($\mu = 1.83, SD = 1.54; t(70) = 1.35, P = 0.179$).'</p> <p>'- Isik et al., 2021, p. 486.</p> <p>'The mean score for the treatment group demonstrated a statistically significant effect between baseline to 6 weeks (P < 0.001, SD = 0.988) and from baseline to 12 weeks (P < 0.001, SD = 1.029) for interruption of daily activities' – Isik et al., 2021, p. 484.</p> <p>'I missed a little bit of school ... because I had a flare-up' Nichols et al., 2020, p. 7.</p>
	Mind-Body Health	Physical symptom	Day-time expectoration, day-time cough, day-time wheezing, day-time shortness of breath, night-time cough, night-time wheezing, night-time shortness of breath, night-time expectoration, quality of life regarding asthma symptoms, asthma symptoms, app enhances autonomy through symptom management, learning to manage asthma symptoms, cough, wheeze, chest tightness, shortness of breath (n = 16).	<p>'In this population of high-risk youth with asthma, symptoms of wheezing or chest tightness were never reported beyond a little with only coughing being infrequently reported as a lot' – Teufel II et al., 2018, p. 8.</p> <p>'There was a statistically significant difference in mean symptom scores (coughing, feeling tired, asthma attacks, wheezing, tightness in chest, shortness of breath, difficulty taking a deep breath, and trouble sleeping at night) for the treatment group when compared to the control group throughout three time points (baseline, post-intervention 6 weeks, and follow-up at 12-weeks); (F(2, 138) = 29.83, P < 0.001, partial $\eta^2 = 0.302$)' – Isik et al., 2021, p. 484.</p> <p>'The most frequently selected asthma-related problems during the first three visits was cough' Van-Bragt et al., 2016, p. 996.</p> <p>'The number of times as asthma related problem was selected by 115 children over 3 hospital visits for shortness of breath was N = 33, sore throat N = 28 and wheeze was N = 18' Van-Bragt et al., 2016, p. 997.</p>
		Psychological wellbeing	Quality of life regarding emotional functioning, quality of life, total quality of life, asthma coping, handling feelings, not feeling alone, separation anxiety, social anxiety, personal beliefs and confidence about managing stress, depression symptoms, total SACRED score, high anxiety participants, general anxiety, adverse event regarding high anxiety symptoms, adverse event regarding thoughts of self-harm, adverse events regarding thoughts of concerning behaviour, embarrassment, stigma, potential burden of EMA, importance of peer relationships, importance of social acceptance, social isolation, limit ability to engage with peers, perception from others, disease privacy from peers, pride and accomplishment in asthma self-management, stress, unrelaxed, unhappy, angry and bored (n = 31).	<p>'There were no significant differences after the intervention in children's quality of life regarding emotional functioning from week 0 (M 57.00, SD 5.34) to 13 weeks (M 59.50, SD 5.34) (t – 2.55, P = 0.031) post intervention' – Horner et al., 2018, p. 6.</p> <p>'Several students commented about how they liked seeing they were not alone in their daily struggles with their asthma ... significant reductions in anxiety and improvements in personal beliefs/asthma management self-efficacy, and asthma IRs were found despite the small sample size ... the participants not only felt calmer and more confident about being able to manage their asthma, they also had a more accurate understanding of asthma' – McGovern et al., 2019, p. 13.</p> <p>'Children who participated in COPE for Asthma reported a significant decrease in the separation anxiety factor of the SCARED (t = 2.00; df = 31; P = 0.054) with a small to moderate positive effect (Cohen's d = 0.41) A small to medium positive effect was observed for the decrease in social anxiety, although this did not reach statistical significance, (t = 1.49, df = 31, P = 0.15).'</p> <p>'- McGovern et al., 2019, p. 10.</p> <p>'There were significant differences after the intervention in children's quality of life two months after the intervention (M 144.44, SD 17.57) in comparison to the control group (110.78, SD 21.77) F 75.744 p = 0.000.' – Sangnimitchaikul et al., 2022, p. 164.</p>
Tools and working together	Strategies and features	Program/intervention/app	Did not like interacting with others, liked group safety, general positive comments, liked the interventionist, no negative comments about program, program needed to be longer, liked everything about the program, did not like how some of the questions were hard, did not like someone talking about their eating, app is easy to use, familiar with mobile technology, technology to manage routine maintenance and monitoring, comfortable using app, app is visually appealing, frequency of Ecological Momentary Assessments (EMA) use, easy to complete, fun, and childish (n = 18).	<p>'not wanting to interact/talk with others, some of the questions were hard, and someone talked about my eating' – McGovern et al., 2019, p. 10.</p> <p>'I felt really comfortable. It was an easy app to learn and I've been using it' – Nichols et al., 2020, p. 8.</p> <p>'I'm a kid, so the phone is my life' – Nichols et al., 2020, p. 8.</p> <p>'Children evaluated the Pelican instrument as easy to complete (95%) and fun to do (65%); however, 12.5% of children remarked that the instrument was somewhat childish' – Van-Bragt et al., 2016, p. 1001.</p>

(continued on next page)

Table 2 (continued)

Themes	Sub-theme	Categories	Codes (n = number of codes)	Representative Quotes
		Program/intervention/app	PFM feature to record PF measurements, PFM feature to track asthma status, want PFM feature to send alerts, PFM feature makes PFM easier, PFM feature aids potential documentation burden, want PFM feature to have an interactive game, asthma trigger feature useful to track triggers, chart feature assist in tracking asthma status, want the chart feature to cover a longer timeframe, diary feature to track asthma status, school form feature increases confidence in asthma self-management, self-check quiz feature to check asthma status, and self-check quiz feature to communicate asthma status to parents (n = 13).	'I used the peak flow feature with the chart, both of those because that's the thing that I monitor the most and the thing that I need the help, most help with tracking because it's easier to remember the medication and triggers but you really can't remember how your peak flows are doing over the week' – Roberts et al., 2019, p. 776. <i>'You can document how it's going and see if you're getting any better of it you're getting worse. That's what I really liked'</i> – Roberts et al., 2019, p. 776. <i>'You like sign it (school form) and like print it off then your doctor can sign it and you can take it to the school and like yeah, your doc – your nurse will let you use that asthma pump or something else.'</i> – Roberts et al., 2019, p. 778. <i>'I like how you can just like check up on how you're doing each day and if you feel okay, and then it tells you at the bottom like the total score, like if it's like between 10 and 12 or below you have trouble with this and that. So, I liked that.'</i> – Roberts et al., 2019, p. 779.
	Healthcare professionals	Therapeutic relationship	Nurse–patient relationship, nurse–patient communication, and communication preferences (n = 3).	<i>'Seventeen of the 20 responses indicated a perception of positive change in the nurse–patient relationship'</i> – Haze & Lynaugh, 2013, p. 269. <i>'Anecdotal patient comments in response to this question included that the communication "felt like friends texting'</i> – Haze & Lynaugh, 2013, p. 269. <i>"Some teenagers were more comfortable communicating with text messaging and believed that they were 'able to ask more questions' than in verbal phone communication."</i> – Haze & Lynaugh, 2013, p. 269.
		Provider interaction	Health information monitoring by healthcare professionals, not wanting to replace face-to-face care, doctors' appointment reminder feature helps remember appointments, improved access to nursing care, and feature facilitates provider interaction (n = 5).	<i>'Although text messaging and video conferencing were valued means of interaction, none of the participants wanted to completely replace traditional face-to-face encounters.'</i> – Nichols et al., 2020, p. 10. <i>'Adolescents noted how the asthma trigger feature could be used for reinforcing purposes through interaction with others, including healthcare providers'</i> – Roberts et al., 2019, p. 777. <i>"I think that really makes it a lot easier if you'd be able to communicate with your doctor and tell him what's going on ... if you want to just say here is how I'm doing, here are my peak flows. You know, do you think I need to do anything to adjust my asthma medications, is there anything? Do you think I should come back in for an appointment?"</i> – Roberts et al., 2019, p. 776. <i>'Like your diary, like you have something that's like kind of in-between ... your doctor can kind of tell if it's getting better or if it's worse'</i> (diary feature), <i>'you like sign it and like print it off ... take it to the school ... your nurse will let you use that asthma pump'</i> (school form feature), <i>'I have a lot of appointments and sometimes I forget them, so it reminds me'</i> (appointment reminder feature), and <i>'it's good ... I can give her information. I can send it ... so when I go back to the doctor she can say ... on this date you had some problems with your asthma, tell me about that'</i> (doctor report feature) – Roberts et al., 2019, pp. 777–779.

M mean, SD standard deviation.

Not-italicised quotes were extrapolated from Tables; italicised quotes are direct quotes.

Theme 1: health literacy

The theme health literacy included two sub-themes (preventing and managing exacerbation and education and self-management), four categories, and 50 codes generated from 142 findings evident across all 15 studies (Altay & Çavuşoğlu, 2013; Barikani et al., 2021; Cevik Guner & Celebioglu, 2015; Haze & Lynaugh, 2013; Horner et al., 2018; Isik et al., 2021; Kouba et al., 2013; McGovern et al., 2019; Nichols et al., 2020; Rasberry et al., 2014; Roberts et al., 2019; Sangnimitchaikul et al., 2022; Teufel II et al., 2018; Valizadeh et al., 2014; van Bragt et al., 2016).

Preventing and managing exacerbation

The sub-theme preventing and managing exacerbation included two categories being asthma attacks and medication, evident across six studies (Barikani et al., 2021; Cevik Guner & Celebioglu, 2015;

McGovern et al., 2019; Nichols et al., 2020; Roberts et al., 2019; Teufel II et al., 2018). All CYP reported experiencing uncontrolled asthma attacks initially in a RCT, however there were significant differences ($p < 0.05$) post-intervention (motivational interview) in the CYP's self-efficacy scores in the prevention/management of attacks and rates of attack management between control and intervention groups (Barikani et al., 2021). Similarly, a two-day training program reported significant ($p < 0.05$) results on better self-reported awareness of attack symptoms and knowing how to respond during an attack in the intervention group compared to the control group post-intervention (Cevik Guner & Celebioglu, 2015). CYP appreciated ASM applications, believing the process of inputting their medications and plan improved how they responded to attacks (Roberts et al., 2019).

Several studies explored medication adherence (Barikani et al., 2021; Cevik Guner & Celebioglu, 2015; Nichols et al., 2020; Teufel II et al., 2018). CYP who engaged in ASMS demonstrated significant

Table 3
Characteristics of included studies.

Author/Date/Country	Design, JBI Score	Participants	Data collection	Nursing strategy	Self-reported Findings and Recommendations
<p>Title: Using Orem's self-care model for asthmatic adolescents. Aim: The aim of the study was to determine the effect of Orem's self-care model on the self-care of adolescents with asthma.</p>					
Altay & Çavuşoğlu, 2013. Turkey.	Quantitative design. Two group randomized experimental design. Data was analysed using SPSS 11.5. Score: 10/13	80 adolescents with asthma diagnosed at least one year ago aged 12–18 years, using at least one long-term medicine and quick reliever, with no other chronic illness. The majority (67.5%) of adolescents were aged 12–14 years, and 72.5% were male.	Demographic data form and self-care data form based on Orem's self-care model. The self-care data form has 5 subscales related to self-care: medicines (16 questions), PEF meter (12 questions), Asthma Action Plan (2 questions), daily follow-up schedule (2 questions) and protecting against asthma triggers (42 questions). Both forms were completed by all adolescent's pre-intervention. The self-care data form was completed again post-study.	Home-visits. Intervention group had 8 home visits/individualised care over 5 months based on theory-guided nursing diagnoses developed from the self-care data form. Nursing diagnoses related to Orem's self-care model addressed deficiency in self-care related to (a) use of medicines, (b) use of a PEF meter, (c) application of an asthma action plan, (d) keeping a daily follow-up schedule, and (e) protection against factors triggering an asthma attack. Two home visits were made to the control group, visit one (beginning of the study) and visit two (5 months later). There were no nursing interventions for the control group, only routine care.	The number of adolescents in the experimental group assuming responsibility for their own treatments had significantly increased, and the number of adolescents whose parents assumed responsibility for their treatment had significantly decreased, compared with the first visit. No significant change was detected in the control group. All of the adolescents experienced problems related to self-care at the first visit. Nursing diagnoses related to the self-care of the adolescents in the experimental group began to decrease significantly after the third visit and again after the sixth visit. The five self-care skills also differed significantly between the experimental and control group at the final visit. Education and consultation services as well as intermittent home follow-up according to Orem's self-care model effectively facilitated an increase in the respective self-care skills of adolescents with asthma. The adolescent needs to be treated more like an adult and be given increasing responsibility for their self-care. We recommend that nurses facilitate the transfer of control over the illness to the adolescent by including them in decisions related to illness self-care.
<p>Title: The Impact of Motivational Interview on Self-Efficacy, Beliefs About Medicines and Medication Adherence Among Adolescents with Asthma. Aim: This study aimed to determine the impact of motivational interviewing (MI) on self-efficacy, beliefs about medicines and medication adherence among adolescents with asthma.</p>					
Barikani et al., 2021. Iran.	Quantitative design. Two group randomized experimental design. Data was analysed using SPSS 16. Score: 10/13	46 adolescents with moderate - severe physician diagnosed (last year) persistent asthma aged 10–18 years, with daily use of corticosteroid prophylactic medications, ability to speak Persian, and a willingness to communicate. 65% of adolescents were male.	Data was obtained through four questionnaires: demographic characteristics, Medication Adherence Scale (MARS) in Farsi, self-efficacy (CASES) questionnaire in Farsi, and the beliefs about medicines questionnaire (BMQ). Questionnaires were completed by self-report before the intervention and 40 days after the intervention.	Sessions of motivational interview. All received the routine standard treatment for the patients with asthma. Participants in the educational intervention group additionally received 3 extra one-hour sessions of MI each week. Sessions were held individually in the areas of medication adherence, beliefs about medicines and self-efficacy.	Adolescents' medication adherence, self-efficacy, and beliefs about medication were not significantly different between the control and intervention groups pre-intervention, however, there was a significant difference observed after the intervention across all variables. All the participants reported uncontrolled asthma attacks at the beginning of the study. After the intervention, the rates of management of asthma attacks increased in both groups; though, there was a statistically significant difference between the two groups regarding these values in favour of the experimental group. This research can help the healthcare team to be aware of the causes and solutions of medication adherence, the reasons to take medication, the ways to deal with anxiety regarding medication complications, as well as the ability to prevent and control asthma attacks in the routine educations for the

(continued on next page)

Table 3 (continued)

Author/Date/Country	Design, JBI Score	Participants	Data collection	Nursing strategy	Self-reported Findings and Recommendations
<p>Title: Impact of symptom management training among asthmatic children and adolescents on self-efficacy and disease course. Aim: The study was conducted to examine the effect of a training program provided to asthmatic children/adolescents on disease course and self-efficacy.</p>					
Cevik Guner & Celebioglu, 2015. Turkey.	Quantitative design. Two group randomized experimental design. Data was analysed using SPSS 13. Score: 10/13	80 children and adolescents with bronchiolitis asthma or asthma aged 10–18 years, who are using inhaler treatments, have healthy vision and hearing, willingness to communicate with researchers, and no previous training in asthma management.	Data was obtained through the; Asthmatic Child Information Form (IF), Disease Evaluation Form (DEF), Peak Expiratory Flow Rate Evaluation Form (PEFREF), and an Asthmatic Child/Adolescent Self-Efficacy Scale (ACASES). IF, DEF and ACASES were completed pre-test. 2 months post-intervention, DEF and ACASES were recompleted. PEFREF was completed by the experimental group in visits three and six.	2-day training program. Sessions lasted 45– 50 min. The training materials consisted of a VCD with information about asthma maintenance and an asthma self-management booklet. Following completion of the training program, four additional visits were conducted at 15-day intervals. During these visits, additional concerns were addressed, treatment support was provided, and support of the children and adolescents was provided to meet their personal needs.	patients with asthma. While the difference in pre-test self-efficacy scores was not statistically significant between groups, post-test self-efficacy scores were significantly different in favour of the experimental group. Both experimental and control groups significantly increased their self-efficacy scores. The frequency of day-time cough and wheezing and night-time cough differed significantly between the experimental and control groups in post-test evaluation, in favour of the experimental group. The frequency of other daytime and night-time symptoms did not differ significantly post-test. Post-test evaluation revealed that the experimental group reported significantly fewer physical limitations in daily motions, fewer asthma attacks following physical activity, fewer school absences, fewer emergency service visits, better awareness about attack symptoms, better knowledge of what to do in an attack, and more regular use of medications relative to the control group. Nurses should offer the training program to support children/adolescents during asthma attacks and encourage the development of self-efficacy. Nurses must be equipped with sufficient knowledge of the behavioural aspects involved in the treatment of asthma in children and adolescents.
<p>Title: Building Patient Relationships: A Smartphone Application Supporting Communication Between Teenagers With Asthma and the RN Care Coordinator. Aim: To study the feasibility and efficacy of using a smartphone to communicate between a patient with asthma and his/her RN care coordinator.</p>					
Haze & Lynaugh, 2013. United States of America.	Mixed methods design. Score: 8/10 and 5/8	25 teenagers with mild to moderate persistent asthma aged between 13 and 18 years who are already enrolled in the paediatric asthma care coordination program.	Data collection methods included data logs from the smartphone application (base-line, bimonthly, and end-of-pilot patient surveys. Post-pilot, semi structured interviews with patients and RN care coordinators. Of the 25 teenagers who beta-tested the app, 20 completed these interviews.	Patient and RN communication application. Use of a mobile health smartphone application in which the patient could (a) complete a questionnaire assessing asthma control in which most recent answers were displayed on the dashboard, (b) view a personalized asthma action plan, (c) select to view education modules, and (d) send text messages to their RN care coordinator. The RN care coordinator could enrol the patient, input patient-specific information, view patient application use, and text message.	17 of the 20 responses indicated a perception of positive change in the nurse-patient relationship. Some teenagers were more comfortable communicating with text messaging. Several teenagers indicated that improved access was the reason for an improvement in the relationship with the RN care coordinator. Although the RN care coordinators did not increase shift hours and were not available outside scheduled clinic hours, the teenagers commented that it was easier to contact their nurse and received a quicker response than with traditional telephone communication. One teenager reported that he did not know he had an RN care coordinator. This pilot reinforced the strong need for nursing to become involved in the development and utilization of technology to ensure that

emerging technologies are used to enhance patient care, not to replace nursing care.

Title: Feasibility study of a combined lifestyle behaviours and asthma self-management intervention for school-aged children.

Aim: The aims for this study were to (a) Test the feasibility (acceptability, retention) of implementing a 12-week family-based intervention that combined lifestyle health promotion with a focus on weight management and asthma self-management (Living Healthy with Asthma) and (b) examine changes in children's asthma self-management, metered dose inhaler (MDI) skill, asthma severity, QOL, physical activity self-efficacy, dietary quality (total calories, calories from sugar, daily fruit servings, daily vegetable servings), and BMI from pre-test to post-test at 13 weeks.

Horner et al., 2018. United States of America.	Mixed methods design. Quantitative data analysed using SPSS-PC 19. Qualitative data were analysed with simple descriptive analysis. Score: 9/9 and 6/10	13 normal weight and obese children with a physician diagnosis of asthma aged between 9 and 14 years, experiencing current asthma symptoms (last 12 months) and who are able to read and speak English or Spanish.	Data collection methods included asthma related - 13-item Asthma Inventory for Children (measure of asthma self-management), 9-item Child Physical Activity Self-Efficacy Scale, and the 23-item Paediatric Asthma Quality of Life scale.	Living Healthy with Asthma. The Living Healthy with Asthma intervention was delivered over 12-weeks in 6 home visits (weeks 1, 2, 4, 6, 9 and 12) and three support phone calls (weeks 3, 5, and 7). The intervention addressed both asthma self-management and healthy lifestyle behaviours for weight management. Home visit started with a motivational interviewing (MI) approach. Concerns were addressed, and behaviours were identified for nutrition, physical activity, and asthma self-management to change. Challenges and solutions were discussed. Children set goals that were feasible, flexible, and achievable in the next week. Educational information and PEF meters were given.	By week 13, children significantly improved their total quality of life from baseline to post-test. Within quality of life scores, the difference between baseline to post-intervention scores for asthma symptoms, emotional functioning, and activity limitations were all significant. There was no significant difference after the intervention in children's asthma self-management or physical activity self-efficacy, however these scores did improve post-test. The findings supported the feasibility of implementing a family-based intervention that combined lifestyle health promotion with asthma self-management using MI and goal setting with home visits and telephone monitoring. Our experience indicates it would be better to focus on overweight and obese children with asthma in future studies. The intervention needs to be lengthened with additional visits and longer follow-up to continue monitoring and encouraging families as they make lifestyle and asthma self-management behavioural changes. Comprehensive, multi-focused interventions have the potential to help nurses meet the complex needs of their patients who are dealing with comorbid conditions.
---	---	--	---	--	--

Title: A School Nurse–Led Asthma Intervention for School-Age Children: A Randomized Control Trial to Improve Self-Management.

Aim: The purpose of this study examined the effectiveness of a theoretically based school nurse–led asthma intervention on symptoms, asthma self-management with peak flow meter (PFM) usage, interruption of daily activities, and school absences in a sample of elementary school-age children between the ages of 7 and 12.

Isik et al., 2021. United States of America.	Quantitative design. A randomized controlled, two-group, repeated measures design (pre-test, post-test, and follow-up test). Data was analysed using SPSS 25. Score: 9/13	71 English speaking children with diagnosed asthma aged 7–12 years with no other disabilities or comorbid medical conditions sourced from eight elementary schools. 63% of participants were female. Participants had a mean age of 9.29 years.	Data collection methods were the; Asthma Control and Variation Questionnaire (ACQ), and the Paediatric Asthma Quality of Life Questionnaire with standardized activities (PAQLQ(S)). PFM frequency was obtained from the device and as reported.	6-week school-nurse led asthma intervention. The randomly assigned treatment group participated in a theoretically based school nurse–led asthma intervention comprised of 6 weekly 30-min group lessons in eight elementary schools. The PI, who is also a school nurse, implemented the intervention sessions at all the eight schools. Topics included asthma disease and pathophysiology, PFM, identification of asthma symptoms and implementation of an asthma action plan, medications, recognition and control of asthma triggers and breathing exercises, and discussion of individualised choices and goal setting for	Whilst there was no significant difference at baseline between the two groups in relation to asthma symptoms, there was a statistically significant difference in mean symptom scores for the treatment group when compared to the control group throughout three time points. Within the treatment group, the mean symptom score demonstrated a statistically significant effect from baseline to 6 weeks and 12 weeks, and 6 to 12 weeks. The control group symptoms did not significantly improve; the mean score for the control group significantly decreased from baseline to 6 weeks and 12 weeks. The mean score did not significantly change
---	---	---	--	--	---

(continued on next page)

Table 3 (continued)

Author/Date/Country	Design, JBI Score	Participants	Data collection	Nursing strategy	Self-reported Findings and Recommendations
				<p>self-management. Sessions included hands on experiences, problem-based learning techniques, role-play, case studies, storytelling, classroom discussion, and colouring to enhance class interaction and learning. Treatment participants were given a PFM with a personal PF chart and spacer. The control group received usual asthma care.</p>	<p>from 6 to 12 weeks. Whilst there was no significant difference at baseline between the two groups in relation to asthma control, there was a statistically significant difference in mean asthma control scores in the treatment group compared to the control group from baseline to 6 weeks and 12 weeks. The mean asthma control score for the treatment group demonstrated a statistically significant effect between baseline to 6 weeks and 12 weeks, and from 6 to 12 weeks. There were no statistically significant differences in the control group asthma control scores over time.</p> <p>PFM usages significantly increased in the treatment group post-intervention. Significant differences in PFM usage were also found between the intervention and control group post-intervention. Whilst there was no significant difference at baseline between the two groups in relation to interruption of daily activities, there was a significant difference post-intervention. The mean score for the treatment group demonstrated a statistically significant effect between baseline to 6 and 12 weeks. No significant effect was found for the control group. There were no statistically significant differences in mean absences between the treatment group and the control group, however, the treatment group missed fewer school days than the control group over the 12 weeks. There was a statistically significant difference on the quality-of-life scores in the treatment group compared to the control group between baseline, 6 and 12 weeks. The mean score for the treatment group demonstrated a statistically significant difference in quality-of-life scores from baseline to 6 and 12 weeks, and 6 to 12 weeks. The mean quality of life score for the control group decreased significantly between baseline to 6 weeks. This study demonstrated that children must know their own health condition. Offering an age-appropriate health intervention is essential to increase awareness and self-management of health. Orem's self-care theory supports education programs for children to learn/adapt new skills for asthma self-management. This study has the potential to motivate school nurses and health leaders to implement school nurse-led interventions for asthma,</p>

thus empowering children with knowledge and skills for optimal well-being.

Title: Efficacy of the I Can Control Asthma and Nutrition Now (ICAN) Pilot Program on Health Outcomes in High School Students With Asthma

Aim: The present research aims to determine the effectiveness of the ICAN program on nutrition knowledge and dietary behaviours, specifically increased intake of fruits and vegetables, decreased intake of sugar-sweetened beverages, decreased screen time, and increased breakfast consumption. In addition, the present research aims to determine the effectiveness of the ICAN program on asthma self-care, asthma-related QOL, asthma knowledge, coping, asthma health outcomes, and weight status.

Kouba et al., 2013. United States of America.	Quantitative design. Quasi-experimental study. All data were entered and analysed using SPSS 17. Score: 6/9	25 urban minority high school students with a physician diagnosis of mild, moderate or severe persistent asthma, a prescription medication for asthma, enrolled in 9th – 12th grades at the participating school, able to read and write English at the fourth grade level, and without any other chronic diseases.	Adolescent data was obtained through the following measures at baseline, first post-test and second post-test: Self-care agency; ASC (Adolescent Coping Scale), AKT (Asthma Knowledge Test), ABS (Asthma Self-Belief Scale). Self-care measures; the Asthma Self-Care Practice Instrument. Health outcomes; PAQLQ (Paediatric Asthma Quality of Life Questionnaire, and ACT (Asthma Control Test).	Combined asthma and lifestyle intervention. The I Can Control Asthma and Nutrition Now (ICAN) program is an educational and supportive innovative school-based program implemented by a multidisciplinary team to improve the health status of youth with asthma who are at risk of unhealthy weight through education and behavioural approaches, based on Orem's self-care deficit theory. The program is composed of asthma education, nutrition education synthesized with CST, targeting obesity prevention/management, visits with an RN and dietetic intern, and a family meeting. Program delivery was during the lunch period, and sessions were 45–60 min. Electronic home modules were offered. Sessions covered an 8-week period, followed by two visits. Program spanned 14 weeks.	Initial correlation findings suggest that there is an important connection between nutrition and asthma. Proper nutrition self-efficacy and knowledge is associated with increased self-care and QOL for those with asthma. Significant increases in asthma knowledge, asthma self-efficacy, asthma quality of life, and asthma self-care, were observed over the course of the pilot program. No significant differences were observed in asthma knowledge and asthma coping. Increased ICAN dosage was significantly predictive of increased asthma QOL at the first and second post-test. ICAN dosage was not predictive of any other study outcomes. The ICAN program has demonstrated promising preliminary results in improving asthma health outcomes with urban minority high school students. Future research should implement a randomized experimental design with a larger sample size.
--	---	---	--	---	---

Title: COPE for Asthma: Outcomes of a Cognitive Behavioural Intervention for Children With Asthma and Anxiety.

Aim: The specific aims of this study were to (1) assess the feasibility and acceptability of the seven-session COPE for Asthma intervention for children with persistent asthma and elevated symptoms of anxiety/depression delivered in group format in schools, and (2) examine the preliminary efficacy of the COPE for Asthma program on anxiety and depressive symptoms, asthma management self-efficacy, symptom interpretation, asthma IRs, controller medication adherence, asthma-related quality of life (QOL), health care utilization, and asthma control.

McGovern et al., 2019. United States of America.	Quantitative design. Quasi-experimental design. Data was analysed using SPSS 24. Score: 6/9	33 children aged 8–12 years enrolled in a participating school who had a diagnosis of persistent asthma, a previous prescription of an asthma controller medication, elevated scores on at least one factor of the anxiety or depression measure, no other pulmonary conditions or learning limitations, were fluent in English, were not receiving treatment from a mental health professional, and their caregiver had at least equal responsibility for the daily management of the child's asthma. The mean age was 9.42 years.	Data was obtained through the following questionnaires at baseline and immediate post-intervention completed by child participants; SACRED (Screen for Child Anxiety Related Emotional Disorder), PROMIS (Patient Reported Outcomes Measurement Information System) Short Form for Depressive Symptoms, CASE (Child Asthma Management Self-Efficacy), PBS-C (Personal Beliefs Scale – Child Version), CASCL (Childhood Asthma Symptom Checklist), AIRS-C (Asthma Illness Representation Scale Child Version), PAQLQ (Paediatric Asthma Quality of Life Questionnaire), and C-ACT (Childhood Asthma Control Test). Children also answered immediate post-intervention programme evaluation questions.	COPE for Asthma. The COPE for Asthma intervention targets providing accurate asthma education integrated with cognitive-behavioural skills building to improve children's understanding about asthma management to be more in line with the professional model of asthma. The goal is to enhance children's self-efficacy and ability to cope with the stressors/challenges associated with their asthma, therefore reducing anxiety/depressive symptoms. It helps children build and use CB skills (changing negative thoughts to positive thoughts, self-talk, guided imagery, activities to stay present, goal setting, and problem solving). Sessions were scheduled to occur each week for seven weeks during lunch, each lasting 30 min. Small groups (five students or less) were separated by lunch periods and age groups (2nd and 3rd graders were in the earlier lunch, and 4th through 6th graders were in the second	Results indicated that the program was highly feasible to implement in small groups during the school day. The program evaluation comments were overwhelmingly positive (97%), indicating acceptability of the COPE for Asthma program. Children who participated in COPE for Asthma reported a significant decrease in the separation anxiety factor of the SCARED with a small to moderate positive effect. A small to medium positive effect was observed for the decrease in social anxiety, although this did not reach statistical significance. Significant improvements were made on the child's personal beliefs with a small to moderate positive effect, asthma management self-efficacy with a small to moderate positive effect, and asthma illness representations with a medium positive effect. Quality of life achieved a small effect size, although this did not reach statistical significance. No clinically
---	---	---	--	---	---

(continued on next page)

Table 3 (continued)

Author/Date/Country	Design, JBI Score	Participants	Data collection	Nursing strategy	Self-reported Findings and Recommendations
				lunch) period. COPE for Asthma book was used as a workbook and kept at school during the intervention period. Children answered four/five questions after each session to assess comprehension.	or statistically significant differences were observed for children's depression scores or asthma control. The subgroup of children scoring high on anxiety at baseline (≥ 30 on the SCARED measure) showed reductions with the intervention, having large positive effect sizes for separation and social anxiety as well as medium and large positive effect sizes on the personal beliefs and asthma illness representations, respectively. Given that children with asthma and anxiety have increased morbidity, providing tools to reduce anxiety and improve asthma control can contribute to positive life changes for this population. While implementing an intervention for children with asthma and anxiety may require extra time, taking a proactive approach may save time and class interruptions in the long run.
Nichols et al., 2020. United States of America.	Qualitative design. Thematic analysis was used inductively through emergent findings and deductively based on self-determination theory (SDT). Score: 9/10	11 (phase one) and 19 (phase two) children and adolescents aged 8–17 years with high-risk asthma, prescribed a controller and rescue medication compatible with Bluetooth inhaler cap, English speaking, has a phone compatible with Bluetooth devices, has a primary care provider with at least one visit in the past year, and has a willingness and availability to participate in study visits.	Dyadic KIs were conducted with the enrolled youth using a semi-structured interview guide following the completion of the 2-month interventional phase of the study.	Asthma self-management application. Phase 1 focused on assessing the feasibility and acceptability of collecting real-time asthma information, and phase 2 included the intervention of asynchronous video assessment of inhaler use techniques and synchronous direct-to-consumer telehealth encounters. Enrolees had the SAMS app downloaded to their mobile phones and were requested to report EMAs daily. The EMA included 8 questions on their asthma symptoms, mood, or affect. Participants were asked to track asthma medication use for a 2-month period. Each study participant completed 1 video capture session and 1 telehealth visit to assess feasibility, acceptability, and preferences towards these approaches, including their perceived benefits on the educational content from the personalized inhaler feedback.	Children explained how asthma affects their ability to engage in activities, causes them to miss school days, and can even lead to embarrassment and potential stigma. The major themes included autonomy, competence, relatedness, and the impact of asthma on life. Older adolescents expressed that they were able to take on a more active role and expanded autonomy through self-management of medication administration and symptom management. All participating children shared the sentiment that it was easy to use and highlighted the use of technology as a normative component of their daily lives. Children demonstrated a strong willingness and ability to actively engage in their care. Children reported the importance of relatedness, underscoring the importance of peer relationships and social acceptance. They further expressed how asthma has the potential to increase social isolation and limit the ability to engage with peers at the same level or for the same duration. The study demonstrated the feasibility of enhancing the self-management of asthma by youth in the community. The use of mobile apps among high-risk children with asthma and their parents shows promise in improving self-management,

Title: Patient and Parent Perspectives on Improving Paediatric Asthma Self-Management Through a Mobile Health Intervention: Pilot Study.

Aim: This study aimed to explore the perceptions of youths with high-risk asthma and their caregivers on the use of a smartphone app, Smartphone Asthma Management System, in the prevention and treatment of asthma symptoms, possible use of the app to improve self-management of asthma outside traditional clinical settings, and the impact of asthma on everyday life to identify potential needs for future intervention development.

medication adherence, and disease awareness and in reducing overall disease morbidity.

Title: Indicators of asthma control among students in a rural, school- based asthma management program.

Aim: The evaluation examined whether a comprehensive model of a school-based asthma management program in a small, rural school district helped students improve their asthma control. To determine this, evaluators posed two key questions: (1) “Did students in the asthma program demonstrate better asthma control than students in a comparison group?” and (2) “Did students in the asthma program experience improvements in indicators of asthma control between baseline and follow-up?”

<p>Rasberry et al., 2014. Quantitative design. United States of America. Quasi-experimental, cross-sectional design. Data was analysed using SAS 9.3. Score: 9/9</p>	<p>$N = 456$ students with asthma ($n = 299$ in the intervention school, $n = 157$ in the comparison school) aged 6–17 years participated in cross-sectional data collection. Mean age was 12.04 and 12.38 in intervention and comparison groups respectively.</p>	<p>Self-report data was obtained by the ACQ (Asthma Control Questionnaire).</p>	<p>School-based program. The asthma program in the intervention district included asthma education, case management, and asthma training for staff. Asthma education included both formal and informal strategies, including computer-based programmes, asthma support groups, and all-day workshops. Staff also conducted informal, one-on-one education. School nurses and the asthma educator provided case management. The comparison school district had no formal asthma program, but school nurses conducted basic activities as part of normal nursing duties.</p>	<p>Findings revealed the intervention district students with asthma exhibited significantly better asthma control (measured by ACQ) than comparison district students with asthma, even when controlling for race, age, gender, and grade. Intervention district students had, on average, an asthma control score 0.21 points lower than comparison district students. 51.8% of the students from the intervention district had well-controlled asthma, whereas 40.1% of students from the comparison district had well-controlled asthma. The odds of having well-controlled asthma were 54.8% higher for students in the intervention school district than for students in the comparison school district. The collective evidence provides support for school-based programs to use comprehensive approaches (e.g., including education and trigger reduction for students living with asthma and families, case management, and linkage to clinical care) to improve students' asthma control.</p>
--	---	---	--	---

Title: Adolescent feedback on predisposing, reinforcing, and enabling features in asthma self-management apps.

Aim: We aimed to gain feedback from adolescents with asthma on two existing asthma self-management apps to guide the development of an evidence and theory-based asthma app that meets their asthma management needs. We sought to classify features of two existing apps as predisposing, reinforcing, and enabling use as posited by the PPM, as well as how adolescents perceive and actually engage with such features. In addition, we examined how adolescents would improve upon existing features for additional predisposing, reinforcing, and enabling uses to meet their asthma self-management needs.

<p>Roberts et al., 2019. Qualitative design. Data was analysed using SPSS 24 and thematically using MAXQDA II. The Precede-Proceed Model (PPM) was used to evaluate perceptions of app features. Score: 9/10</p>	<p>20 adolescents with persistent asthma aged 12–16 years who were able to read and understand English, owned a cell phone, smartphone or tablet, and were present at the visit with an adult caregiver.</p>	<p>Adolescents completed a brief demographic survey. Participants provided feedback on usability and experiences of two asthma-self management apps during two semi-structured interviews at baseline and then 1-week after using.</p>	<p>Asthma self-management application. After their medical visit, adolescents were given an iPod preloaded with two asthma self-management apps and shown how to use the apps. We selected one app, iAsthma in Control, targeted towards children and another app, AsthmaMD, targeted towards adults. Participants explored each app individually for approximately 10 min, and then provided feedback on both apps during a semi-structured 30-min interview. Adolescents were instructed to use both apps over the course of the following week. One week later, adolescents completed a 30-min telephone interview that included questions on overall impressions of the apps and how features can be improved to meet their needs.</p>	<p>The majority of app features functioned as enabling asthma self-management according to the adolescents (e.g. inputting triggers, time to take medications, recording doctor's appointments and tracking peak flow). Adolescents noted the utility of various features of the asthma self-management applications in communication with their medical providers and facilitating their interactions with healthcare providers, including reminders of health appointments, logging asthma-related data, and recollection of symptoms. Participants recommended addition of predisposing and reinforcing features, including knowledge on dealing with asthma triggers and improving trigger awareness (predisposing) a reward system for daily peak flow entry (reinforcing), and the ability to schedule more alerts or reminders to better support their asthma management. Findings suggest that including predisposing, reinforcing and enabling features in asthma apps could facilitate asthma</p>
--	--	--	--	---

(continued on next page)

Table 3 (continued)

Author/Date/Country	Design, JBI Score	Participants	Data collection	Nursing strategy	Self-reported Findings and Recommendations
					self-management. Public health professionals should partner with app developers in the development of asthma self-management apps that include predisposing, reinforcing and enabling features to meet the needs of adolescents and ensure they are effective and accepted behaviour change apps.
<p>Title: The Effectiveness of a Family-Based Asthma Self-Management Program in Enhancing the Asthma Health Outcomes in School-Age Children. Aim: This study is aimed then developing and evaluating an intervention for the asthma management of school-age children with a focus on the family as a unit of care to develop family interventions for transferring asthma management responsibilities to school-age children. The purpose of this study was to evaluate the effectiveness of a family-based asthma self-management program in enhancing health outcomes, including asthma control status, pulmonary function, and the quality of life of school-age children with asthma.</p>					
Sangnimitchaikul et al., 2022. Thailand.	Quasi-experimental design. Randomized controlled trial. Score: 8/9	37 children (7–12 years) diagnosed with mild to severe persistent asthma and uncontrolled asthma by a physician for at least six months that attended the outpatient pulmonary department at a university hospital in Thailand. Children mustn't have history of developmental delays/cognitive impairment, have no other chronic diseases, be of Thai ethnicity, and be able to communicate in Thai.	Families completed the demographic questionnaire at baseline. The Childhood Asthma Control Questionnaire (C-ACT) and the Paediatric Asthma Quality of Life Questionnaire (PAQLQ), translated into Thai at baseline and again after the intervention of the program at 2-months.	Family-based asthma self-management program based on the individual/family self-management theory. Children were grouped into 7–8 years and 9–12 years and matching pairs for asthma severity. Each pair was assigned into the experimental and control groups. The experimental group received routine nursing care for asthma and participated in the activities of the family-based asthma self-management program. Three 60-min sessions conducted in the clinical setting over two months. Program components were developing asthma knowledge, beliefs and skills, practising role functioning to transfer asthma management responsibility, enhancing effective family communication, training self-monitoring, building positive affective responses, and enhancing confidence in self-management skills. This was tailored to the individual families to practice family functioning and the children's self-management. The control group received routine nursing care for asthma only.	The results demonstrated that the family-based asthma self-management program increased the asthma control status, pulmonary function, and quality of life of the children after implementation, whereas routine nursing care did not. Children in the experimental group were able to take their own asthma medicine and assess abnormal symptoms, leading to the perception of the warning signs of an asthma attack and the ability to take action to avoid asthma triggers. Consequently, the school-age children were able to prevent and manage their symptoms, resulting in decreased severity of asthma attacks and enhanced physiologic status, such as good asthma control and better quality of life. A family-based asthma self-management program such as the one employed in this study can be utilized as a nursing intervention so that patients and families can collaborate to increase the self-management skills of school-age children. To be successful, asthma management requires encouraging the children to manage their asthma on their own, and for this effective communication within the family is vital. These can be considered critical factors for successfully maintaining effective self-management. This program appears to have increased the ability and confidence of the school-age children in terms of managing their asthma. It can also be linked to contributing to clinical improvements of childhood asthma, such as asthma control and quality of life.
<p>Title: Smartphones for Real-time Assessment of Adherence Behaviour and Symptom Exacerbation for High-Risk Youth with Asthma: Pilot Study. Aim: This study aimed to design and test the feasibility of using smartphone technology to assess contextual factors that may impact changes in daily medication adherence and to identify new symptom episodes among high-risk youth with asthma in their home environment. Secondly, this study aimed to explore contextual factors that may impact daily adherence behaviour, as well as understand the utility of the collected data for the identification of newly symptomatic patients.</p>					
Teufel II et al., 2018. United States of America.	Mixed methods design. Data was analysed using SAS 9.4. Score: 6/10 and 7/8	14 youth with high-risk asthma aged 8–16 years who are prescribed with a controller and rescue medication compatible with Bluetooth inhaler cap, own a smartphone, English speaking, have	Data available through the SAMs app; EMA (Ecological Momentary Assessments) and medication use (Bluetooth Inhaler Caps and manual entry). After the 2-month study period the acceptability was	Asthma self-management application. The SAMS (Smartphone Asthma Monitoring System) app was downloaded on participants' phones at enrolment. Daily text message (short message service)	Over the 2-month study period, participants reported coughing (38%), wheezing (7%), chest tightness (8%), boredom (52%), and 10 new asthma symptom episodes. The controller

an identified primary care provider (with at least one visit in the last year) and at least one caregiver present for enrolment.

assessed with a usability survey, semi-structured key informant interviews (KII), and frequency of days with asthma data.

KII data were used in an iterative design approach to identify challenges, strengths, and suggestions for maximizing use. A more extensive qualitative analysis is reported in Nichols et al., 2020.

reminders were sent to complete ecological momentary assessment (EMA) of asthma symptoms and other contextual factors such as emotional state. Bluetooth inhaler devices were used to record timestamps of inhaler use with the ability to review and manually enter use of controller or rescue medication. All participants were instructed to enter their 8-item EMA daily. Providers were able to review youth asthma data in real time through the linked web-based portal. The portal has the capability to automatically process data and send pre-programmed reminders or reports to patients, caregivers or providers through email, reminders, or SMS text messages.

medication adherence was low (30%), which increased significantly on days with reported asthma symptoms or boredom, suggesting that daily contextual factors may be associated with a change in adherence behaviour. Surveys and KIIs suggest acceptability among youth. All youth agreed or strongly agreed with the statement “I feel comfortable with a doctor or a nurse monitoring my health information using mobile technology.” Following an iterative redesign using enrollee feedback, the percentage of enrollees who responded agree or strongly agree to the app being visually appealing increased non-significantly from 60% to 100%. Enrolees had data collected 89% of days, a significant increase when compared to enrollees prior to the redesign, signalling improvements in ease of use. Challenges reported during the study included lost or damaged phones and available memory. Medication adherence was higher on days with reports of no symptoms than on no report days, suggesting no report days were similar to no symptom days but might represent days with even lower adherence. Understanding the reasons for daily adherence behaviour among high-risk youth with asthma might lead to better-tailored interventions that maximize adherence. Larger studies should be performed to determine the generalizability of the findings.

Title: The Effects of Triggers' Modifying on Adolescent Self-Efficacy with Asthma: A Randomized Controlled Clinical Trial.

Aim: The aim of this study was to examine the effects of a triggers' educational-modifying intervention on self-efficacy among adolescents diagnosed with asthma living in Iran.

Valizadeh et al., 2014, Iran.

Quantitative design. 4-month two group randomized experimental design conducted in a paediatric pulmonary clinic. Data was analysed with SPSS 13. Score: 10/13

60 adolescents with moderate or severe asthma diagnosed by a physician 1 year ago or more aged 12–18 years with no other concurrent conditions (including mental health conditions). Participants were selected from the university clinic in an urban setting.

The self-efficacy scale for children with asthma developed by Bursh et al. was used for data collection. All participants completed the self-efficacy scale at two periods before the intervention, and five weeks after the intervention.

Educational and modifying intervention. Control group received standard care, whilst the experimental group participated in a 5-week, nurse led, triggers modifying educational intervention. Participants were placed into two groups (12–15 and 16–18 years) and sessions were designed accordingly. Four educational sessions were delivered via lectures, discussion, Q&A, and educational booklets twice a week. There were 20–30-min lectures and a 10–15-min discussion each session. In the final individual session, triggers of each adolescent were identified and the measures to control it were planned. Two follow-up calls were made.

Pre-intervention, differences in the level of asthma self-efficacy (indicated by self-efficacy scores) between the two groups was not statistically significant. Post-intervention, differences in the level of asthma self-efficacy was statistically significant between the intervention and control groups. Self-efficacy was significantly better for adolescents in the intervention group compared to adolescents in the control group post-intervention. There was a statistically significant increase in self-efficacy scores for the intervention group. There was no significant differences (increase nor decrease) in self-efficacy scores observed in the control group. According to this study, the educational and triggers modifying intervention was effective in improving adolescents' asthma

(continued on next page)

Table 3 (continued)

Author/Date/Country	Design, JBI Score	Participants	Data collection	Nursing strategy	Self-reported Findings and Recommendations
van Bragt et al., 2016. Netherlands.	Qualitative design. 9-month two-group randomized controlled trial in 5 paediatric outpatient clinics. Data was analysed by descriptive statistics. Score: 7/13	97 children with physician-diagnosed asthma aged 6–12 years who had used asthma medication for at least 6 weeks during the previous year, did not have any comorbid conditions that significantly affect HRQL, could attend a regular school class and had sufficient skills in speaking and/or reading the Dutch language.	Demographic data was collected by a proxy questionnaire. Information on children's individual problems and their level of impairment was indicated by the Pelican instrument. Satisfaction with PCC was investigated by questionnaire a month after the child had finished the study.	Patient-centred care and quality of life instrument. Children in the control group received usual care, whilst children in the intervention group received patient-centred care in addition to usual care. The starting point was the child's outcome on the asthma-specific health-related quality of life instrument (PELICAN). This is an online self-administered asthma specific HRQL questionnaire. The selection of the child's asthma-related problems is forwarded to the nurse to provide PCC. Six-step PCC intervention was then delivered by the nurse with the child and parent(s). A nurse discussed which selected problem would be prioritized, and a treatment goal was chosen through shared decision making. Goals were formulated according to SMART principles; possible solutions were discussed in a fun brainstorm on which mutual agreement was achieved and documented. The results of the written action plan were evaluated, and if the treatment goal had not been achieved, the six-step intervention was repeated. PCC was conducted over four visits.	self-efficacy. Since this type of intervention has the potential to improve self-efficacy in adolescents living with asthma, it is suggested that adolescent education about asthma triggers along with modulating triggers will be of value and parent-centred care could be diminished. The most frequently identified problems by children on the health-related asthma-specific PELICAN quality of life instrument were "cough," "cigarette smoke," and "shortness of breath." 82% of the asthma-related problems that were selected by children showed room for improvement. About 2–7 actions were formulated per problem and treatment goal, and children had an active role in >76% of the actions. "Using rescue medication prior to activities/triggers," and "talk to others about your asthma" were most frequently recommended. In follow-up, children provided feedback that the PELICAN quality of life instrument. Children found that the instrument was easy (95%) and fun (65%), yet some thought that it was somewhat childish (12.5%). Implementation of PCC based on the Pelican instrument is recommended in specialized care.

Title: PELICAN: Content Evaluation of Patient-Centered Care for Children With Asthma Based on an Online Tool.

Aim: The aim of this study was to describe the content of the PCC intervention and the supportiveness of respective stakeholders to integrate PCC in paediatric asthma management.

improvement ($p < 0.05$) in medication adherence and regular medication use compared to the control groups (Barikani et al., 2021; Cevik Guner & Celebioglu, 2015) and CYP expressed positive views on how applications enhanced adherence, administration, and autonomy (Nichols et al., 2020). Studies explored CYP's understanding of medications; following Barikani et al.' (2021) intervention, the experimental group demonstrated a significant difference ($p < 0.05$) in beliefs about medications compared to the control group, indicating a more positive perception of medication necessity and fewer medication concerns, whilst anecdotal comments reported by Roberts et al. (2019) highlighted how applications appeared to improve CYP's medication knowledge. CYP provided feedback on medication-related factors, including a desire for interventionalists to provide inhalers, additional alert reminders, and preference for game-based reminders (McGovern et al., 2019; Roberts et al., 2019).

Education and self-management

The sub-theme education and self-management included two categories being knowledge and self-care, evident across 12 studies (Altay & Çavuşoğlu, 2013; Cevik Guner & Celebioglu, 2015; Haze & Lynaugh, 2013; Horner et al., 2018; Isik et al., 2021; Kouba et al., 2013; McGovern et al., 2019; Rasberry et al., 2014; Roberts et al., 2019; Sangnimitchaikul et al., 2022; Valizadeh et al., 2014; van Bragt et al., 2016). During their first three visits, children's most frequently selected asthma-related problems on the 'PELICAN' instrument were cough, cigarette smoke, and shortness of breath, with many problems ($n = 81\%$) showing room for improvement in education and self-management (van Bragt et al., 2016). One study identified a gap in healthcare support knowledge, with one participant commenting that they were unaware they had an RN care-coordinator (Haze & Lynaugh, 2013). Two single-group studies observed mixed results on asthma knowledge; whilst one found no significant difference in asthma knowledge after an asthma and lifestyle intervention (Kouba et al., 2013), whereas another found significant improvement ($p < 0.001$) in asthma illness representations after their cognitive-behavioural skills-building ASMS, especially for those who had high anxiety (McGovern et al., 2019). CYP appreciated improving their knowledge in face-to-face ASMS and ASM applications; 'it makes me think about like what my actual triggers are ... I never really thought I had any ... I think some of my triggers are on here' (McGovern et al., 2019; Roberts et al., 2019). CYP expressed that they would use applications that included trigger management information but wanted more informative feedback on quiz results to enhance meaning and increase confidence in ASM (Roberts et al., 2019) (p. 779).

Self-reported asthma-related problems decreased when ASM behaviours were explored, this included improved physical condition, medication inhalation technique, inhaler availability, and symptom monitoring (van Bragt et al., 2016). In one study, educational home-visits led to increased ASM responsibility in CYP across five fields (medications, using a peak flow meter (PFM), applying an asthma action plan, keeping a daily follow-up schedule, and protecting against triggers) with a significant decrease in parental responsibility ($p < 0.05$) after the third and sixth home-visit (Altay & Çavuşoğlu, 2013). Despite all CYP reporting self-care problems before the intervention, the nursing diagnoses related to these deficits decreased significantly in the experimental group at the last visit, with significant increases ($p < 0.001$ – 0.002) in self-care skills across all five fields (medicine usage, peak expiratory flow, meter usage, applying an asthma action plan, keeping a daily follow-up, schedule, and protecting against triggering factors), which differed significantly ($p < 0.05$) from the control group (Altay & Çavuşoğlu, 2013). Isik et al. (2021) found a significant increase ($p < 0.001$) in PFM usage post-intervention in the intervention group. The amount of improvement in ASM scores differed between studies, however improvements were reported within all intervention groups (Horner et al., 2018; Isik et al., 2021; Kouba et al., 2013; McGovern et al., 2019). Implementation of ASM in CYP was not

related to variables such as age, sex, and illness duration (Altay & Çavuşoğlu, 2013).

ASM self-efficacy was explored in four studies (Cevik Guner & Celebioglu, 2015; Kouba et al., 2013; McGovern et al., 2019; Valizadeh et al., 2014). One study found both intervention and control groups had significant increased self-efficacy scores, however this was higher in the intervention group ($p < 0.05$) (Cevik Guner & Celebioglu, 2015) whereas one study only reported a significant increase ($p < 0.001$) in self-efficacy that received the intervention (Valizadeh et al., 2014). Similarly, Kouba et al. (2013) and McGovern et al. (2019) reported significant increases in self-efficacy scores after CYP participated in an intervention. Self-reported asthma control as evidence of ASM was further assessed in five studies (Isik et al., 2021; Kouba et al., 2013; Rasberry et al., 2014; Sangnimitchaikul et al., 2022; van Bragt et al., 2016). One study reported the percentage of students in control of their asthma improved from 56% pre-intervention to 76% post-intervention (Kouba et al., 2013). Isik et al. (2021) observed a significant difference in asthma control scores between the intervention and control groups from pre-intervention to six and 12-weeks post-intervention, and a significant effect on asthma control within the intervention group at three time points, whilst the control group's scores did not change significantly. Similarly, Rasberry et al. (2014) found that students in the intervention group had significantly better asthma control than students in the control group, even when controlling for race, gender, and age ($p = 0.0045$). Based on these scores, 51.8% and 40.1% of students from the intervention and control groups had well-controlled asthma respectively, and the odds of having well-controlled asthma were 54.8% higher for the intervention group (Rasberry et al., 2014). Finally, Sangnimitchaikul et al. (2022) observed a significant difference in CYP's asthma control following a two-month family-based ASMS between the experimental and control groups, in favour of the experimental group ($p = 0.000$).

Theme 2: health and wellbeing

The theme health and wellbeing included two sub-themes (active living and mind-body health), four categories, and 56 codes generated from 120 findings evident across nine studies (Cevik Guner & Celebioglu, 2015; Horner et al., 2018; Isik et al., 2021; Kouba et al., 2013; McGovern et al., 2019; Nichols et al., 2020; Sangnimitchaikul et al., 2022; Teufel II et al., 2018; van Bragt et al., 2016).

Active living

The sub-theme active living included two categories being physical activity and daily activities, evident across four studies (Cevik Guner & Celebioglu, 2015; Horner et al., 2018; Isik et al., 2021; Nichols et al., 2020). During an e-health ASMS, CYP described physical activity limitations; 'there are certain things I can't do like strenuous exercise or certain sports' as 'my chest feels tight' or 'my lungs started to hurt' (Nichols et al., 2020) (Textbox 1). Cevik Guner and Celebioglu (2015) found that CYP who completed a two-day asthma training program reported significantly fewer ($p < 0.001$) asthma attacks following physical activity, whilst Horner et al. (2018) observed significant improvements in QOL regarding activity limitations following the 'Living Healthy with Asthma' intervention. Asthma affected CYP's daily lives, notably school attendance (Nichols et al., 2020). One study found that the intervention group reported significantly fewer limitations in daily activities school absences, and emergency department visits post-intervention (Cevik Guner & Celebioglu, 2015). Isik et al. (2021) implemented a school RN-led intervention, revealing a significant post-intervention difference in the interruption of daily activities between groups; the intervention group showed significant improvements ($p < 0.001$) to interruptions of daily activities from pre-intervention to six and 12 weeks, while the control group showed no significant improvement ($p = 0.104$). There were no significant differences in school absences, however the

intervention group missed fewer days ($n = 42$ days) than the control group ($n = 66$ days) (Isik et al., 2021).

Mind-body health

The sub-theme mind-body health included two categories being physical symptoms and psychological wellbeing, evident across nine studies (Cevik Guner & Celebioglu, 2015; Horner et al., 2018; Isik et al., 2021; Kouba et al., 2013; McGovern et al., 2019; Nichols et al., 2020; Sangnimitchaikul et al., 2022; Teufel II et al., 2018; van Bragt et al., 2016). CYP reported physical symptoms of cough, shortness of breath, chest tightness (Teufel II et al., 2018; van Bragt et al., 2016). Cevik Guner and Celebioglu (2015) reported a significant difference ($p < 0.05$) in symptom frequency for daytime/night-time cough and daytime wheeze between the intervention and control groups post-intervention, however the frequency of daytime/night-time shortness of breath, daytime/night-time expectoration and night-time wheeze did not differ significantly ($p > 0.05$). Both Horner et al. (2018) and Isik et al. (2021) assessed QOL related to cough, tiredness, attacks, wheeze, chest tightness, shortness of breath, difficulty deep breathing, and trouble sleeping, and reported significant improvements ($p = 0.002 - p < 0.001$) post-intervention.

CYP frequently reported feeling stressed, unrelaxed, unhappy, angry, embarrassed, and isolated by feeling 'different', yet also felt pride and accomplishment when self-managing their care (Nichols et al., 2020; Teufel II et al., 2018). CYP emphasised the importance of peer relationships, social acceptance, being considered 'normal', and disease privacy (Nichols et al., 2020). CYP enjoyed learning coping strategies, learning that they were not alone, and appreciated the sense of solidarity in their struggles with asthma (McGovern et al., 2019) (p. 9). QOL was measured in five studies; McGovern et al. (2019) found their ASMS had a non-significant positive impact on QOL, whilst other studies reported significant improvements (Horner et al., 2018; Isik et al., 2021; Kouba et al., 2013; Sangnimitchaikul et al., 2022), one of which reported improvements ($p < 0.001$) in emotional functioning (Horner et al., 2018). One ASMS that was effective for CYP with high anxiety reported a significant decrease in separation anxiety ($p = 0.01$), social anxiety ($p = 0.04$), and improvements in personal confidence in managing stress ($p = 0.069$) (McGovern et al., 2019). No significant differences were observed for depression symptoms, with no CYP scoring moderate/high on this scale, however, one participant expressed thoughts of self-harm, and another stated his 'goal' was to become a 'robber' indicating dysfunctional behaviour (McGovern et al., 2019) (p. 11).

Theme 3: tools and working together

The theme tools and working together included two sub-themes (strategies and features and healthcare professionals), four categories, and 39 codes generated from 71 findings evident across six studies (Haze & Lynaugh, 2013; McGovern et al., 2019; Nichols et al., 2020; Roberts et al., 2019; Teufel II et al., 2018; van Bragt et al., 2016).

Strategies and features

The sub-theme strategies and features included two categories being program/intervention/app and asthma devices/charts/quiz, evident across five studies (McGovern et al., 2019; Nichols et al., 2020; Roberts et al., 2019; Teufel II et al., 2018; van Bragt et al., 2016). CYP's feedback on 'COPE for Asthma' included liking the interventionalist, educational lessons, and group safety (McGovern et al., 2019). The majority of CYP liked everything about this program, with 97% of the evaluation questions being positive, however some expressed it 'was not long enough', that they 'didn't like having to talk/interact with others', and that 'some of the questions were hard' (McGovern et al., 2019) (pp. 9–10). Four studies included CYP feedback on technology-based ASMS (Nichols et al., 2020; Roberts et al., 2019; Teufel II et al., 2018; van Bragt et al., 2016). CYP experienced an ecological momentary assessment application as comfortable and easy to use (Nichols et al., 2020)

(Nichols et al., 2020), and a self-administered asthma-specific health-related QOL instrument as 'easy to complete' ($n = 95\%$), 'fun' ($n = 65\%$), yet also 'somewhat childish' ($n = 12.5\%$) (van Bragt et al., 2016) (p. 1001). One study observed that after an application redesign harnessing CYP's feedback, CYP's satisfaction with the application's visual appeal increased from 60% to 100% ($p = 0.09$), and a significant improvement in data acquisition was observed, indicating ease of use (Teufel II et al., 2018). Reporting was not significantly associated to CYP's age ($p = 0.48$), sex ($p = 0.28$), or weekend versus weekday use ($p = 0.09$) (Teufel II et al., 2018). CYP preferred to use technology to facilitate ASM and emphasised the convenience it offered for maintenance and monitoring (Nichols et al., 2020).

CYP expressed that multiple features aided in various aspects of ASM through tracking/communicating their asthma status, simplifying the process, and assessing progress (Roberts et al., 2019). CYP mentioned the convenience of logging PFM measurements through applications, simplifying the process and reducing documentation burden; 'I think this makes it easier to actually do it ... makes it simpler', and also suggested additional alerts and a gamification element to make monitoring more engaging; '...maybe you can like gain points ... unlock like little mini games ... like a leader board' (Roberts et al., 2019) (p. 776). The trigger feature was valued for keeping records of potential triggers 'so you could look back to it' (Roberts et al., 2019) (p. 776). CYP agreed that the chart feature was helpful for tracking their asthma, yet recommended extending its timeframe (Roberts et al., 2019). The diary feature allowed CYP to review their asthma data and track their health, whilst the school form feature appeared to increase confidence in ASM (Roberts et al., 2019). The self-check quiz feature, although not designed for long-term tracking, was used daily by many CYP for this reason; 'I did it every day to see am I doing good or am I doing bad' (Roberts et al., 2019) (p. 778).

Healthcare professionals

The sub-theme healthcare professionals included two categories being therapeutic relationship and provider interaction, evident across four studies (Haze & Lynaugh, 2013; Nichols et al., 2020; Roberts et al., 2019; Teufel II et al., 2018). The majority of CYP perceived a positive change in the patient/RN relationship when using a patient/RN communication application (Haze & Lynaugh, 2013). CYP described communication as similar to 'friends texting', felt more comfortable communicating in this way, believed they could 'ask more questions' compared to phone calls, and experienced improved accessibility and quicker response times, even though RNs did not increase their shift hours (Haze & Lynaugh, 2013) (p. 269). Whilst CYP did not desire completely replacing face-to-face encounters (Nichols et al., 2020), they recognised the utility of applications in facilitating interactions with providers and felt comfortable with a doctor or RN monitoring their health using technology (Roberts et al., 2019; Teufel II et al., 2018). CYP reflected on how features related to PFM monitoring, triggers, doctor reports, charts, school forms, appointments, and diaries facilitated face-to-face interactions with providers (Roberts et al., 2019). Overall, CYP found it beneficial to share application data with providers and believed that it enhanced communication during/between medical visits (Roberts et al., 2019).

Discussion

Health literacy

CYP's understanding of asthma is crucial for ASM. However, they have identified issues like poor communication, unclear explanations, and rushed interactions as barriers that hinder their engagement in ASM (Canny et al., 2022; Zaeh et al., 2021). This integrated review found that CYP acknowledged gaps in asthma health literacy and enjoyed improving different facets of their asthma knowledge, increasing their confidence in self-observation, and subsequently, their

physical and psychological ASM (McGovern et al., 2019; Roberts et al., 2019), which is concordant with the literature (Carpenter et al., 2016; Holley et al., 2018; Schneider et al., 2019). Research suggests that CYP prioritise effective self-management of acute asthma symptoms, rather than emphasising long-term self-management goals (Coombs et al., 2017; Gibson-Scipio et al., 2015). However, studies have typically focused on the relationship between caregiver health literacy and child asthma outcomes, with children's health literacy not appropriately assessed (Tzeng et al., 2018). CYP also appreciated applications that supported their asthma attack knowledge and subsequent response (Roberts et al., 2019). Other research reports similar findings where CYP appreciated consolidated asthma attack information and attributed this to guidance and the ability to share information and receive social support (Carpenter et al., 2016; Odom & Christenbery, 2016). CYP with uncontrolled asthma gained confidence in preventing/managing asthma attacks through motivational interview or symptom management (Barikani et al., 2021; Cevik Guner & Celebioglu, 2015), which is concordant with research harnessing e-health ASMS (Burbank et al., 2015). By targeting CYP's asthma attack health literacy and associated skills, CYP may have greater capacity to learn long-term, preventative ASM behaviours (Coombs et al., 2017).

CYP living with asthma frequently report low/intermittent medication usage due to forgetfulness, false beliefs, and medication avoidance, whilst only a small percentage seek medication support (Gibson-Scipio et al., 2015; Koster et al., 2015; Sleath et al., 2013). CYP valued applications that empowered them by improving their medication knowledge and administration, yet wanted additional medication reminders (Nichols et al., 2020; Roberts et al., 2019). Similarly, research reports that CYP often use ASM applications to set medication goals and perceive medication reminders as valuable (Carpenter et al., 2016; Davies et al., 2021). However, some CYP find reminders frustrating, thus research recommends an individualised ability to schedule reminders is needed (Schneider et al., 2019). CYP in this review self-reported improvements in medication adherence (Cevik Guner & Celebioglu, 2015; Teufel II et al., 2018), or both adherence and beliefs (Barikani et al., 2021). In the literature, application-based reminders have improved CYP's medication adherence, whilst educational ASMS have reported weaker results (Horner et al., 2016; Johnson et al., 2015). CYP believe that whilst medication reminders improve adherence, self-monitoring, and motivation, reminders do not enhance medication knowledge (De Simoni et al., 2021). Thus, education should be coupled with reminders to enhance CYP's medication knowledge that is tailored to CYP's individual needs and incorporate this into their daily routine (Zaeh et al., 2021).

This integrated review found that CYP assumed increased responsibility for ASM, indicating their capability for autonomy (Altay & Çavuşoğlu, 2013). Conversely, the literature reports CYP have a persistent reliance on caregivers, with limited asthma knowledge, and engage passively in asthma management (Coombs et al., 2017; Kelada et al., 2021; Koster et al., 2015). Some CYP fluctuate between having independent asthma responsibility and interdependence on caregivers, feel inadequately supported, and want providers to involve them more, reinforcing the importance of active engagement and provision of youth-centric information/support (Gibson-Scipio et al., 2015; Holley et al., 2018; Ödling et al., 2020). CYP in this study in this review experienced ASM problems related to medication and PFM use, applying an asthma action plan, keeping a daily follow-up schedule, and protecting against triggers, which improved after individualised home visits and school RN-led strategies (Altay & Çavuşoğlu, 2013; Isik et al., 2021). Research has reported improvements in CYP's self-management skills following ASMS with and without caregiver involvement (Martinez-Martin et al., 2020; Schneider et al., 2019). Various ASMS improved ASM among CYP, as evidenced by responses on asthma control, self-efficacy, and self-management were found in this review (Cevik Guner & Celebioglu, 2015; Horner et al., 2018; Isik et al., 2021; Kouba et al., 2013; McGovern et al., 2019; Rasberry et al., 2014; Sangnimitchaikul

et al., 2022; Valizadeh et al., 2014). This is in keeping with other literature which has similarly shown improvements through education, interventions, care coordination including outreach nurses, and community connectivity (Beerhuizen et al., 2021; Britto et al., 2014; Griffiths et al., 2016), including CYP within RCT control groups (Holmes et al., 2022). CYP in this study stated ASM applications enabled them to better self-manage their asthma across multiple domains (Roberts et al., 2019). The wider literature also highlights that ASM applications can improve CYP's understanding of the connection between triggers and symptoms, provide a sense of control, facilitate caregiver partnerships, and offer user-friendly, consistent collaboration (Rhee et al., 2014; Schneider et al., 2019).

Health and wellbeing

Following ASMS, CYP reported improvements in limitations for daily activities, school absences, asthma attacks following physical activity, and emergency department visits (Cevik Guner & Celebioglu, 2015; Isik et al., 2021). Research using a web-based or asthma day camp strategy reported similar results, however improvements in activity limitations was either not measured (Horner et al., 2016) or observed (Bruzzese et al., 2021). A significant limitation identified in the research is the lack of CYP's perspectives on physical competence, as enhancing this aspect is crucial to enhance CYP's QOL (Peters et al., 2017). However, one study in this review reported significant improvements in CYP's QOL regarding physical activity self-efficacy following an asthma and healthy living program (Horner et al., 2018).

Research highlights that whilst CYP with asthma generally perceive themselves as being healthy, they acknowledge experiencing asthma symptoms on multiple occasions (Jonsson et al., 2017). Additionally, asthma symptoms prevail as the primary topic in adolescent-initiated messages within ASM applications (Rhee et al., 2014). However, research observes that CYP conceptualise asthma symptoms relative to their usual symptom patterns, decide when to take medications by appraising the advantages and disadvantages, and do not voice symptoms perceived as normal to caregivers or providers (Mammen et al., 2017). CYP in this review appreciated application features that facilitated autonomy and confidence in symptom management and reported increased QOL regarding asthma symptoms following ASMS (Horner et al., 2018; Isik et al., 2021; Nichols et al., 2020), which is concordant with the wider literature (Bruzzese et al., 2021; Peters et al., 2017). CYP demonstrated that an ASMS was associated with improvements in daytime/night-time cough and daytime wheeze (Cevik Guner & Celebioglu, 2015). Potentially stronger experiences were reported by Britto et al. (2014), where the proportion of CYP in control of their symptoms tripled following an evidence-based, self-management intervention. Alternatively, Bruzzese et al. (2021) reported no improvement in daytime symptoms but significantly lower night-time awakenings following a web-based intervention.

As mentioned in the findings of this review CYP reported feeling stressed, unrelaxed, unhappy, angry, and bored, and many experienced ASM as a burdensome task (Nichols et al., 2020; Roberts et al., 2019; Teufel II et al., 2018). Negative psychological experiences tied to a 'life of vigilance' have been reported by CYP in the wider literature (Coombs et al., 2017) (p. 183). Additionally, CYP in this review expressed how asthma led to embarrassment, feeling different from peers, and isolation, and some wanted a degree of disease privacy when engaged in ASMS (Nichols et al., 2020). Similar negative relational experiences reported in the literature, which are often heightened when asthma limits peer engagement, include hesitancy to disclose asthma, and putting on a healthy façade (Holley et al., 2018; Kelada et al., 2021; Peters et al., 2017; Zaeh et al., 2021). Not all CYP held strong disease privacy preferences, and some appreciated sharing experiences with peers or others who had asthma as this provided them with informational and emotional support (Danielis et al., 2021; Holley et al., 2018; Koster et al., 2015). ASMS should be tailored to the individual

needs of CYP, as they juggle wanting recognition for their identity beyond asthma, while simultaneously not wanting their asthma to be ignored (Jonsson et al., 2017).

Negative emotions, worsening self-management, and physical symptoms are interconnected, whilst the inevitable transition to adult healthcare is characterised with increased feelings of isolation, uneasiness, and uncertainty, highlighting the importance of incorporating psychological wellbeing in ASMS throughout childhood (Conn et al., 2016; Ödling et al., 2020). CYP in this review valued in-person and technology-based ASMS that enhanced psychological wellbeing (social anxiety, separation anxiety, and stress), connection, and pride/confidence in ASM (McGovern et al., 2019; Nichols et al., 2020). In accordance with these findings, the literature has emphasised anxiety symptoms are a significant yet overlooked aspect of CYP's asthma experiences where greater support and practical tools are required (Peters et al., 2017). Additionally, psychological factors and impediments to autonomy, competence, and relatedness are considered major influences on QOL among CYP and should be included in ASMS (Peters et al., 2017). In this review, CYP experienced improvements in their QOL which were either statistically significant (Horner et al., 2018; Isik et al., 2021; Kouba et al., 2013; Sangnimitchaikul et al., 2022) or not (McGovern et al., 2019), which is concordant with the wider literature (Beerthuizen et al., 2021; Davies et al., 2021; Fedele et al., 2021).

Tools and working together

This study found that CYP expressed favourable opinions towards various ASMS; they appreciated group security, found assessment instruments and applications user-friendly, and showed a preference for using technology for ongoing ASM (McGovern et al., 2019; Nichols et al., 2020; van Bragt et al., 2016), which is concordant with the wider literature (Bruzese et al., 2021; Burbank et al., 2015; Davis et al., 2021; Fedele et al., 2021; Schneider et al., 2019). Whilst CYP experienced many application features as enabling (inputting triggers, charts, diaries, self-check quizzes, appointment calendars, and PFM monitoring), they recommended further reminders, information, feedback, and games (Roberts et al., 2019). Similar feedback has been reported by CYP in the literature, who positively experienced skills and information-based features yet also reported missing knowledge, functionality, and wanted additional reminders, content, and interaction within ASM applications (Davis et al., 2021; De Simoni et al., 2021; Fedele et al., 2021; Ramsey et al., 2019).

In this review, CYP who used a communication application reported positive changes in the patient/RN relationship, predominantly due to experiencing easier, faster, and more comfortable communication with their RN care-coordinator (Haze & Lynaugh, 2013). Similarly, in the literature CYP with asthma who experienced negative provider-relationships felt excluded with no voice or support (Holley et al., 2018). Similarly, CYP in this review reported positively when applications facilitated provider interactions, predominantly if applications aided in communication, remembering asthma appointments, sent information to providers in-between/during visits, and allowed providers to monitor their health information that led to improved access to care (Haze & Lynaugh, 2013; Roberts et al., 2019; Teufel II et al., 2018). These findings highlight the burden of ASM for CYP and the value of applications in improving their healthcare experiences (Davis et al., 2021; Ramsey et al., 2019). Interestingly, CYP in one study voiced not wanting to completely replace face-to-face encounters despite the perceived benefits of applications in ASM (Nichols et al., 2020). This perspective, concordant with the research, highlights the importance of bi-model ASMS harnessing in-person and technology-based delivery (Davis et al., 2021; Ramsey et al., 2019; Roberts et al., 2016; Warren et al., 2016).

Strengths and limitations

This integrative review provided a comprehensive audit trail, used established tools to ensure findings are reproducible and robust and

utilized up-to-date empirical research (2013–2023) to ensure that findings answered the research question. Previous reviews have evaluated ASMS without focusing on CYP's experiences or by disaggregating ASMS differences, resulting in fragmented findings. The findings of this review reflect the voices of CYP and support RNs in their evidence-based, patient-centred role when providing ASM support.

This review has several limitations: data searching relied on Western-focused databases, potentially leading to overgeneralized findings and Western-centric bias. Most studies included in this review were undertaken in developed countries such as the United States of America ($n = 9$) and the Netherlands ($n = 1$), with limited representation from developing countries. Additionally, this review only included studies published in English. English dominance in publication gives researchers from English-speaking countries an advantage in disseminating their work whilst non-English-speaking researchers face publication hurdles that restrict their representation, potentially introducing bias and reducing the generalizability of findings.

To ensure a strong nursing focus, this review only included studies where RNs were involved in ASMS. Broadening the inclusion criteria to include other fields of expertise such as psychology, medicine, pharmaceuticals, and informatics could provide additional depth. Additionally, caregiver-proxy and provider-proxy findings/studies were excluded due to the focus being on CYP's self-reported experiences. Caregivers and providers often play a crucial role in observing and interpreting CYP's behaviours, emotions, and experiences, and exclusion of these findings/studies may have resulted in a less comprehensive understanding of CYP's experiences.

Implications for nursing practice and research

Strategies must bolster health literacy, improve physical and psychological health, and harness interactive, youth-centric, and informative tools to facilitate communication and decrease the burden of self-management. Applications pose a promising avenue for self-management support which registered nurses can harness. Nurses and other health care professionals should engage and partner with youth to develop apps and/or other technology to support their asthma management. Opportunities for youth to 'gamify' their asthma management is forward thinking and nurses, and other professionals need to look towards new and progressive ways of working with CYP who are already active mobile phone users. This age group remains underexplored and future research should enable meaningful engagement with CYP to better understand their perspectives and improve strategy success. This will require an adoption of co-design qualitative methodologies working with CYP and a step away from quantitative measures, valuing the unique insights and agency of CYP. Future research also needs to be undertaken with diverse populations, minority and marginalised CYP within developed and developing countries to address cultural nuances, and safety that is meaningful and effective for CYP's asthma SMS.

Conclusion

The findings of this review inform RNs within a variety of contexts on CYP's experiences of ASMS. CYP have the physical and mental capability and willingness to learn and perform such skills. Nursing ASMS should be guided by improving health literacy, targeting both physical and mental health and wellbeing, and embrace technology alongside face-to-face connection. This requires a patient-centred approach and awareness of self-management applications that can be offered to CYP.

CRedit authorship contribution statement

H. Kemble: Writing – review & editing, Writing – original draft, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **M. Foster:** Writing – review & editing, Writing – original draft, Validation, Supervision, Methodology, Formal analysis,

Data curation, Conceptualization. **J. Blamires:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Formal analysis. **R. Mowat:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Formal analysis.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.pedn.2024.03.029>.

References

- Altay, N., & Çavuşoğlu, H. (2013). Using Orem's self-care model for asthmatic adolescents. *Journal for Specialists in Pediatric Nursing*, 18(3), 233–242. <https://doi.org/10.1111/jspn.12032>.
- Althubaiti, A. (2016). Information bias in health research: Definition, pitfalls, and adjustment methods. *Journal of Multidisciplinary Healthcare*, 9, 211–217. <https://doi.org/10.2147/jmdh.s104807>.
- Barikani, A., Negarandeh, R., Moin, M., & Fazlollahi, M. R. (2021). The impact of motivational interview on self-efficacy, beliefs about medicines and medication adherence among adolescents with asthma: A randomized controlled trial. *Journal of Pediatric Nursing*, 60, 116–122. <https://doi.org/10.1016/j.pedn.2021.04.020>.
- Barker, T. H., Stone, J. C., Sears, K., Klugar, M., Tufanaru, C., Leonardi-Bee, J., ... Munn, Z. (2023). The revised JBI critical appraisal tool for the assessment of risk of bias for randomized controlled trials. *JBI Evidence Synthesis*, 21(3), 495–506. <https://doi.org/10.11124/jbies-22-00430>.
- Barnard, T. L., & Zhang, J. (2021). The impact of respiratory disease in New Zealand: 2020 update. *Asthma and Respiratory Foundation NZ*, 1–172. Retrieved 2nd January from: <https://www.asthmafoundation.org.nz/assets/documents/Respiratory-Impact-report-final-2021Aug11.pdf>.
- Bayless, A. K., Wyatt, T. H., & Raynor, H. (2021). Obese-asthma phenotype self-management: A literature review. *Journal of Pediatric Nursing*, 60, 154–163. <https://doi.org/10.1016/j.pedn.2021.04.027>.
- Beasley, R., Beckert, L., Fingleton, J., Hancox, R. J., Harwood, M., Hurst, M., ... Reid, J. (2020). Asthma and respiratory foundation NZ adolescent and adult asthma guidelines 2020: A quick reference guide. *New Zealand Medical Journal*, 133(1517), 73–99. <https://journal.nzma.org.nz/journal-articles/asthma-and-respiratory-foundation-nz-adolescent-and-adult-asthma-guidelines-2020-a-quick-reference-guide>.
- Beerthuis, T., Rikkers-Mutsaerts, E. R. V. M., Snoeck-Stroband, J. B., & Sont, J. K. (2021). The role of education, monitoring, and symptom perception in internet-based self-management among adolescents with asthma: Secondary analysis of a randomized controlled trial. *JMIR Pediatrics and Parenting*, 4(4), Article e17959. <https://doi.org/10.2196/17959>.
- Blackman, J. A., & Gurka, M. J. (2007). Developmental and behavioral comorbidities of asthma in children. *Journal of Developmental & Behavioral Pediatrics*, 28(2), 92–99.
- van Bragt, S., van den Bemt, L., Cretier, R., van Weel, C., Merkus, P., & Schermer, T. (2016). Pelican: Content evaluation of patient-centered care for children with asthma based on an online tool. *Pediatric Pulmonology*, 51(10), 993–1003. <https://doi.org/10.1002/ppul.23397>.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. <https://doi.org/10.1191/1478088706qp0630a>.
- Britto, M. T., Vockell, A., -L. B., Munafo, J. K., Schoettker, P. J., Wimberg, J. A., Pruet, R., ... Byczkowski, T. L. (2014). Improving outcomes for underserved adolescents with asthma. *Pediatrics*, 133(2), 418–427. <https://doi.org/10.1542/peds.2013-0684>.
- Bruzzese, J. M., George, M., Liu, J., Evans, D., Naar, S., DeRosier, M. E., & Thomas, J. M. (2021). The development and preliminary impact of Camp air: A web-based asthma intervention to improve asthma among adolescents. *Patient Education and Counseling*, 104(4), 865–870. <https://doi.org/10.1016/j.pcc.2020.09.011>.
- Burbank, A. J., Lewis, S. D., Hewes, M., Schellhase, D. E., Rettiganti, M., Hall-Barrow, J., ... Perry, T. T. (2015). Mobile-based asthma action plans for adolescents. *Journal of Asthma*, 52(6), 583–586. <https://doi.org/10.3109/02770903.2014.995307>.
- Burnard, P., Gill, P., Stewart, K., Treasure, E., & Chadwick, B. (2008). Analysing and presenting qualitative data. *British Dental Journal*, 204(8), 429–432. <https://doi.org/10.1038/sbj.bj.2008.292>.
- Camp-Spivey, L. J., Logan, A., & Nichols, M. (2021). Theoretical and contextual considerations for self-management strategies of children and adolescents with chronic diseases: An integrative review. *Journal of Child Health Care*, 26(2), 242–261. <https://doi.org/10.1177/13674935211013697>.
- Canny, A., Donaghy, E., Murray, V., Campbell, L., Stonham, C., Bush, A., McKinstry, B., Milne, H., Pinnock, H., & Daines, L. (2022). Patient views on asthma diagnosis and how a clinical decision support system could help: A qualitative study. *Health Expectations*, 26(1), 307–317. <https://doi.org/10.1111/hex.13657>.
- Carnevale, F. A. (2020). A “thick” conception of children's voices: A hermeneutical framework for childhood research. *International Journal of Qualitative Methods*, 19. <https://doi.org/10.1177/1609406920933767>.
- Carpenter, D. M., Geryk, L. L., Sage, A., Arrindell, C., & Sleath, B. L. (2016). Exploring the theoretical pathways through which asthma app features can promote adolescent self-management. *Translational Behavioral Medicine*, 6(4), 509–518. <https://doi.org/10.1007/s13142-016-0402-z>.
- Cevik Guner, U., & Celebioglu, A. (2015). Impact of symptom management training among asthmatic children and adolescents on self-efficacy and disease course. *Journal of Asthma*, 52(8), 858–865. <https://doi.org/10.3109/02770903.2015.1010732>.
- Chan, M., Gray, M., Burns, C., Owens, L., Woolfenden, S., Lingam, R., Jaffe, A., & Homaira, N. (2021). Community-based interventions for childhood asthma using comprehensive approaches: A systematic review and meta-analysis. *Allergy, Asthma & Clinical Immunology*, 17(1), 1–16. <https://doi.org/10.1186/s13223-021-00522-9>.
- Chang, J. C., Davis, A. M., Klein-Gitelman, M. S., Cidav, Z., Mandell, D. S., Knight, A. M., & Klein-Gitelman, M. S. (2021). Impact of psychiatric diagnosis and treatment on medication adherence in youth with systemic lupus erythematosus. *Arthritis Care & Research*, 73(1), 30–38. <https://doi.org/10.1002/acr.24450>.
- Cheng, Z. R., Tan, Y. H., Teoh, O. H., & Lee, J. H. (2022). Keeping pace with adolescent asthma: A practical approach to optimizing care. *Pulmonary Therapy*, 8(1), 123–137. <https://doi.org/10.1007/s41030-021-00177-2>.
- Conn, K. M., Fisher, S. G., & Rhee, H. (2016). Parent and child independent report of emotional responses to asthma-specific vignettes: The relationship between emotional states, self-management behaviors, and symptoms. *Journal of Pediatric Nursing*, 31(2), 83–90. <https://doi.org/10.1016/j.pedn.2015.10.002>.
- Coombs, N., Allen, L., Cooper, S., Cant, R., Beauchamp, A., Laszczyk, J., ... Peck, B. (2017). Exploring young Australian adults' asthma management to expand an educational video. *Health Education Journal*, 77(2), 179–189. <https://doi.org/10.1177/0017896917740721>.
- Cuevas-Parra, P. (2020). Co-researching with children in the time of covid-19: Shifting the narrative on methodologies to generate knowledge. *International Journal of Qualitative Methods*, 19. <https://doi.org/10.1177/1609406920982135>.
- Dall'Oglio, I., Gasperini, G., Carlin, C., Biagioli, V., Gawronski, O., Spitaletta, G., ... Raponi, M. (2021). Self-care in pediatric patients with chronic conditions: A systematic review of theoretical models. *International Journal of Environmental Research and Public Health*, 18(7), 1–24. <https://doi.org/10.3390/ijerph18073513>.
- Danielis, M., Peressonni, L., Piani, T., Colaetta, T., Mesaglio, M., Mattiussi, E., & Palese, A. (2021). Nurses' experiences of being recruited and transferred to a new sub-intensive care unit devoted to COVID-19 patients. *Journal of Nursing Management*, 29(5), 1149–1158. <https://doi.org/10.1111/jonm.13253>.
- Davies, C., Marshall, H. S., Zimet, G., McCaffery, K., Brotherton, J. M. L., Kang, M., ... Skinner, S. R. (2021). Effect of a school-based educational intervention about the human papillomavirus vaccine on psychosocial outcomes among adolescents: Analysis of secondary outcomes of a cluster randomized trial. *JAMA Network Open*, 4(11), e2129057. <https://doi.org/10.1001/jamanetworkopen.2021.29057>.
- Davis, S. R., Peters, D., Calvo, R. A., Sawyer, S. M., Foster, J. M., & Smith, L. (2021). A consumer designed smartphone app for young people with asthma: Pilot of engagement and acceptability. *Journal of Asthma*, 58(2), 253–261. <https://doi.org/10.1080/02770903.2019.1680997>.
- De Simoni, A., Fleming, L., Holliday, L., Horne, R., Priebe, S., Bush, A., ... Griffiths, C. (2021). Electronic reminders and rewards to improve adherence to inhaled asthma treatment in adolescents: A non-randomised feasibility study in tertiary care. *BMJ Open*, 11(10), 1–11. <https://doi.org/10.1136/bmjopen-2021-053268>.
- Dharmage, S. C., Perret, J. L., & Custovic, A. (2019). Epidemiology of asthma in children and adults. *Frontiers in Pediatrics*, 7. <https://doi.org/10.3389/fped.2019.00246>.
- Fedele, D. A., Thomas, J. G., McConville, A., McQuaid, E. L., Voorhees, S., Janicke, D. M., ... Gurka, M. J. (2021). Using mobile health to improve asthma self-management in early adolescence: A pilot randomized controlled trial. *Journal of Adolescent Health*, 69(6), 1032–1040. <https://doi.org/10.1016/j.jadohealth.2021.06.011>.
- Garnett, V., Smith, J., & Ormandy, P. (2016). Child-parent shared decision making about asthma management. *Nursing Children and Young People*, 28(4), 16–22. <https://doi.org/10.7748/ncyp.28.4.16.s20>.
- Gibson-Scipio, W., Gourdin, D., & Krouse, H. J. (2015). Asthma self-management goals, beliefs, and behaviors of urban African American adolescents prior to transitioning to adult health care. *Journal of Pediatric Nursing*, 30(6), 53–61. <https://doi.org/10.1016/j.pedn.2015.06.012>.
- Global Asthma Network (2018). The global asthma report 2018. Retrieved January 10th from: http://globalasthmareport.resources/Global_Asthma_Report_2018.pdf.
- Global Initiative for Asthma (2022). Global strategy for asthma management and prevention. Retrieved 22nd January from: <https://www.ginaasthma.wp-content/uploads/2022/07/GINA-Main-Report-2022-FINAL-22-07-01-WMS.pdf>.
- Gorrieri, G., Scudieri, P., Caci, E., Schiavon, M., Tomati, V., Sirci, F., ... Galiotta, L. J. (2016). Goblet cell hyperplasia requires high bicarbonate transport to support mucin release. *Scientific Reports*, 6(1), 1–15. <https://doi.org/10.1038/srep36016>.
- Grady, P. A., & Gough, L. L. (2014). Self-management: A comprehensive approach to management of chronic conditions. *American Journal of Public Health*, 104(8), 25–31. <https://doi.org/10.2105/ajph.2014.302041>.
- Greenhalgh, T. (2019). *How to read a paper: The basics of evidence-based medicine and healthcare* (6th ed.). Wiley Blackwell.
- Griffiths, C., Bremner, S., Islam, K., Sohanpal, R., Vidal, D., Dawson, C., ... Eldridge, S. (2016). Effect of an education programme for south Asians with asthma and their clinicians: A cluster randomised controlled trial (oedipus). *PLoS One*, 11(12), 1–16. <https://doi.org/10.1371/journal.pone.0158783>.
- Haze, K. A., & Lynaugh, J. (2013). Building patient relationships: A smartphone application supporting communication between teenagers with asthma and the RN care

- coordinator. *Computers, Informatics, Nursing*, 31(6), 266–271. <https://doi.org/10.1097/nxn.0b013e318295e5ba>.
- Hodkinson, A., Bower, P., Grigoroglou, C., Zghebi, S. S., Pinnock, H., Kontopantelis, E., & Panagioti, M. (2020). Self-management interventions to reduce healthcare use and improve quality of life among patients with asthma: Systematic review and network meta-analysis. *BMJ*, 1–12. <https://doi.org/10.1136/bmj.m2521>.
- Holley, S., Walker, D., Knibb, R., Latter, S., Liossi, C., Mitchell, F., Radley, R., & Roberts, G. (2018). Barriers and facilitators to self-management of asthma in adolescents: An interview study to inform development of a novel intervention. *Clinical & Experimental Allergy*, 48(8), 944–956. <https://doi.org/10.1111/cea.13141>.
- Holmes, L. C., Orom, H., Lehman, H. K., Lampkin, S., Halterman, J. S., Akiki, V., ... Wilding, G. E. (2022). A pilot school-based health center intervention to improve asthma chronic care in high-poverty schools. *Journal of Asthma*, 59(3), 523–535. <https://doi.org/10.1080/02770903.2020.1864823>.
- Horner, S. D., Brown, A., Brown, S. A., & Rew, D. L. (2016). Enhancing asthma self-management in rural school-aged children: A randomized controlled trial. *The Journal of Rural Health*, 32(3), 260–268. <https://doi.org/10.1111/jrh.12150>.
- Horner, S. D., Timmerman, G. M., & McWilliams, B. C. (2018). Feasibility study of a combined lifestyle behaviors and asthma self-management intervention for school-aged children. *Journal for Specialists in Pediatric Nursing*, 23(3), 1–8. <https://doi.org/10.1111/jspn.12224>.
- Hough, K. P., Curtiss, M. L., Blain, T. J., Liu, R., Trevor, J., Deshane, J. S., & Thannickal, V. J. (2020). Airway remodeling in asthma. *Frontiers in Medicine*, 7, 1–16. <https://doi.org/10.3389/fmed.2020.00191>.
- Isik, E., Fredland, N. M., Young, A., & Schultz, R. J. (2021). A school nurse-led asthma intervention for school-age children: A randomized control trial to improve self-management. *The Journal of School Nursing*, 37(6), 480–490. <https://doi.org/10.1177/1059840520902511>.
- Joanna Briggs Institute (2022). Critical appraisal tools. <https://jbi.global/critical-appraisal-tools>.
- Johnson, K. B., Patterson, B. L., Ho, Y.-X., Chen, Q., Nian, H., Davison, C. L., ... Mulvaney, S. A. (2015). The feasibility of text reminders to improve medication adherence in adolescents with asthma. *Journal of the American Medical Informatics Association*, 23(3), 449–455. <https://doi.org/10.1093/jamia/ocv158>.
- Jonsson, M., Schuster, M., Protudjer, J. L. P., Bergström, A., Egmar, A.-C., & Kull, I. (2017). Experiences of daily life among adolescents with asthma – A struggle with ambivalence. *Journal of Pediatric Nursing*, 35, 23–29. <https://doi.org/10.1016/j.pedn.2017.02.005>.
- Kelada, L., Molloy, C. J., Hibbert, P., Wiles, L. K., Gardner, C., Klineberg, E., ... Jaffe, A. (2021). Child and caregiver experiences and perceptions of asthma self-management. *npj Primary Care Respiratory Medicine*, 31(1), 1–7. <https://doi.org/10.1038/s41533-021-00253-9>.
- Koster, E. S., Philbert, D., de Vries, T. W., van Dijk, L., & Bouvy, M. L. (2015). “I just forget to take it”: Asthma self-management needs and preferences in adolescents. *Journal of Asthma*, 52(8), 831–837. <https://doi.org/10.3109/02770903.2015.1020388>.
- Kouba, J., Velsor-Friedrich, B., Militello, L., Harrison, P. R., Becklenberg, A., White, B., ... Ahmed, A. (2013). Efficacy of the I can control asthma and nutrition now (ICAN) pilot program on health outcomes in high school students with asthma. *The Journal of School Nursing*, 29(3), 235–247. <https://doi.org/10.1177/1059840512466110>.
- Kouzegaran, S., Samimi, P., Ahanchian, H., Khoshkhui, M., & Behmanesh, F. (2018). Quality of life in children with asthma versus healthy children. *Open Access Macedonian Journal of Medical Sciences*, 6(8), 1413–1418. <https://doi.org/10.3889/oamjms.2018.287>.
- Lam, K., Yang, Y., Wang, L. C., Chen, S., Gau, B., & Chiang, B. (2016). Physical activity in school-aged children with asthma in an urban city of Taiwan. *Pediatrics and Neonatology*, 57(4), 333–337. <https://doi.org/10.1016/j.pedneo.2015.05.003>.
- Lizzo, J. M., & Cortes, S. (2022). *Pediatric asthma*. StatPeals Publishing. <https://www.ncbi.nlm.nih.gov/books/NBK51631/#!po=2.08333>.
- Lundy, L. (2018). In defence of tokenism? Implementing children's right to participate in collective decision-making. *Childhood*, 25(3), 340–354. <https://doi.org/10.1177/0907568218777292>.
- Mammen, J. R., Rhee, H., Norton, S. A., & Butz, A. M. (2017). Perceptions and experiences underlying self-management and reporting of symptoms in teens with asthma. *Journal of Asthma*, 54(2), 143–152. <https://doi.org/10.1080/02770903.2016.1201835>.
- Martinez-Martin, N., Dasgupta, I., Carter, A., Chandler, J. A., Kellmeyer, P., Kreitman, K., ... Cabrera, L. Y. (2020). Ethics of digital mental health during COVID-19: Crisis and opportunities. *JMIR Mental Health*, 7(12), Article e23776. <https://doi.org/10.2196/23776>.
- Mathiazhakan, U., & Abirami, P. (2023). Impact of caregiver's burden of children with asthma: A systematic review. *International Journal of Nutrition, Pharmacology, Neurological Diseases*, 13(2), 89–95. https://doi.org/10.4103/ijnpnd.ijnpnd_60_22.
- McChesney, K., & Aldridge, J. (2019). Weaving an interpretivist stance throughout mixed methods research. *International Journal of Research & Method in Education*, 42(3), 225–238. <https://doi.org/10.1080/1743727x.2019.1590811>.
- McClure, N., Seibert, M., Johnson, T., Kannenberg, L., Brown, T., & Lutenbacher, M. (2018). Improving asthma management in the elementary school setting: An education and self-management pilot project. *Journal of Pediatric Nursing*, 42, 16–20. <https://doi.org/10.1016/j.pedn.2018.06.001>.
- McDermott, K. W., Stocks, C., & Freeman, W. J. (2018). Overview of pediatric emergency department visits, 2015. *Healthcare cost and utilization project (HCUP) statistical briefs* Statistical brief# 242. <https://www.ncbi.nlm.nih.gov/books/NBK526418/>.
- McGovern, C. M., Arcoleo, K., & Melynk, B. (2019). Cope for asthma: Outcomes of a cognitive behavioral intervention for children with asthma and anxiety. *School of Psychology*, 34(6), 665–676. <https://doi.org/10.1037/spq0000310>.
- McTague, K., Prizeman, G., Shelly, S., Eustace-Cook, J., & McCann, E. (2022). Youths with asthma and their experiences of self-management education: A systematic review of qualitative evidence. *Journal of Advanced Nursing*, 78(12), 3987–4002. <https://doi.org/10.1111/jan.15459>.
- Miller, W. R., Lasiter, S., Bartlett, E. R., & Buelow, J. M. (2015). Chronic disease self-management: A hybrid concept analysis. *Nursing Outlook*, 63(2), 154–161. <https://doi.org/10.1016/j.outlook.2014.07.005>.
- Nichols, M., Miller, S., Treiber, F., Ruggiero, K., Dawley, E., & Teufel, R. II (2020). Patient and parent perspectives on improving pediatric asthma self-management through a mobile health intervention: Pilot study. *JMIR Formative Research*, 4(7), Article e15295. <https://doi.org/10.2196/15295>.
- Nickels-Nelson, G. M. (2019). Adolescent ownership of asthma health: A concept analysis. *Nursing Forum*, 54(2), 246–253. <https://doi.org/10.1111/nuf.12324>.
- Nurmagambetov, T., Kuwahara, R., & Garbe, P. (2018). The economic burden of asthma in the United States, 2008–2013. *Annals of the American Thoracic Society*, 15(3), 348–356. <https://doi.org/10.1513/annats.201703-259oc>.
- O'Connell, S., Mc Carthy, V. J., & Savage, E. (2018). Frameworks for self-management support for chronic disease: A cross-country comparative document analysis. *BMC Health Services Research*, 18(1), 1–10. <https://doi.org/10.1186/s12913-018-3387-0>.
- Ödling, M., Jonsson, M., Janson, C., Melén, E., Bergström, A., & Kull, I. (2020). Lost in the transition from pediatric to adult healthcare? Experiences of young adults with severe asthma. *Journal of Asthma*, 57(10), 1119–1127. <https://doi.org/10.1080/02770903.2019.1640726>.
- Odom, L., & Christenbery, T. (2016). There is an “app” for that: Designing mobile phone technology to improve asthma action plan use in adolescent patients. *Journal of the American Association of Nurse Practitioners*, 28(11), 583–590. <https://doi.org/10.1002/2327-6924.12375>.
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *Systematic Reviews*, 10(1), 1–11. <https://doi.org/10.1186/s13643-021-01626-4>.
- Peters, D., Davis, S., Calvo, R. A., Sawyer, S. M., Smith, L., & Foster, J. M. (2017). Young people's preferences for an asthma self-management app highlight psychological needs: A participatory study. *Journal of Medical Internet Research*, 19(4). <https://doi.org/10.2196/jmir.6994>.
- Pinnock, H. (2015). Supported self-management for asthma. *Breathe*, 11(2), 98–109. <https://doi.org/10.1183/20734735.015614>.
- Pinnock, H., Parke, H. L., Panagioti, M., Daines, L., Pearce, G., Epiphaniou, E., ... Taylor, S. J. (2017). Systematic meta-review of supported self-management for asthma: A healthcare perspective. *BMC Medicine*, 15(1), 1–32. <https://doi.org/10.1186/s12916-017-0823-7>.
- Pité, H., Carvalho, S., & Morais-Almeida, M. (2021). *The challenges and facilitators of self-management in pediatric asthma* 21(2). (pp. 135–143), 135–143. <https://doi.org/10.1097/aci.0000000000000731>.
- Quaranta, J., Wool, M., Logvis, K., Brown, K., & Joshy, D. (2014). Interpersonal influences on the self-management skills of the rural asthmatic adolescent. *Online Journal of Rural Nursing and Health Care*, 14(2), 97–122. <https://doi.org/10.14574/ojrnhc.v14i2.281>.
- Ramsey, R. R., Carmody, J. K., Holbein, C. E., Guilbert, T. W., & Hommel, K. A. (2019). Examination of the uses, needs, and preferences for health technology use in adolescents with asthma. *Journal of Asthma*, 56(9), 964–972. <https://doi.org/10.1080/02770903.2018.1514048>.
- Rasberry, C. N., Cheung, K., Buckley, R., Dunville, R., Daniels, B., Cook, D., ... Dean, B. (2014). Indicators of asthma control among students in a rural, school-based asthma management program. *Journal of Asthma*, 51(8), 876–885. <https://doi.org/10.3109/02770903.2014.913620>.
- Rayyan (2022). Rayyan website. Retrieved December from: <https://www.rayyan.ai/>.
- Rehman, N., Morais-Almeida, M., & Wu, A. C. (2020). Asthma across childhood: Improving adherence to asthma management from early childhood to adolescence. *The Journal of Allergy and Clinical Immunology: In Practice*, 8(6), 1802–1807. <https://doi.org/10.1016/j.jaip.2020.02.011>.
- Rhee, H., Miner, S., Sterling, M., Halterman, J. S., & Fairbanks, E. (2014). The development of an automated device for asthma monitoring for adolescents: Methodologic approach and user acceptability. *JMIR mHealth and uHealth*, 2(2) e27 21–16. <https://doi.org/10.2196/mhealth.3118>.
- Roberts, C. A., Geryk, L. L., Sage, A. J., Sleath, B. L., Tate, D. F., & Carpenter, D. M. (2016). Adolescent, caregiver, and friend preferences for integrating social support and communication features into an asthma self-management app. *Journal of Asthma*, 53(9), 948–954. <https://doi.org/10.3109/02770903.2016.1171339>.
- Roberts, C. A., Sage, A. J., Geryk, L. L., Sleath, B. L., & Carpenter, D. M. (2019). Adolescent feedback on predisposing, reinforcing, and enabling features in asthma self-management apps. *Health Education Journal*, 78(7), 770–783. <https://doi.org/10.1177/0017896919836693>.
- Sangnimitchikul, W., Srisatidnarakul, B., & Ladores, S. (2022). The effectiveness of a family-based asthma self-management program in enhancing the asthma health outcomes in school-age children. *Comprehensive Child and Adolescent Nursing*, 45(2), 156–170. <https://doi.org/10.1080/24694193.2020.1837290>.
- Schneider, T., Baum, L., Amy, A., & Marisa, C. (2019). I have most of my asthma under control and I know how my asthma acts: Users' perceptions of asthma self-management mobile app tailored for adolescents. *Health Informatics Journal*, 26(1), 342–353. <https://doi.org/10.1177/1460458218824734>.
- Serebrisky, D., & Wiznia, A. (2019). Pediatric asthma: A global epidemic. *Annals of Global Health*, 85(1). <https://doi.org/10.5334/aogh.2416>.
- Sleath, B., Carpenter, D. M., Beard, A., Gillette, C., Williams, D., Tudor, G., & Ayala, G. X. (2013). Child and caregiver reported problems in using asthma medications and question-asking during paediatric asthma visits. *International Journal of Pharmacy Practice*, 22(1), 69–75. <https://doi.org/10.1111/ijpp.12043>.
- Sonney, J., Segrin, C., & Kolstad, T. (2019). Parent- and child-reported asthma responsibility in school-age children: Examining agreement, disagreement, and family functioning. *Journal of Pediatric Health Care*, 33(4), 386–393. <https://doi.org/10.1016/j.pedhc.2018.11.005>.

- Sudarsan, I., Hoare, K., Sheridan, N., & Roberts, J. (2022). Giving voice to children in research: The power of child-centered constructivist grounded theory methodology. *Research in Nursing & Health, 45*(4), 488–497. <https://doi.org/10.1002/nur.22231>.
- Sullivan, K., & Thakur, N. (2020). Structural and social determinants of health in asthma in developed economies: A scoping review of literature published between 2014 and 2019. *Current Allergy and Asthma Reports, 20*(2), 1–12. <https://doi.org/10.1007/s11882-020-0899-6>.
- Suri, H. (2019). Ethical considerations of conducting systematic reviews in educational research. In O. Zawacki-Richter, M. Kerres, S. Bedenlier, M. Bond, & K. Buntins (Eds.), *Systematic reviews in educational research* (pp. 41–54). Springer. https://doi.org/10.1007/978-3-658-27602-7_3.
- Taylor, S. J., Pinnock, H., Epiphaniou, E., Pearce, G., Parke, H. L., Schwappach, A., ... Sheikh, A. (2014). A rapid synthesis of the evidence on interventions supporting self-management for people with long-term conditions: Prisms – Practical systematic review of self-management support for long-term conditions. *Health Services and Delivery Research, 253*, 1–580. <https://doi.org/10.3310/hsdr02530>.
- Teufel, R. J., II, Patel, S. K., Shuler, A. B., Andrews, A. L., Nichols, M., Ebeling, M. D., ... Treiber, F. A. (2018). Smartphones for real-time assessment of adherence behavior and symptom exacerbation for high-risk youth with asthma: Pilot study. *JMIR Pediatrics and Parenting, 1*(2), Article e8. <https://doi.org/10.2196/pediatrics.9796>.
- Tinschert, P., Jakob, R., Barata, F., Kramer, J. -N., & Kowatsch, T. (2017). The potential of mobile apps for improving asthma self-management: A review of publicly available and well-adopted asthma apps. *JMIR mHealth and uHealth, 5*(8). <https://doi.org/10.2196/mhealth.7177>.
- Toronto, C. E., & Remington, R. (2020). *A step-by-step guide to conducting an integrative review*. Springer International Publishing. <https://doi.org/10.1007/978-3-030-37504-1>.
- Turnbull, S., Cabral, C., Hay, A., & Lucas, P. J. (2020). Health equity in the effectiveness of web-based health interventions for the self-care of people with chronic health conditions: Systematic review. *Journal of Medical Internet Research, 22*(6). <https://doi.org/10.2196/17849>.
- Tzeng, Y. -F., Chiang, B. -L., Chen, Y. -H., & Gau, B. -S. (2018). Health literacy in children with asthma: A systematic review. *Pediatrics and Neonatology, 59*(5), 429–438. <https://doi.org/10.1016/j.pedneo.2017.12.001>.
- United Nations (2013). Definition of youth. Retrieved August from: <https://www.un.esa/socdev/documents/youth/fact-sheets/youth-definition.pdf>.
- Valizadeh, L., Zarei, S., Zamanazadeh, V., Bilan, N., Nasiri, K., & Howard, F. (2014). The effects of triggers' modifying on adolescent self-efficacy with asthma: A randomized controlled clinical trial. *JCS: Journal of Caring Sciences, 3*(2), 121–129. <https://doi.org/10.5681/jcs.2014.013>.
- Warren, C. M., Dyer, A., Blumenstock, J., & Gupta, R. S. (2016). Leveraging mobile technology in a school-based participatory asthma intervention: Findings from the student media-based asthma research team (SMART) study. *American Journal of Health Education, 47*(2), 59–70. <https://doi.org/10.1080/19325037.2015.1133337>.
- Whittemore, R., & Knafl, K. (2005). The integrative review: Updated methodology. *Journal of Advanced Nursing, 52*(5), 546–553. <https://doi.org/10.1111/j.1365-2648.2005.03621.x>.
- World Health Organization (2014). Adolescence: A period needing special attention 2014. Retrieved January from: <https://apps.who.int/adolescent/second-decade/section2/page1/recognizing-adolescence.html>.
- World Health Organization (2022). *Self-care interventions for health*. World Health Organization Retrieved 20th February from: <https://www.who.int/news-room/fact-sheets/detail/self-care-health-interventions>.
- Wu, Y., Howarth, M., Zhou, C., Hu, M., & Cong, W. (2019). Reporting of ethical approval and informed consent in clinical research published in leading nursing journals: A retrospective observational study. *BMC Medical Ethics, 20*(1), 1–10. <https://doi.org/10.1186/s12910-019-0431-5>.
- Zaeh, S. E., Lu, M. A., Blake, K. V., Ruvalcaba, E., Ayensu-Asiedu, C., Wise, R. A., ... Eakin, M. N. (2021). "It is kind of like a responsibility thing": Transitional challenges in asthma medication adherence among adolescents and young adults. *Journal of Asthma, 59*(5), 956–966. <https://doi.org/10.1080/02770903.2021.1897836>.