Improving Quality of Care in Children and Adolescents with Asthma in Primary Health Care: Rapid Evidence Synthesis

This document is a supplement to the rapid policy brief on the issue.

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Competing interests
The authors do not have any relevant competing interests.

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List of abbreviations

GINA	Global Initiative for Asthma
ICS	Indian Chest Society
LMICs	Low- and middle-income countries
MDI	Meter Dose Inhaler
NCCP	National College of Chest Physicians
NCD	Non Communicable Disease
PEF	Peak Expiratory Flow
PHC	Primary Health Care
PICO	Population, Interventions, Comparisons and Outcomes
WHO	World Health Organization

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Executive Summary

Background:
Asthma is a chronic respiratory illness of childhood. Optimal asthma care is essential to reduce the disease burden and to improve patients' quality of life. Strategies to improve quality of care generally include self-management support and education.

Objective: This rapid review aims at offering a comprehensive synthesis of evidence on interventions to improve quality of care among children and adolescents with asthma in the primary healthcare sector.

Methods: A comprehensive systematic search was conducted in PubMed, Embase, Cochrane Library and Health Systems Evidence electronic databases to identify studies that examined interventions to improve quality of care for asthma patients in primary care in the past five years. In total, eight systematic reviews fulfilled the eligibility criteria and were included in the final report.

Results: Most of the systematic reviews included randomised controlled trials, and were conducted in high-income countries, mainly UK and USA. Overall, there was limited and mixed evidence on the effectiveness of interventions targeting enhanced quality of care for asthma patients in primary care. There is some evidence of effectiveness for self-management support and education to improve medication adherence and asthma control. Self-management training may include interventions focussed on techniques to help children and their parents/caregivers to monitor their symptoms and to modify treatment, as necessary. ehealth interventions, particularly mobile app-based, are effective and acceptable in improving patient medication adherence.

Conclusion: The findings from this review highlight the gaps in evidence on quality of asthma care in primary health care settings, more so from low- and middle-income countries' perspective. Researchers and policy-makers should address these gaps to generate contextualised and tailored evidence that ensures relevance and targeted high-impact interventions at the primary health care level.

Key words: asthma, quality of care, primary healthcare, evidence synthesis

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1. Background

Asthma is a chronic respiratory disease characterised by reversible breathing difficulties due to narrowing of the airways, thickening of the airway walls and increased mucus production.(1) Symptoms may include wheeze, shortness of breath, chest tightness, cough, and variable expiratory flow limitation.(1) A total of 37.9 million cases of asthma were reported in India in 2016.(2) Further, the deaths and disability-adjusted life-years (DALYs) per case of asthma were 2·4 times higher in India compared to the global average in 2016.(2)

The World Health Organization (WHO) defined primary health care (PHC) as the "essential health care based on scientifically sound and socially acceptable methods and technology, which make universal health care accessible to all individuals and families in a community. It is through their full participation and at a cost that the community and the country can afford to maintain at every stage of their development in the spirit of self-reliance and self-determination".(3) The Institute of Medicine (IOM) and the WHO defined quality of care (QoC) as the degree to which health care services improve desired health and patient outcomes that are consistent with current professional knowledge.(4, 5) The WHO further states that to achieve QoC, the health care that is provided should be safe, effective, timely, efficient, equitable and people-centred.

The State Health Resource Centre (SHRC) in Raipur, identified that asthma is highly prevalent in Chhattisgarh, and that there is a lack of comprehensive understanding of the QoC paradigm of PHC provided across the healthcare system. There is an increased attention to QoC due to an increasing burden of disease and a need for good quality care. Therefore, the Centre requested for a rapid overview of evidence on interventions to improve QoC in PHC setting to help inform decision-making. Rapid evidence synthesis (RES) is a type of research synthesis that is time-efficient, and informs and guides specific decision-making needs of policy-makers.

This rapid systematic overview aims to meet the need of policy decision-makers for evidence on interventions to improve QoC in the treatment of asthma in PHC settings. This is a comprehensive review of published research evidence that highlights evidence-based interventions targeted at improving QoC within the PHC sector. Further, the review also identifies the knowledge gaps in the QoC domain for asthma from a primary care perspective.

Review question
- What is the best available evidence on the effectiveness of interventions to improve quality of care among children and adolescents with asthma in primary healthcare settings?

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2. Methods

This section describes the methods used in the development of the rapid review.

Inclusion Criteria (PICO)

Systematic reviews that met the following criteria were included.

Population

Children and adolescents, aged ≤18 years with a diagnosis of asthma.

Intervention

Reviews that examined interventions designed to improve the QoC in the treatment of asthma in PHC settings were considered for inclusion. The following interventions were considered:

- Patient and provider education
- Self-management
- Pharmacist role
- Medication management (inhaler techniques, inhaled bronchodilators, inhaled corticosteroids)
- Lifestyle modifications
- Peer support
- Telehealth or mhealth
- Financial incentives

Reviews that examined the effectiveness of asthma medications, medical procedures, complementary and alternative medicine, psychological interventions, school-based therapy, and of nutrients were not considered.

Outcome/s

Quality of care was defined as patient reported outcome measures, clinical behaviours, and intermediate clinical and physiological measures (as defined by systematic review authors).

Study designs

Systematic reviews/meta-analyses of randomised controlled trials (RCTs) or non-RCTS, controlled before after studies or interrupted time studies published in the last 5 years were included. In the absence of systematic reviews for interventions of interest, relevant primary studies were searched for. Qualitative systematic reviews and studies, observational and descriptive studies, case reports, case series, commentaries, and expert opinions were not considered.

Setting

Studies conducted in primary health care context were considered.

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Search methods

A comprehensive search was conducted in electronic databases such as PubMed, Cochrane Library, EMBASE, and Health Systems Evidence. Search strategies are provided in Appendix 1. The search was restricted to reviews published in the English language in the past 5 years for recency and relevancy, with a focus on LMIC context.

Data collection, and reporting

Quantitative data was extracted from included systematic reviews using a semi-structured data collection form. The data extracted included details about the review and sample characteristics (study designs, sample size, setting, country, participants' age range), interventions, outcome measures, and results of significance (estimated effect size with corresponding 95% confidence interval if quantitative statistical analysis was conducted).

Data synthesis and reporting

A narrative summary of the included systematic reviews aided by tables and figures, where appropriate is presented.

3. Results

The results section presents detailed findings from the systematic reviews, based on the type of intervention.

Description of characteristics of included systematic reviews

Search results and study selection

The PRISMA diagram (Figure 1) reports the number of studies identified, the screening process and the final list of included studies. All titles and abstracts were screened by one reviewer (SM). The full texts were examined by a single reviewer, with two other reviewers (JT and MK) conducting a secondary examination. Any disagreements were resolved by discussion. Studies that did not clearly meet the inclusion criteria were excluded. The full texts of the remaining reviews were retrieved and assessed for methodological quality.

Excluded reviews

Seven systematic reviews (SRs) were excluded following full text examination in detail. A list of the excluded SRs is provided in Appendix 2. The SRs were excluded mainly due to wrong population and not being relevant to primary care settings.

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Methodological quality of included SRs

Systematic reviews included in the report were appraised using the AMSTAR checklist (Appendix 3). The checklist consists of a 16-item questionnaire that requires reviewers to address each question with 'yes', 'no', or 'partial yes' for each SR. The SRs were of moderate to high methodological quality and well reported; however, there was no reference to an apriori protocol, and assessment of publication bias was not reported in non-Cochrane SRs.(6-10)

Key characteristics of the included SRs are summarised in Table 1. Almost all the studies included in the SRs were conducted in high-income countries such as the United States, United Kingdom, Australia, and Canada. The included reviews were published between 2016 and 2019. The sample sizes of the studies included in the reviews ranged from 12 to 375 participants.

Search for primary studies

An additional search for primary studies such as RCTs, non-RCTs, controlled before after studies or interrupted time studies was conducted. The search identified a total of 245 studies from four databases. The search strategies for each database are provided in Appendix 4. Following exclusion of five duplicates, the titles and abstracts of 240 studies were screened. Only three studies were identified as potentially eligible for full text examination. However, on detailed review, none of the studies were found eligible to be included in the review, due to not being relevant to primary care setting. Figure 2 presents the PRISMA flow chart with the study selection process.
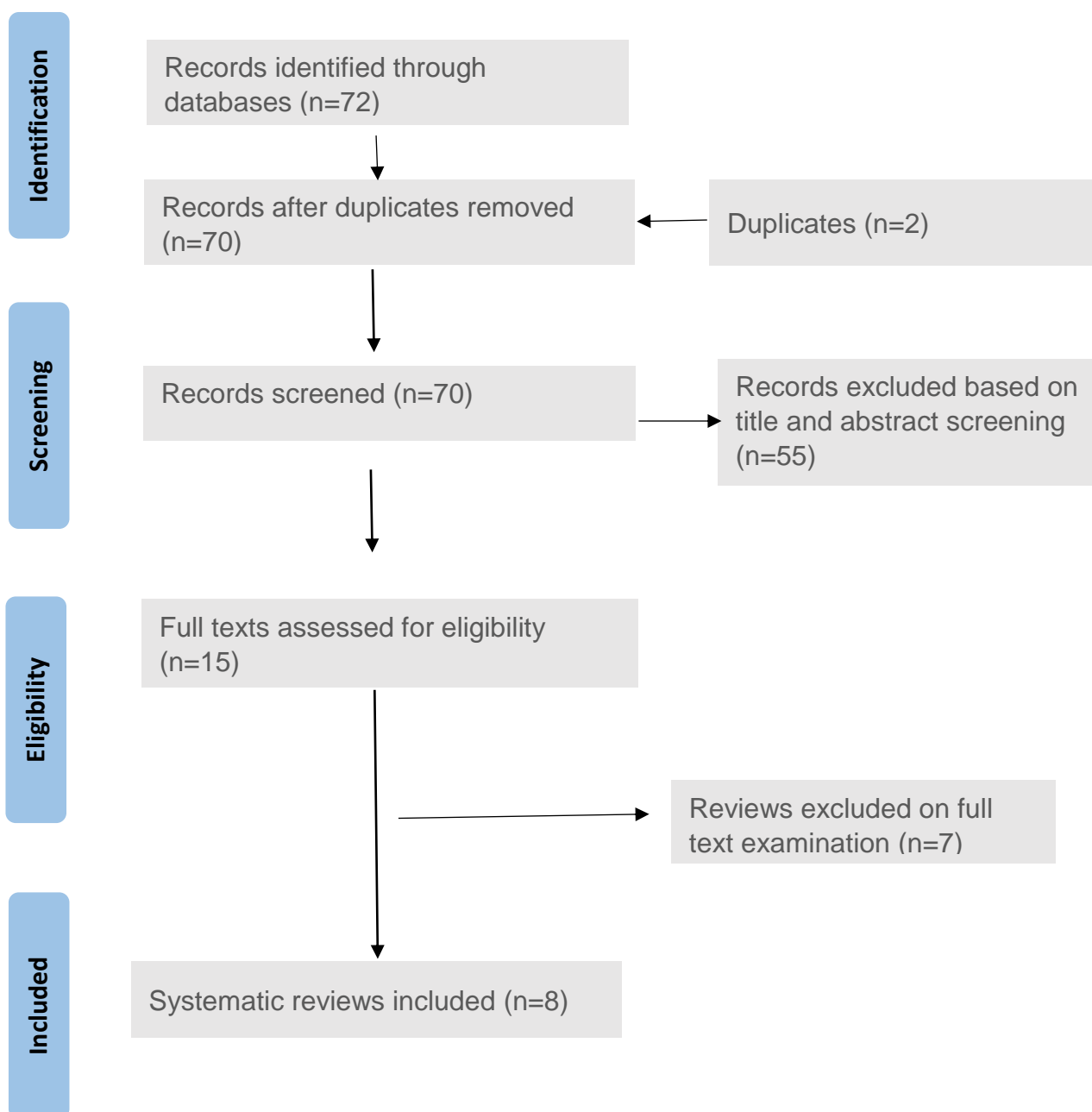
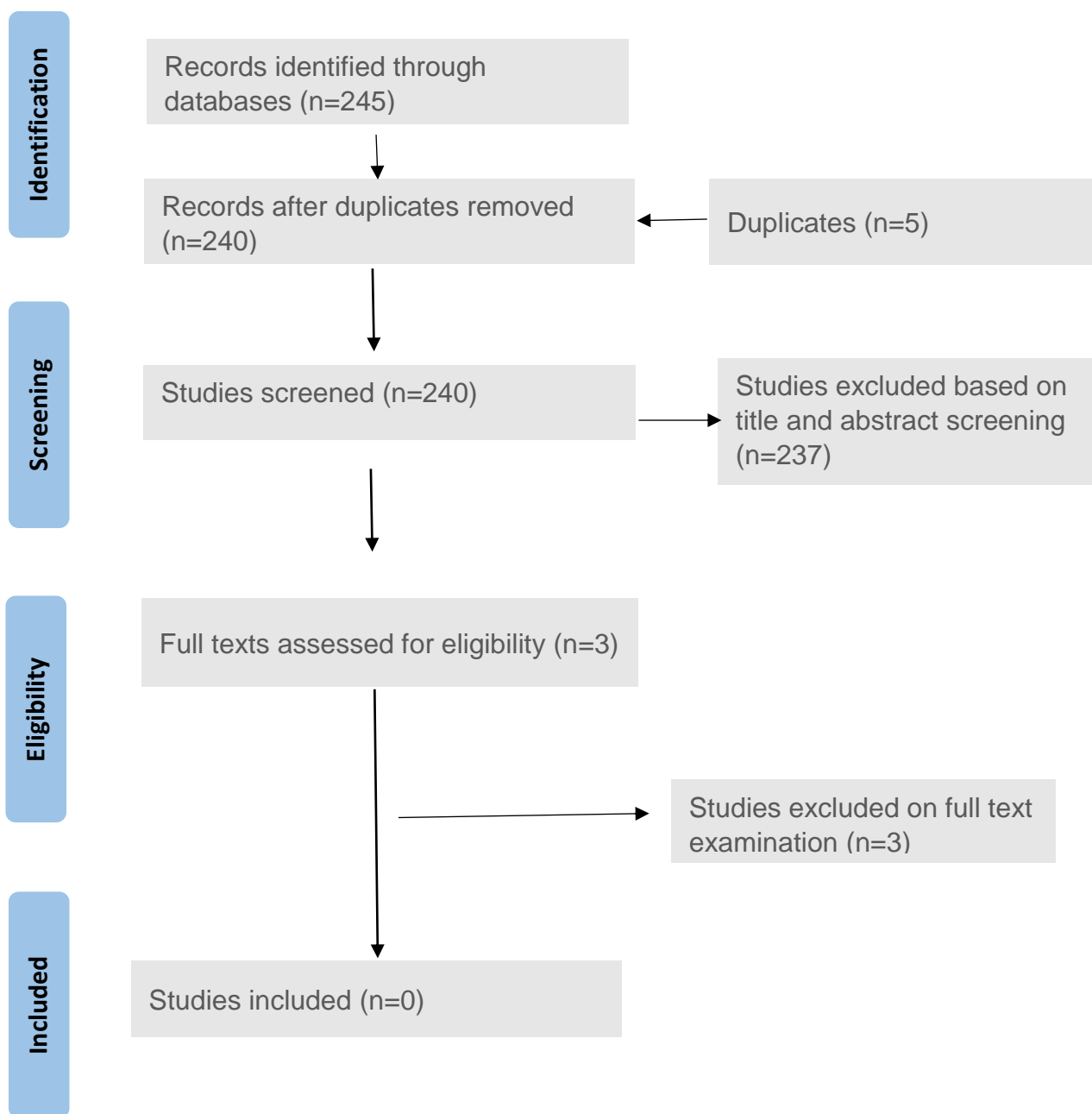**Figure 1   PRISMA Study Selection Flow Chart for Systematic Reviews**

Identification

Records identified through databases (n=72)

Records after duplicates removed (n=70) ← Duplicates (n=2)

Screening

Records screened (n=70) → Records excluded based on title and abstract screening (n=55)

Eligibility

Full texts assessed for eligibility (n=15)

Reviews excluded on full text examination (n=7)

Included

Systematic reviews included (n=8)

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Figure 2   **PRISMA Study Selection Flow Chart for Primary Studies**

Identification

Records identified through databases (n=245)

Records after duplicates removed (n=240) ← Duplicates (n=5)

Screening

Studies screened (n=240) → Studies excluded based on title and abstract screening (n=237)

Eligibility

Full texts assessed for eligibility (n=3)

Studies excluded on full text examination (n=3)

Included

Studies included (n=0)

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Table 1. Description of Included Systematic Reviews

Review citation details	Question/focus of the Review	Review and Demographic characteristics	Interventions & Outcome measure(s)	Brief findings
Ahmed et al 2018(6)	To synthesise the evidence on the effectiveness of self-management interventions in different socio-cultural contexts	Three out of 16 trials were conducted in PHC settings., with two trials specifically in PHC and one other in a combination of primary care and hospital settings. All the three were conducted in UK, between years 2000-2016. The target population included South Asians (Indians, Pakistanis, Bangladeshis, and Sri Lankans) residing in the UK. Studies included children, adolescents, and adults. Age range of the participants in the three studies was between 3-59 years. Sample size ranged between 164-375 across the three studies.	Education formed a central component of most of the self-management interventions. Education, training, nurse follow ups and review as part of self-management strategies. Mode of delivery is in either individual or group sessions. Outcomes measured mainly included clinical outcomes such as unscheduled care and asthma control. The outcomes ere measured using AQLQ and ACT.	Time to first unscheduled care effect was not found to be significant between the intervention and control (usual care) groups; HR 0.72, 95% CI 0.48 to 1.09. No significant differences between different ethnic groups in proportion attending unscheduled asthma care. No significant difference in asthma control between different ethnic groups. Time to first unscheduled contact FU: HR = 1.19 (0.92 to 1.53). Proportion without unscheduled care FU: OR = 0.72 (0.45 to 1.16) Time to first unscheduled primary care contact FU: HR = 1.20, 0.92 to 1.57 Time to first routine review in primary care FU: HR = 2.22, 1.67 to 2.95

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Review citation details	Question/focus of the Review	Review and Demographic characteristics	Interventions & Outcome measure(s)	Brief findings
				Number of asthma events/episodes for South Asians: no between group differences Proportion with an admission. I: 5.3 vs. C: 6.3% OR 0.83 (0.28 to 2.44) Proportion with an emergency department attendance. I: 1.4 vs. C: 4.0% OR 2.92 (0.52 to 21.2) Proportion with out-of-hours primary care. I: 2.8 vs. C: 2.6% FU: OR 0.95 (0.19 to 4.60) Proportion with a GP consultation. I: 55 9 vs. 50.3%. OR 0.80 (0.49 to −1.30) At 1 year FU Quality of life in South Asians was significantly better in the intervention effect Group. Change in AQLQ FU: I: 0.11 vs. −0.15. Between group mean difference 0.26 (0.17–0.36)

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Review citation details	Question/focus of the Review	Review and Demographic characteristics	Interventions & Outcome measure(s)	Brief findings
Alquran et al 2018(7)	To assess the feasibility and effectiveness of mobile phone applications in improving asthma self-management among children and adolescents	One out of eight studies related to primary care, which was conducted in the USA in 2015. The sample included 12 children and adolescents, aged between 11-16 years (urban minority group of African Americans).	Mobile Adolescents' Disease Empowerment and Persistency Technology (M-ADEPT) app, which included: Reminders for participants to take their ICS medication; basketball game (immediate encouragement) for taking ICS; and positive text messages for each puff of ICS taken. Outcome measures included asthma control tests, self-efficacy, and medication adherence	Median ICS adherence increased from 19% to 67 % after eight weeks of using the app. The percentage of participants who met the target ICS adherence (>50%) improved from 8% at baseline to 58% at eight weeks follow up. Adherence for short-acting beta 2-agonist reduced from a median of three to zero. The participants' median ACT scores improved from 18 at baseline to 23 in the 8th week during the study period.
Farzandipour et al 2017(8)	To summarise the evidence regarding the effects of mHealth apps for different self-management outcomes among patients with asthma	One out of 10 studies included in the SR was relevant to PHC setting. The study was conducted in the UK in 2012. Study duration was 6 months. The study included 288 adolescents and adults with poorly controlled asthma from 32 primary care practices.	Web-browser based mobile phone application that allowed the patient to record symptoms, drug use, and peak flow data, with immediate feedback prompting action according to an agreed plan or paper based monitoring (patients were asked to keep a paper diary, recording the same outcome data as the intervention group twice daily).	No significant difference in the change in asthma control between the intervention group (mean change 0.75) when compared to the paper group (mean change 0.73). At six months FU, 29/139 (21%) of participants in the mobile application group had achieved the well-controlled threshold of ACQ ≤0.75 when compared to 31/139 (22%) in the paper group.

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Review citation details	Question/focus of the Review	Review and Demographic characteristics	Interventions & Outcome measure(s)	Brief findings
			Outcomes measures included changes in scores on ACQ and self efficacy (knowledge, attitude, and self efficacy asthma questionnaire (KASE-AQ)) at six months follow up.	No significant difference was reported between the groups in change in mini-AQLQ score; however, more patients in the mobile group reported to have improved their quality of life by than those in the paper group. Additionally, no significant difference was found between the two groups in the number of acute attacks, prescription of steroid courses, unscheduled GP or nurse consultations, out of hours visits, attendances at ED, or admissions. There was a significant cost difference between the two groups in relation to the telemonitoring service (around £69 per patient). The mean cost of providing respiratory care (including the nurse monitoring reviews) was £246 (SD £226) in the mobile group compared with £245 (SD £201) in the paper group (mean difference −£1.26 (−£51.47 to £48.95).

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Review citation details	Question/focus of the Review	Review and Demographic characteristics	Interventions & Outcome measure(s)	Brief findings
Jeminiwa et al 2019(9)	To assess the overall effectiveness of eHealth interventions on patient adherence to ICS, and to evaluate the satisfaction of patients using eHealth tools	Two out of 15 RCTs were relevant to PHC setting, and both were conducted in the USA. The study duration ranged between 12-24 months. Sample size ranged from 1,187 to 2,698. One study (conducted in 2015) included children, aged between 3-12 years, and another study (conducted in 2010) included children, adolescents, and adults (age range 5-56 years).	Computerised speech recognition (CSR) vs usual care, and Patient medication adherence feedback vs no feedback. The primary outcome of interest was medication (ICS) adherence, as assessed by pharmacy refill.	Medication adherence improved by 44.5% in the CSR group compared to 35.5% in the control group (p < 0.001). SMD (0.37); 95% CI 0.24 to 0.50. No significant improvement in patient medication adherence between the feedback group (21.3%) and control group (23.3%) (p=0.553). SMD -0.85; 95% CI -0.93 to -0.77.
Kew and Cates 2016(11)	To assess the safety and efficacy of conducting asthma check-ups remotely compared to usual face-to-face consultations	One before-and-after study out of six studies was relevant to PHC setting. The study was conducted (in 2007) in the UK that included three general practices, involving a total of 278 patients.	Structured telephone call or face-to-face check-up both at a prearranged time. Outcomes included asthma morbidity and enablement on the mini AQLQ, ACQ, adverse events, costs.	In terms of asthma exacerbations requiring oral corticosteroids at 3 months, the risk with face-to-face-check-ups was 21 per 1000 compared to 36 per 1000 with telephone check-up. OR 1.74; 95% CI 0.41 to 7.44.
Kew et al 2017(12)	To assess the safety and efficacy of lay-led and peer support interventions for adolescents with asthma	One (RCT) out of five studies conducted in three primary care practices in USA. The study was conducted in 2013 over a period of 10 weeks. Sample included 68 adolescents (African American or Hispanic), aged between 11 to 16 years (mean age 13.3 years). Male to	Intervention group participants received peer support and mp3 messaging. Participants in the intervention group received music tracks and attended coping peer group sessions led by social workers during weeks 1 to 4 and 6 to 9.	Only one study in the SR to report on medication adherence. Baseline adherence to ICS was very low at 27.4% in the intervention group (IQR 14.3 to 35.0) and 25.9% in the control group (IQR 14.0 to 37.5). After 10 weeks, medication adherence further

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Review citation details	Question/focus of the Review	Review and Demographic characteristics	Interventions & Outcome measure(s)	Brief findings
		female ratio 1:1; (range 11 to 16) years; 85% had uncontrolled asthma; and 26.5% had 2 or more OCS courses in past 12 months.	During the session, participants developed and recorded 2 to 4 messages from the discussion to encourage daily use of ICS, to be played at random between music tracks Control group included attention control, with all participants receiving medical supervision, peak flow meters and an iPod during the run-in. The primary outcome of interest was ICS adherence (average daily adherence over the previous 14 days) measured with an electronic medication monitor for ICS, measured at baseline and at 5 and 10 weeks.	reduced in both the peer support group (median 7.1%; IQR 0.9 to 21.4) and the control group (median 14.3%; IQR 5.4 to 21.4).
McCleary et al 2018(10)	To synthesise the evidence regarding educational initiatives for professionals involved in self-management support for asthma.	Three (RCTs) out of 15 studies relevant to primary care. Studies were conducted in Australia (2011), Sweden (1997) and UK (2016). Studies' duration ranged from 12-18 months across the three studies. Participants included GPs, children and adolescents.	Two studies included evaluated PACE initiative for primary care physicians to develop skills for treating asthma, including supporting patients & families to self-manage. The third study examined academic detailing for diagnosis and treatment of asthma, covering general management	Compared to control, at 1 year no difference in Unscheduled care: OR 0.71 (95% CI 0.43 to 1.20), p = .20; Time to first unscheduled care: HR 1.19 (95% CI 0.92 to 1.53), p = 0.19. Compared to control, at 3 months there was greater improvement in QoL (AQ20)

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Review citation details	Question/focus of the Review	Review and Demographic characteristics	Interventions & Outcome measure(s)	Brief findings
		Sample size ranged from 221 to 375. Age range of the participants was between 3-16 years.	of asthma, specifically including self-management support. Control group participants in all the three studies received standard care. Outcomes measured included development of asthma action plans, unscheduled care, QoL, hospitalisation rates, PEF, and medication prescription.	mean diff −2.56 (95% CI −3.89 to −1.24), p < 0.001. Parents had a written action plan I: 61% C: 46% diff 15% (95% CI 2 to 28%), p = 0.046; GPs provided written action plan > 70% of the time I: 76% C: 53% diff 23% (95% CI 11 to 36%), p= 0.002. Compared to control, at 1 year there was no difference in Hospitalisation: I: 18% C: 12% diff 6% (95% CI −4 to 15%), p = 0.12. Compared to control, at 1 year, there was no significant difference in proportion given a PEF-based self-management plan I: 46%, C: 32%, p > 0.05. Compared to control, at 1 year there was no significant difference in ratios of prescribed inhaled beta-agonists to inhaled glucocorticoids measured as defined daily doses.

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Review citation details	Question/focus of the Review	Review and Demographic characteristics	Interventions & Outcome measure(s)	Brief findings
Normansell et al 2017(13)	To assess the impact of interventions to improve inhaler technique on clinical outcomes and safety in children with asthma	Five (RCTs) out of 29 studies were identified as relevant to PHC setting. Studies were conducted in Turkey, UK, USA. The duration of studies around 1 month. Studies were conducted between 2001-2015. Four studies included children and adolescents (age range studies was 7-17 years), and sample size ranged from 36 to 91. One other study included 110 adolescents and adults, with an age range from 12-87 years.	Interventions and control group participants across various studies received: An educational computer game called Space Inhalers comprising of educational material about inhaler technique and asthma information. Tele-pharmacy counselling group with MDI technique assessed at different times. 3-minute video on MDI technique with specific instructions on how to use. Multi-media touch screen system (MTS) on correct inhaler use and additional information on posture (in two studies). Control group participants received: Space Inhalers game as in the intervention group, but without educational material. MDI technique with written instruction materials. 3-minute video on nutrition.	Multimedia training vs usual care: Change in inhaler technique score was reported in two studies at 4 weeks FU. Mean (SD) change in the intervention group was 2.60 (0.60) and 0.87 (1.09) compared to 0.50 (0.50) and 0.32 (1.87) in the control group. Asthma control was reported in one study, with change from baseline showing a Mean change was 0.73 in the intervention group compared to 1.2 in the control group.

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Review citation details	Question/focus of the Review	Review and Demographic characteristics	Interventions & Outcome measure(s)	Brief findings
			Patient information leaflets on the correct use of inhalers (in two studies) Relevant outcomes measured: inhaler technique, and asthma control (ACT)	

AQLQ – Asthma Quality of Life Questionnaire; ACT – Asthma Control Test; ACQ - Asthma Control Questionnaire; AQ20 - Airways Questionnaire 20; C – Control group; CI – Confidence Interval; ED – Emergency Department; FU – Follow Up; GP - General Practitioner; HR – Hazard Ratio; ICS – Inhaled Corticosteroids; I = Intervention group; IQR – InterQuartile Range; MDI – Metered Dose Inhaler; OR – Odds Ratio; PACE - Physician Asthma Care Education; PEF - Peak Expiratory Flow; PHC – Primary Health Care; RCT – Randomised Controlled Trial; SD - Standard Deviation; SMD – Standardised Mean Difference; QoL – Quality of Life

Table 3: Critical appraisal results of included systematic reviews assessed using the AMSTAR-2 checklist (see Appendix 3)

Citation	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16
Ahmed et al 2018	Y	Y	N	PY	N	N	N	Y	Y	N	NMC	NMC	N	Y	NMC	Y
Alquran et al 2018	Y	N	N	PY	Y	N	PY	Y	Y	N	NMC	NMC	N	N	NMC	Y
Farzandipour et al 2017	Y	N	N	PY	Y	Y	N	Y	Y	N	NMC	NMC	N	N	NMC	Y
Jeminiwa et al 2019	Y	N	N	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	N	Y
Kew and Cates 2016	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Kew et al 2017	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
McCleary et al 2018	Y	Y	N	Y	Y	Y	N	Y	Y	N	NMC	NMC	N	Y	NMC	Y
Normansell et al 2017	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Y- Yes; N - No; PY – Partial Yes; NMC – No Meta-analysis Conducted

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Summary of evidence from included systematic reviews

This section presents the main findings from the systematic reviews based on the effect of different types of interventions. The findings for each intervention are further categorised based on the sub-categories of interventions. Main outcomes measured included asthma control, quality of life, self-efficacy, asthma medication adherence, and unscheduled care visits.

Self-management

The included reviews assessed one or some combination of the following: self-management education (instructions on how to modify treatment when symptoms occur or exacerbate), and eHealth-based interventions.

Education

One SR assessed the effectiveness of interventions to enhance the adoption of self-management interventions in a South Asian ethnic population. Three studies in the SR were relevant to PHC setting. Education was the main component of the interventions, but content, and mode of delivery varied. Overall, the results showed that interventions improved clinical outcomes and reduced unscheduled care visits. There was mixed evidence on improvement in quality of life and asthma self-efficacy.

One study assessed a self-management education programme and reported that there was a weak but positive benefit on morbidity. There was no significant difference between the intervention and control group for time to first unscheduled care (Hazard Ratio (HR) 0.72, 95% CI 0.48 to 1.09). In one other study, a multicomponent education intervention (plus chronic disease self-management programme) did not show any positive effect on time to unscheduled care (median time to event 171 days in intervention patients, 189 in the controls, (HR = 1.19, 95% CI 0.92 to 1.53). However, the time to an asthma review consultation in primary care significantly shortened (HR = 2.22, 95% CI 1.67 to 2.95). Further, patients in the intervention group reported significant improvements in quality of life and asthma self efficacy, at 3 months follow up.

The use of asthma specialist nurses with a liaison care model (education of patients post discharge with educational outreach and clinical support for primary care clinicians) was found to reduce unscheduled care for acute asthma in a disadvantaged population (HR 0.73, 95% CI 0.54 to 1.00). Further, the percentage of participants attending with acute asthma reduced after one year. Rates of hospital admission, attendance at an emergency department, and visits to primary care for acute asthma were found to be lower for participants receiving specialist nurse care. The overall yearly attendance rates for unscheduled care for each participant were 1.98 in the intervention group compared to 2.36 in the control group. In terms of an impact of the intervention, there was reduced healthcare utilisation at the PHC level. However, the

study did not report any significant changes in self-management behaviour, use of oral rescue corticosteroids, and quality of life.

The evidence regarding the effectiveness of education for primary care providers implementing supported self-management for asthma was based on three studies. There was some evidence to show that provider education improved outcomes in terms of improved adherence and asthma control. In one study, children with infrequent intermittent asthma symptoms received self-management support from primary care providers. It was found that there was a lower use of inhaled corticosteroids (ICS) (Mean Difference (MD) 24%, 95% CI -43% to -5%) and long-acting bronchodilators (MD 19%, 95% CI -34% to -5%). Overall, patients' knowledge and awareness of asthma symptoms and asthma control significantly improved after they received self-management support. A significant increase in knowledge on asthma self-management was also reported in primary care providers. However, it was not clear from the studies which components of the interventions improved outcomes.(10)

eHealth-based interventions

A SR included one study that assessed the effect of a tailored mobile health intervention to encourage self-management in terms of improving medication adherence and asthma control in adolescents. The study reported that ICS adherence increased from 19% to 67% and to 67% at eight weeks follow up. Further, the percentage of participants who met the target ICS adherence (>50%) improved from 8% at baseline to 58% at eight weeks follow up.(7)

Medication management/Inhaler techniques

Multimedia training vs usual care

Five studies were conducted in primary care facilities that assessed the impact of multimedia training interventions to improve inhaler technique on clinical outcomes and safety in children with asthma. One out of five studies included both adults and adolescents (age range 12 to 87 years).

Two studies in children reported change from baseline for inhaler technique at one-month follow-up through multimedia training. Only one study in children reported asthma control using the ACT and reported that there was no significant difference between the intervention and control group.(13) Multimedia training for inhaler technique may improve quality of life and asthma control among children; however, the results were mixed, and studies were small. Studies that examined relevant interventions did not report any significant improvement in clinical outcomes. Enhanced inhaler technique education and multi-media training were found to improve inhaler technique immediately post-intervention and at one month follow-up. However, how and when inhaler technique was assessed did affect whether inhaler technique improved and the degree of improvement.(13)

Peer support interventions

A SR assessed the safety and efficacy of lay-led and peer support interventions for adolescents with asthma.(12) Only one study relevant to primary care was identified in the SR, which was conducted in the USA. Peer support intervention was examined, which aimed to improve the well-being and disease management through sharing of experiences and information with those who received similar interventions previously. Several outcomes were measured including asthma-related quality of life (using Asthma Quality of Life Questionnaire (AQLQ)), asthma exacerbations requiring at least a course of oral steroids, asthma control (using Asthma Control Questionnaire (ACQ)) or Asthma Control Test (ACT)), unscheduled visits to health services for asthma, medication (ICS) adherence, and adverse events.

Median adherence was found to have reduced in both the peer support group (median 7.1%; IQR 0.9 to 21.4) and the control group (median 14.3%; IQR 5.4 to 21.4), at 10 weeks follow up. Adolescents who received peer support were found to have better quality of life compared to those in the control group. However, peer support did not seem to show any important benefit on most other outcomes of interest. Very little information was reported on asthma attacks or unscheduled visits, and therefore, it was not clear whether the intervention was beneficial for asthma control. Overall, there was limited evidence to show the benefits of routine use of peer support interventions in improving asthma control, exacerbations and medication adherence.(12)

Telehealth Interventions

Telehealth or eHealth is described as the use of information and communication technologies (ICT) to remotely deliver healthcare through monitoring and personalised feedback to support patient self-management.(14) eHealth interventions examined included smartphone applications, text messaging, pagers or web technologies to promote medication adherence among patients with asthma.

Computerised speech recognition vs usual care

One study relevant to primary care was identified in the SR by Jeminiwa,(9) which was conducted in the USA. Pharmacy refill was the outcome measurement for medication (ICS) adherence. Computerised speech recognition was compared with usual care. Medication adherence improved by 44.5% in the intervention group compared to the usual care group. Participants also reported increased satisfaction with the intervention they received. A total of 1,187 participants were included in this study (24 months duration) that included children and adolescents (age range 3-12 years).

Patient medication adherence feedback vs no feedback

In another study (12 months duration) in the SR by Jeminiwa, patient medication adherence feedback was compared with no feedback on medication adherence. There was no significant difference in terms of improvement between the treatment (21.3%)

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and control group (23.3%). The participants in this study included children, adolescents and adults (age range 5-56 years), and the sample size was 2,698.

Telehealth check-ups vs face-to-face check-ups

Another SR examined the effectiveness of regular asthma check-ups conducted remotely compared to face-to-face check-ups.(11) Only one out of six studies included target population of interest (adolescents).There is insufficient evidence to suggest that remote asthma check-ups demonstrate any important benefits in terms of improving exacerbations, asthma control or quality of life. Routine use of remote asthma check-ups may not be a safe alternative to the usual face-to-face consultations.(11)

Mobile phone application vs paper based monitoring

Mobile phone application monitoring compared to paper based monitoring did not significantly improve clinical outcomes, or increase self efficacy, when delivered in the context of standard clinical care for the management of asthma. Healthcare costs were found to be similar in both groups; however, there was the additional cost of telemonitoring expenses in the mobile application group.(8)

4. Conclusion

The review aimed to provide a comprehensive overview of evidence on interventions to improve QoC among children and adolescents with asthma in the PHC sector. Overall, it was found that there was a lack of sufficient number of studies examining QoC at the PHC level. This is a significant knowledge gap, more so from LMICs' perspective taking into consideration that the search for studies was not restricted to LMICs. Further, the review highlights the concentration of research output in HICs, mainly the USA and UK, which may have impacted the ability to provide guidance for evidence-informed decision-making and to address policy decision-makers' needs.

Self-management interventions that include education as the main component may be beneficial in reducing unscheduled care visits and improve quality of life, although not considerably. Current evidence suggests that there is a large degree of variation in the way telehealth is defined and delivered in various studies. There is limited evidence to suggest that eHealth-based interventions may help improve adherence to ICS, if they are mobile app-based. However, patients were found to be more receptive and accepting of the telephone consultations by health professionals, and interactive voice response calls. Education on self-management support for asthma patients may benefit through inter-professional collaboration. This should be addressed through specific roles and responsibilities which are emerging as new chronic care models.

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Parents and carers need information and skills to facilitate effective self-management and manage asthma in children. Consistent with this, patient education and regular review are central to improving quality of care for asthma management.

The rapid review did not identify any SRs or primary studies on pharmacist role, lifestyle modifications and financial incentives. Very few studies included in the SRs reported on patient and/or provider satisfaction when examining QoC.

5. Recommendations for future research

- There is a need for large-scale and longer-term studies targeted at primary health care level in LMICs.

6. Strengths and limitations of the review

Strengths

- A robust and comprehensive search strategy was used to identify a significant number of SRs.
- A valid and comprehensive tool (AMSTAR-2 checklist) was used to assess the methodological quality of the included SRs.

Limitations

- The systematic reviews were identified based on searches in only four databases. It is possible that this approach may have resulted in not identifying some other eligible SRs. However, to address this limitation, reference lists of included reviews were hand searched.
- Differences in objectives, methods, outcomes and quality of the included SRs caused more difficult comparisons.
- The search was restricted to the last five years and non-English language SRs were excluded; which may have resulted in exclusion of some relevant reviews in this field.

7. References

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7.   Alquran A, Lambert KA, Farouque A, Holland A, Davies J, Lampugnani ER, et al. Smartphone Applications for Encouraging Asthma Self-Management in Adolescents: A Systematic Review. Int J Environ Res Public Health. 2018;15(11).

8.   Farzandipour M, Nabovati E, Sharif R, Arani MH, Anvari S. Patient Self-Management of Asthma Using Mobile Health Applications: A Systematic Review of the Functionalities and Effects. Appl Clin Inform. 2017;8(4):1068-81.

9.   Jeminiwa R, Hohmann L, Qian J, Garza K, Hansen R, Fox BI. Impact of eHealth on medication adherence among patients with asthma: A systematic review and meta-analysis. Respir Med. 2019;149:59-68.

10.   McCleary N, Andrews A, Buelo A, Captieux M, Morrow S, Wiener-Ogilvie S, et al. IMP(2)ART systematic review of education for healthcare professionals implementing supported self-management for asthma. NPJ Prim Care Respir Med. 2018;28(1):42.

11.   Kew KM, Cates CJ. Remote versus face-to-face check-ups for asthma. Cochrane Database Syst Rev. 2016;4:Cd011715.

12.   Kew KM, Carr R, Crossingham I. Lay-led and peer support interventions for adolescents with asthma. Cochrane Database Syst Rev. 2017;4:Cd012331.

13.   Normansell R, Kew KM, Mathioudakis AG. Interventions to improve inhaler technique for people with asthma. Cochrane Database Syst Rev. 2017;3:Cd012286.

14.   McLean S, Sheikh A, Cresswell K, Nurmatov U, Mukherjee M, Hemmi A, et al. The impact of telehealthcare on the quality and safety of care: a systematic overview. PLoS One. 2013;8(8):e71238.

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8. Appendices

Appendix 1: Search Strategies

PubMed

No.	Search terms	Number of hits
#1	Asthma[MeSH] OR asthma[tw] OR asthma[tw]	173255
#2	education[MeSH] OR education[tw] OR "self-management"[MeSH] OR "self-management"[tw] OR "self management"[tw] OR "self care"[tw] OR "self-care"[tw] OR "pharmacist role"[tw] OR "medication therapy management"[MeSH] OR "medication therapy management"[tw] OR "drug therapy management"[tw] OR "medication management"[tw] OR "inhaler techniques"[tw] OR ((inhaled[tw] OR inhaler[tw]) AND ("bronchodilator agents"[MeSH] OR "bronchodilator agents"[tw] OR bronchodilators[tw] OR "bronchial dilating agents"[tw] OR "broncholytic agents"[tw] OR "bronchodilating agent*"[tw] OR bronchodilatant[tw] OR "bronchospasmolytic agent"[tw] OR corticosteroids[tw] OR "adrenal cortex hormones"[MeSH] OR "adrenal cortex hormones"[tw] OR corticoids[tw] "adrenal steroid hormone"[tw])) OR "lifestyle modification"[tw] OR "lifestyle change"[tw] OR "lifestyle changes"[tw]OR "life style modification"[tw] OR "lifestyle modifications" OR "life style modifications" OR "peer support"[tw] OR "peer group" OR telemedicine[MeSH] OR telemedicine[tw] OR telehealth[tw] OR mhealth[tw] OR eHealth[tw] OR e-Health[tw] OR "financial incentives"[tw] OR "financial rewards"[tw]	1248053
#3	"quality of health care"[MeSH] OR "quality of health care"[tw] OR "quality of healthcare"[tw] OR "health care quality"[tw] OR "healthcare quality"[tw] OR "quality of care"[tw] OR "health care evaluation"[tw]	6847265
#4	"systematic review*"[tw] OR "meta-analysis as topic"[MeSH] OR "meta analy*"[tw] OR "metaanaly*"[tw] OR "systematic overview*"[tw] OR "review literature as topic"[MeSH]	197059
#5	#1 AND #2 AND #3 AND #4 AND Filters: Published in the last 5 years; Humans; English	**63**

Cochrane Library

No.	Search terms	Number of hits
#1	asthma OR asthmas	31118
#2	education OR "self care" OR "self-care" OR "self-management" OR "pharmacist role" OR "medication therapy management" OR "drug therapy management" OR "medication management" OR "inhaler techniques" OR ((inhaled OR inhaler) AND ("bronchodilating agent*" OR "bronchodilator agents" OR bronchodilators OR bronchodilators OR "bronchial dilating agents" OR "broncholytic agents" OR bronchodilatant OR "bronchospasmolytic agent" OR "adrenal cortex hormones" OR corticoids OR corticosteroids OR "adrenal steroid hormone")) OR "lifestyle modification" OR "life style modification" OR "lifestyle modifications" OR	98027

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	"life style modifications" OR "lifestyle change" OR "lifestyle changes" OR "peer support" OR "peer group" OR telehealth OR telemedicine OR eHealth OR e-Health OR mhealth OR "financial incentives" OR "financial rewards"	
#3	"health care quality" OR "health care quality" OR "healthcare quality" OR "quality of care" OR "quality of healthcare" OR "quality of healthcare" OR "health care evaluation"	7884
#4	#1 AND #2 AND #3 AND Filters: Systematic reviews; Published in the last 5 years	**3**

EMBASE

No.	Search terms	Number of hits
#1	Asthma/de OR asthma OR asthmas	322393
#2	education/de OR education OR "self care"/de OR "self care" OR "self-care" OR "self-management" OR "pharmacist role" OR "medication therapy management"/de OR "medication therapy management" OR "drug therapy management" OR "medication management" OR "inhaler techniques" OR ((inhaled OR inhaler) AND ("bronchodilating agent"/de OR "bronchodilating agent*" OR "bronchodilator agents" OR bronchodilators OR "inhaled bronchodilators" OR "bronchial dilating agents" OR "broncholytic agents" OR bronchodilatant OR "bronchospasmolytic agent" OR "adrenal cortex hormones" OR corticoids OR corticosteroids/de OR corticosteroids OR "adrenal steroid hormone")) OR "lifestyle modification"/de OR "lifestyle modification" OR "life style modification" OR "lifestyle modifications" OR "life style modifications" OR "lifestyle change" OR "lifestyle changes" OR "peer support" OR "peer group"/de OR "peer group" OR telehealth/de OR telehealth OR telemedicine OR eHealth OR e-Health OR mhealth OR "financial incentives" OR "financial rewards"	1896825
#3	"health care quality"/de OR "health care quality" OR "healthcare quality" OR "quality of care" OR "quality of healthcare" OR "quality of healthcare" OR "health care evaluation"	279792
#4	"systematic review"/de OR "systematic review*" OR "meta analy*" OR metaanaly* OR "meta-analysis" OR "systematic overview*"	469662
#5	#1 AND #2 AND #3 AND #4 AND [embase]/lim NOT [medline]/lim AND [humans]/lim AND [2015-2020]/py AND [english]/lim	**7**

Total number of hits (SRs) from three databases (≤10 years) = **73**

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No.	Search terms	Number of hits
#1	((asthma OR asthmas) AND ("health care quality" OR "health care quality" OR "healthcare quality" OR "quality of care" OR "quality of healthcare" OR "quality of healthcare" OR "health care evaluation"))	90
#2	Relevant reviews	**0**

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Appendix 2: List of excluded systematic reviews

1. Crossman-Barnes CJ, Peel A, Fong-Soe-Khioe R, Sach T, Wilson A, Barton G. Economic evidence for nonpharmacological asthma management interventions: A systematic review. Allergy. 2018;73(6):1182-95.
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5. Klijn SL, Hiligsmann M, Evers S, Roman-Rodriguez M, van der Molen T, van Boven JFM. Effectiveness and success factors of educational inhaler technique interventions in asthma & COPD patients: a systematic review. NPJ Prim Care Respir Med. 2017;27(1):24.
6. Stephani V, Opoku D, Quentin W. A systematic review of randomized controlled trials of mHealth interventions against non-communicable diseases in developing countries. BMC Public Health. 2016;16:572.
7. Yasmin F, Banu B, Zakir SM, Sauerborn R, Ali L, Souares A. Positive influence of short message service and voice call interventions on adherence and health outcomes in case of chronic disease care: a systematic review. BMC Med Inform Decis Mak. 2016;16:46.

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Appendix 3. AMSTAR-2 Appraisal Checklist

AMSTAR 2: a critical appraisal tool for systematic reviews that include randomised or non- randomised studies of healthcare interventions, or both.

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1. Did the research questions and inclusion criteria for the review include the components of PICO?

For Yes:	Optional (recommended)	
☐ Population	☐ Timeframe for follow-up	☐ Yes
☐ Intervention		☐ No
☐ Comparator group		
☐ Outcome		

2. Did the report of the review contain an explicit statement that the review methods were established prior to the conduct of the review and did the report justify any significant deviations from the protocol?

For Partial Yes: The authors state that they had a written protocol or guide that included ALL the following:	For Yes: As for partial yes, plus the protocol should be registered and should also have specified:	
		☐ Yes
		☐ Partial Yes
☐ review question(s)	☐ a meta-analysis/synthesis plan, if appropriate, *and*	☐ No
☐ a search strategy	☐ a plan for investigating causes of heterogeneity	
☐ inclusion/exclusion criteria	☐ justification for any deviations from the protocol	
☐ a risk of bias assessment		

3. Did the review authors explain their selection of the study designs for inclusion in the review?

For Yes, the review should satisfy ONE of the following:	
☐ *Explanation for* including only RCTs	☐ Yes
☐ OR *Explanation for* including only NRSI	☐ No
☐ OR *Explanation for* including both RCTs and NRSI	

4. Did the review authors use a comprehensive literature search strategy?

For Partial Yes (all the following):	For Yes, should also have (all the following):	
☐ searched at least 2 databases (relevant to research question)	☐ searched the reference lists / bibliographies of included studies	☐ Yes
☐ provided key word and/or search strategy	☐ searched trial/study registries	☐ Partial Yes
☐ justified publication restrictions (e.g. language)	☐ included/consulted content experts in the field	☐ No
	☐ where relevant, searched for grey literature	
	☐ conducted search within 24 months of completion of the review	

5. Did the review authors perform study selection in duplicate?

For Yes, either ONE of the following:	
☐ at least two reviewers independently agreed on selection of eligible studies and achieved consensus on which studies to include	☐ Yes
☐ OR two reviewers selected a sample of eligible studies <u>and</u> achieved good agreement (at least 80 percent), with the remainder selected by one reviewer.	☐ No

---

6. Did the review authors perform data extraction in duplicate?

For Yes, either ONE of the following:	
☐ at least two reviewers achieved consensus on which data to extract from included studies	☐ Yes
☐ OR two reviewers extracted data from a sample of eligible studies <u>and</u> achieved good agreement (at least 80 percent), with the remainder extracted by one reviewer.	☐ No

7. Did the review authors provide a list of excluded studies and justify the exclusions?

For Partial Yes:	For Yes, must also have:	
☐ provided a list of all potentially relevant studies that were read in full-text form but excluded from the review	☐ Justified the exclusion from the review of each potentially relevant study	☐ Yes ☐ Partial Yes ☐ No

8. Did the review authors describe the included studies in adequate detail?

For Partial Yes (ALL the following):	For Yes, should also have ALL the following:	
☐ described populations ☐ described interventions ☐ described comparators ☐ described outcomes ☐ described research designs	☐ described population in detail ☐ described intervention in detail (including doses where relevant) ☐ described comparator in detail (including doses where relevant) ☐ described study's setting ☐ timeframe for follow-up	☐ Yes ☐ Partial Yes ☐ No

9. Did the review authors use a satisfactory technique for assessing the risk of bias (RoB) in individual studies that were included in the review?

RCTs For Partial Yes, must have assessed RoB from	For Yes, must also have assessed RoB from:	
☐ unconcealed allocation, *and* ☐ lack of blinding of patients and assessors when assessing outcomes (unnecessary for objective outcomes such as all-cause mortality)	☐ allocation sequence that was not truly random, *and* ☐ selection of the reported result from among multiple measurements or analyses of a specified outcome	☐ Yes ☐ Partial Yes ☐ No ☐ Includes only NRSI
NRSI For Partial Yes, must have assessed RoB:	For Yes, must also have assessed RoB:	
☐ from confounding, *and* ☐ from selection bias	☐ methods used to ascertain exposures and outcomes, *and* ☐ selection of the reported result from among multiple measurements or analyses of a specified outcome	☐ Yes ☐ Partial Yes ☐ No ☐ Includes only RCTs

10. Did the review authors report on the sources of funding for the studies included in the review?

For Yes	
☐ Must have reported on the sources of funding for individual studies included in the review. Note: Reporting that the reviewers looked for this information but it was not reported by study authors also qualifies	☐ Yes ☐ No

11. If meta-analysis was performed did the review authors use appropriate methods for statistical combination of results?

RCTs
For Yes:
- ☐ The authors justified combining the data in a meta-analysis
  - ☐ AND they used an appropriate weighted technique to combine study results and adjusted for heterogeneity if present.
  - ☐ AND investigated the causes of any heterogeneity

☐ Yes
☐ No
☐ No meta-analysis conducted

For NRSI
For Yes:
- ☐ The authors justified combining the data in a meta-analysis
  - ☐ AND they used an appropriate weighted technique to combine study results, adjusting for heterogeneity if present
  - ☐ AND they statistically combined effect estimates from NRSI that were adjusted for confounding, rather than combining raw data, or justified combining raw data when adjusted effect estimates were not available
  - ☐ AND they reported separate summary estimates for RCTs and NRSI separately when both were included in the review

☐ Yes
☐ No
☐ No meta-analysis conducted

12. If meta-analysis was performed, did the review authors assess the potential impact of RoB in individual studies on the results of the meta-analysis or other evidence synthesis?

For Yes:
- ☐ included only low risk of bias RCTs
- ☐ OR, if the pooled estimate was based on RCTs and/or NRSI at variable RoB, the authors performed analyses to investigate possible impact of RoB on summary estimates of effect.

☐ Yes
☐ No
☐ No meta-analysis conducted

13. Did the review authors account for RoB in individual studies when interpreting/ discussing the results of the review?

For Yes:
- ☐ included only low risk of bias RCTs
- ☐ OR, if RCTs with moderate or high RoB, or NRSI were included the review provided a discussion of the likely impact of RoB on the results

☐ Yes
☐ No

14. Did the review authors provide a satisfactory explanation for, and discussion of, any heterogeneity observed in the results of the review?

For Yes:
- ☐ There was no significant heterogeneity in the results
- ☐ OR if heterogeneity was present the authors performed an investigation of sources of any heterogeneity in the results and discussed the impact of this on the results of the review

☐ Yes
☐ No

15. If they performed quantitative synthesis did the review authors carry out an adequate investigation of publication bias (small study bias) and discuss its likely impact on the results of the review?

For Yes:
- ☐ performed graphical or statistical tests for publication bias and discussed the likelihood and magnitude of impact of publication bias

☐ Yes
☐ No
☐ No meta-analysis conducted

16. Did the review authors report any potential sources of conflict of interest, including any funding they received for conducting the review?

For Yes:
- ☐ The authors reported no competing interests OR
- ☐ The authors described their funding sources and how they managed potential conflicts of interest

☐ Yes
☐ No

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Appendix 4: Search Strategies for primary studies

PubMed

No.	Search terms	Number of hits
#1	Asthma[MeSH] OR asthma[tw] OR asthma[tw]	173318
#2	education[MeSH] OR education[tw] OR "self-management"[MeSH] OR "self-management"[tw] OR "self management"[tw] OR "self care"[tw] OR "self-care"[tw] OR "pharmacist role"[tw] OR "medication therapy management"[MeSH] OR "medication therapy management"[tw] OR "drug therapy management"[tw] OR "medication management"[tw] OR "inhaler techniques"[tw] OR ((inhaled[tw] OR inhaler[tw]) AND ("bronchodilator agents"[MeSH] OR "bronchodilator agents"[tw] OR bronchodilators[tw] OR "bronchial dilating agents"[tw] OR "broncholytic agents"[tw] OR "bronchodilating agent*"[tw] OR bronchodilatant[tw] OR "bronchospasmolytic agent"[tw] OR corticosteroids[tw] OR "adrenal cortex hormones"[MeSH] OR "adrenal cortex hormones"[tw] OR corticoids[tw] "adrenal steroid hormone"[tw])) OR "lifestyle modification"[tw] OR "lifestyle change"[tw] OR "lifestyle changes"[tw]OR "life style modification"[tw] OR "lifestyle modifications" OR "life style modifications" OR "peer support"[tw] OR "peer group" OR telemedicine[MeSH] OR telemedicine[tw] OR telehealth[tw] OR mhealth[tw] OR eHealth[tw] OR e-Health[tw] OR "financial incentives"[tw] OR "financial rewards"[tw]	1248458
#3	"quality of health care"[MeSH] OR "quality of health care"[tw] OR "quality of healthcare"[tw] OR "health care quality"[tw] OR "healthcare quality"[tw] OR "quality of care"[tw]	6848414
#4	"randomized controlled trial*"[tw] OR "randomized controlled trials as topic"[MeSH] OR "clinical trial*"[tw] OR "randomised controlled stud*"[tw] OR "randomized controlled stud*"[tw] OR "randomised controlled trial*"[tw] OR "non-randomized controlled trials as topic"[MeSH] OR "quasi-experimental stud*"[tw] OR "evaluation stud*"[tw] OR "program evaluation"[tw] OR "pretest-posttest"[tw] OR "non-randomized"[tw] OR "non-randomised"[tw] OR nonrandomized[tw] OR nonrandomised[tw] OR "controlled before-after studies"[tw] OR "interrupted time series studies"[tw] OR "repeated measures studies"[tw]	1151694
#5	"primary health care"[tw] OR "primary health care"[tw] OR "primary healthcare"[tw] OR "primary care"[tw] OR "first line care"[tw]	160158
#6	#1 AND #2 AND #3 AND #4 AND Filters: Published in the last 5 years; Humans; English	**228**

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No.	Search terms	Number of hits
#1	asthma OR asthmas	31118
#2	education OR "self care" OR "self-care" OR "self-management" OR "pharmacist role" OR "medication therapy management" OR "drug therapy management" OR "medication management" OR "inhaler techniques" OR ((inhaled OR inhaler) AND ("bronchodilating agent*" OR "bronchodilator agents" OR bronchodilators OR bronchodilators OR "bronchial dilating agents" OR "broncholytic agents" OR bronchodilatant OR "bronchospasmolytic agent" OR "adrenal cortex hormones" OR corticoids OR corticosteroids OR "adrenal steroid hormone")) OR "lifestyle modification" OR "life style modification" OR "lifestyle modifications" OR "life style modifications" OR "lifestyle change" OR "lifestyle changes" OR "peer support" OR "peer group" OR telehealth OR telemedicine OR eHealth OR e-Health OR mhealth OR "financial incentives" OR "financial rewards"	98029
#3	"health care quality" OR "health care quality" OR "healthcare quality" OR "quality of care" OR "quality of healthcare" OR "quality of healthcare" OR "health care evaluation"	7884
#4	"primary health care" OR "primary healthcare" OR "primary care" OR "first line care"	23216
#5	#1 AND #2 AND #3 AND Filters: Trials; Published in the last 5 years	**9**

EMBASE

No.	Search terms	Number of hits
#1	Asthma/de OR asthma OR asthmas	322435
#2	education/de OR education OR "self care"/de OR "self care" OR "self-care" OR "self-management" OR "pharmacist role" OR "medication therapy management"/de OR "medication therapy management" OR "drug therapy management" OR "medication management" OR "inhaler techniques" OR ((inhaled OR inhaler) AND ("bronchodilating agent"/de OR "bronchodilating agent*" OR "bronchodilator agents" OR bronchodilators OR "inhaled bronchodilators" OR "bronchial dilating agents" OR "broncholytic agents" OR bronchodilatant OR "bronchospasmolytic agent" OR "adrenal cortex hormones" OR corticoids OR corticosteroids/de OR corticosteroids OR "adrenal steroid hormone")) OR "lifestyle modification"/de OR "lifestyle modification" OR "life style modification" OR "lifestyle modifications" OR "life style modifications" OR "lifestyle change" OR "lifestyle changes" OR "peer support" OR "peer group"/de OR "peer group" OR telehealth/de OR telehealth OR telemedicine OR eHealth OR e-Health OR mhealth OR "financial incentives" OR "financial rewards"	1897378
#3	"health care quality"/de OR "health care quality" OR "healthcare quality" OR "quality of care" OR "quality of healthcare" OR "quality of healthcare" OR "health care evaluation"	279845

#4	"randomized controlled trial"/de OR "randomized controlled trial*" OR "randomised controlled trial*" OR "randomised controlled stud*" OR "randomized controlled stud*" OR "controlled clinical trial" OR "quasi-experimental study"/de OR "quasi experimental stud*" OR "evaluation stud*" OR "program evaluation" OR "pretest-posttest" OR "non-randomized" OR "non-randomised" OR nonrandomized OR nonrandomised OR "controlled before-after studies" OR "interrupted time series studies" OR "repeated measures studies"	1275112
#5	"primary health care"/de OR "primary health care" OR "primary healthcare" OR "primary care" OR "first line care"	282381
#6	#1 AND #2 AND #3 AND #4 AND [embase]/lim NOT [medline]/lim AND [humans]/lim AND [2015-2020]/py AND [english]/lim	**8**

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No.	Search terms	Number of hits
#1	((asthma OR asthmas) AND ("health care quality" OR "health care quality" OR "healthcare quality" OR "quality of care" OR "quality of healthcare" OR "quality of healthcare" OR "health care evaluation"))	**91**
#2	Relevant studies	**0**

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