

Asthma self-management in children: a best practice implementation project

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ABSTRACT

Introduction: Asthma is one of the most common diseases in children. A self-management program can effectively improve the outcomes for children with asthma and reduce the burden on healthcare services.

Objectives: The aim of this project was to integrate the best evidence on asthma self-management with practice in a children's respiratory clinic and to improve compliance with best practice.

Methods: Seven audit criteria were developed for the pre- and post-audit based on the best available evidence. The Joanna Briggs Institute (JBI) Practical Application of Clinical Evidence System and Getting Research into Practice audit and feedback tools were used in this project.

Results: The baseline audit showed a gap between clinical practice and the best evidence. The only criterion that achieved high compliance was provision of inhaler guidance (100%). After implementation, there were substantial improvements in compliance for many criteria. Training of clinicians increased from 13% at baseline to 67% at follow-up. Education of parents improved, with specific education about asthma triggers increasing from 55% to 100%, education about warning signs from 30% to 85% and education about effective asthma treatment options from 40% to 85%. Use of written asthma action plans increased from 0% to 25%.

Conclusion: Strategies developed in this project were effective at providing necessary information for parents and improved the compliance with evidence. Further implementation strategies and audits are still needed to improve the use of asthma action plans and ensure they are reviewed periodically.

Keywords Asthma self-management; best practice; education; parents; respiratory clinic

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Introduction

Asthma is a chronic inflammatory condition of the airways with variable and recurring symptoms, characterized by reversible airflow obstruction.¹ It has become one of the most common diseases in children. In 2007, a reported 300 million people had asthma globally, and the World Health Organization estimates that asthma prevalence may reach 400 million by 2025.² Prevalence of childhood asthma around the world varies substantially.² Reported prevalence in the Middle East is 7.5%,³ while much higher in the United Kingdom and Australia at 26%^{4,5} and 31%,⁶ respectively. In China, the prevalence of asthma is comparatively

low but is increasing at a rapid rate. The Chinese National Cooperative Group on Childhood Asthma conducted a nationwide survey in 2010 and found that the prevalence of asthma in children aged 0-14 years was 3.0%, which has dramatically increased since 2000.⁷ Asthma places a large burden on patients and their families, as well as the healthcare system.² The impact of asthma in China is considerable, with another survey from 2009-2010 indicating that 66% of children with asthma experienced an asthma attack, 27% attended an emergency department and 16% had been admitted to hospital for treatment, while 37% of parents missed work to take care of their children with asthma.⁸ Asthma accounts for an estimated 250,000 deaths worldwide each year.² Many asthma fatalities are preventable, resulting from suboptimal long-term management and delays in obtaining help during an asthma attack.^{2,9}

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Effective self-management is important for good asthma control; however, the promotion and implementation of self-management among patients and caregivers of children with asthma by healthcare professionals remains low.^{10,11} Patients' health beliefs can influence how they manage asthma and could become a barrier to self-management.¹² Some patients and caregivers have been found to assess asthma by their own approach¹³ and attribute their disease to too much exercise,¹⁴ while some patients do not accept their diagnosis and deny their asthma or minimize its severity.¹⁵ The partnership between patients and healthcare professionals is important for promotion and facilitation of asthma self-management. It is suggested that the healthcare professional include the patient in the consultation, have effective communication and establish a respectful relationship with the patient.^{12,16} It is also suggested that some doctors need to exercise more patience when listening to the patient and ensure consistency in the medical advice that is provided.¹⁷

Education is an essential component of asthma self-management.¹⁸ Some research indicates that many patients and caregivers lack asthma knowledge,¹⁹ have difficulty in recognizing symptoms and awareness of triggers and would like to learn more information about asthma.²⁰ It has been recommended that asthma self-management education be incorporated into routine care for children with asthma.¹ This education should be comprehensive and cover aspects such as prevention of asthma symptoms, self-monitoring, recognizing worsening asthma, rationale for treatment and effective treatment options.^{1,21,22} Education is needed on the importance of using controller medication and understanding how to control symptoms.²³ Research has suggested that poor health literacy is associated with poor asthma control,²⁴ and many preventable factors could be targeted by education.²⁵ Education on self-management of asthma could effectively reduce the morbidity and mortality in both adults and children.²⁶

Knowledge of appropriate medication use is crucial for effective asthma self-management. Some patients and caregivers believe that steroids are toxic, hinder the growth of children and lead to addiction and weight gain.^{15,27} Consequently, they are reluctant to use steroids for long periods or take high doses and stop or reduce medication based on their own experience.²⁸ Some patients forget to use

their medication or use it incorrectly, while some adolescents feel awkward administering medication in front of strangers. Adolescents are more likely to use an inhaler if it is nearby, with sufficient privacy and with support from friends and teachers.²⁹ Other strategies have been used to promote taking medications, including visual cues, reminders and phone alarms.²³ In China, knowledge of asthma medications is low. One study found that 45% of parents would give antibiotics when their children had an asthma attack but only 18% were likely to choose β_2 agonist, the recommended medication.³⁰ Children and their caregivers should receive training on how to use inhaler devices correctly.^{21,22}

There is evidence to suggest that written asthma action plans (AAPs) should be used to facilitate asthma self-management, which include instructions for daily management as well as instructions for recognizing and acting on worsening asthma symptoms.¹ Asthma action plans are viewed as positive to self-management by many patients and general practitioners, but some healthcare professionals do not use AAPs, considering them irrelevant,²⁸ impractical and time-consuming.³¹ Issues within the healthcare system can also affect provision of AAPs, including time restrictions during consultations, poor inter-professional communication between healthcare providers and outside professionals, unclear roles and poor team work.³¹ Current guidelines recommend the use of written AAPs for children with asthma.^{21,22} Children and their caregivers should be trained in how to follow the AAP, which should be reviewed regularly by a healthcare provider.^{21,22}

This implementation project was undertaken in a respiratory clinic in the Children's Hospital of Fudan University. The respiratory clinic is located within the outpatient building and is open nearly every day of the year. There are eight doctors and seven nurses who work in the clinic. The average patient flow per month is approximately 1200. The doctors focus on respiratory diseases, including asthma. The majority of children with asthma seen in the clinic are pre-school age because of the high prevalence of asthma diagnosed at this age. In these children, parents have a crucial role in the management of asthma, and self-management education is targeted towards the parents. Additionally, in Chinese culture, health education is generally targeted towards parents regardless of the age of the child. Older children may receive education from healthcare providers at

the same time as their parents, and the parents also play a role in educating their children.

In the Children's Hospital, self-management education for asthma is mainly conducted by doctors. However, due to the high patient flow, the time available for education of patients and their parents is very limited. Along with a lack of available education resources, parents and their children do not receive standardized information on many important aspects of asthma self-management. Furthermore, the use of AAPs has not been applied in the hospital. This means many children attending the clinic have sub-optimal management of their asthma, putting them at increased risk of morbidity and mortality. Effective strategies to improve self-management in children with asthma is an area that requires improvement in the clinic, which is the focus of this implementation project.

Objectives

The aim of this project was to promote compliance with evidence-based criteria regarding asthma self-management in children. The specific objectives were as follows:

- To determine current compliance with evidence-based criteria regarding asthma self-management
- To improve knowledge regarding asthma self-management among medical staff and parents
- To improve compliance with best practice recommendations for asthma self-management in children

Methods

This evidence implementation project was undertaken over six months, from June to November 2017, and was supported by the Practical Application

of Clinical Evidence System (PACES) and Getting Research into Practice (GRiP) framework developed by JBI involving three phases of activity:

- i. Establishing a team for the project and undertaking a baseline audit based on criteria informed by the evidence;
- ii. Reflecting on the results of the baseline audit and designing and implementing strategies to address non-compliance found in the baseline audit informed by the JBI GRiP framework;
- iii. Conducting a follow-up audit to assess the outcomes of the interventions implemented to improve practice, and identify future practice issues to be addressed in subsequent audits.

The project was registered as a Quality Improvement Activity within the hospital, and ethical approval was not required.

Phase 1: Establishment of project team and audit criteria

The first phase of the project was stakeholder engagement. Based on the different phases of this project, the people who may promote or conduct the project were listed and recruited as team members, including administrators, physicians and nurses. All team members had assigned roles, as detailed in Table 1.

Audit criteria were developed for the project based on a JBI evidence summary.³² Table 2 shows the evidence-informed audit criteria used in the project (baseline and follow-up audit) with a description of the sample and approach for measuring compliance with best practice for each audit criterion. The audit assessed the practice of all clinicians working in the respiratory clinic (seven nurses and eight doctors) and assessed the care and education

Table 1: Team establishment

Position	Role/responsibilities
Head nurse	Project leader: write protocol, design questionnaire, develop strategies, take video, analyze data, write report
Director of nursing department	Coordinator: communicate with chief respiratory doctor and obtain support from doctors
Chief respiratory doctor	Trainer: provide professional training to all clinicians
Respiratory doctor	Develop strategies on asthma action plan
Registered nurse	Guide parents to scan the QR code, and provide education and collect data

provided to 20 children with asthma and their parents. The team discussed the data collection method for each audit criterion (Table 2). Each audit criterion was assessed as “Yes” or “No” according to whether the criterion was determined as being met. Regarding the first criterion, the training record was checked to see if clinicians had been trained. For criteria 2 through 5, consecutive sampling was used to recruit the first 20 parents of children with asthma who attended the clinic during the audit period and agreed to participate in the project. Permission was obtained from 10 of the parents to follow their clinic visit and observe if they received the recommended education; the other 10 parents were followed up by telephone to ask if they had received education. Telephone follow-up with parents was used to ensure that clinicians did not conduct the

recommended education only when they knew they were being observed. For criteria 6 and 7, the patient notes were checked to see if an AAP was provided and reviewed periodically. The baseline audit was conducted from August 7 to 27, 2017.

In addition to the audit data collected, parents’ and clinicians’ knowledge of asthma was assessed using questionnaires to provide extra information on baseline knowledge levels (Appendices I and II; translated from Chinese for the purpose of this implementation report). A detailed review of relevant literature^{1,2,5,8,18,19,33} was conducted to determine which content should be included in the questionnaires. It was determined that the knowledge test should cover asthma triggers, prevention, medication, symptom recognition and other basic concepts of asthma self-management. Content

Table 2: Audit criteria, sample size and measurement method

Audit criteria	Sample	Method used to measure compliance with best practice
1. Clinicians have received training on how to educate children and parents/caregivers about asthma self-management.	7 nurses and 8 doctors working in the respiratory clinic	Check staff training records
2. The child and parents/caregivers have received education regarding asthma triggers and prevention of asthma symptoms.	20 children with asthma and their parents attending the respiratory clinic	On-site observation for 10 parents and telephone follow-up for another 10 parents
3. The child and parents/caregivers have received education regarding how to recognize asthma warning signs.	20 children with asthma and their parents attending the respiratory clinic	On-site observation for 10 parents and telephone follow-up for another 10 parents
4. The child and parents/caregivers have received education regarding effective asthma treatment options.	20 children with asthma and their parents attending the respiratory clinic	On-site observation for 10 parents and telephone follow-up for another 10 parents
5. The child and parents/caregivers have received training on how to use inhaler devices correctly, including inhaler technique, care and cleaning of devices and spacers.	20 children with asthma and their parents attending the respiratory clinic	On-site observation for 10 parents and telephone follow-up for another 10 parents
6. The child and parents/caregivers have been provided with a written asthma action plan and received training on how to follow it.	20 children with asthma and their parents attending the respiratory clinic	Review of patient notes
7. The child’s asthma action plan is reviewed periodically (approximately every six months) and whenever asthma control status or medications change.	20 children with asthma and their parents attending the respiratory clinic	Review of patient notes

validity of the questionnaires was evaluated by two respiratory physicians and one nurse specialist in the field of asthma, whereas face validity was evaluated by five nurses from other clinical units. Both versions of the questionnaire were found to have adequate face and content validity.

For the 20 parents, an electronic questionnaire was sent to assess asthma knowledge in the late afternoon following the consultation. The clinicians completed an electronic questionnaire to assess their asthma knowledge at the beginning of the baseline audit period.

Phase 2: Design and implementation of strategies to improve practice (GRiP)

Phase 2 was conducted from August 28 to November 5, 2017, with JBI PACES and GRiP tools. Reflecting on the results of the baseline audit, the project team identified the barriers and developed corresponding strategies including staff education, establishment of an electronic education platform and education leaflets for parents, and designed a modified AAP template.

Phase 3: Follow-up audit post implementation of change strategy

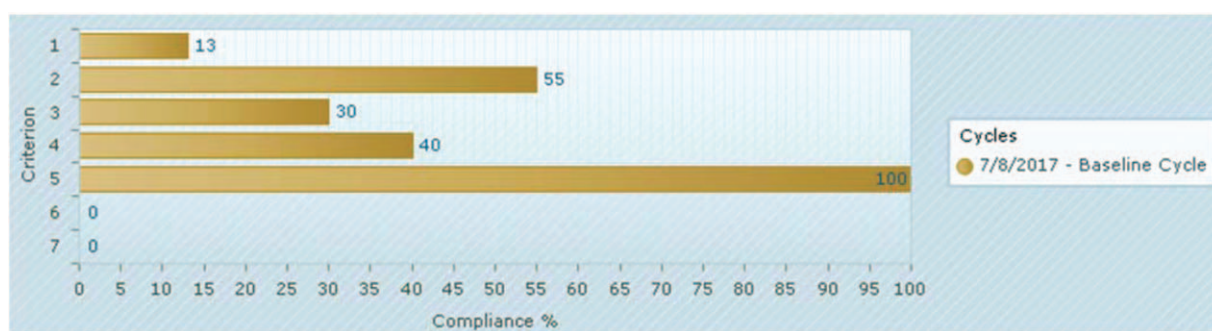
From November 5 to 25, 2017, the follow-up audit was conducted using the same audit criteria and measurement methods as the baseline audit. The

follow-up audit included 20 different children with asthma and their parents and the same 15 clinicians from the baseline audit, and data were entered into JBI PACES. The compliance rates for each criterion were compared between baseline and follow-up. The asthma self-management questionnaires were again used to assess knowledge of parents and clinicians during the follow-up audit to assess the effectiveness of education provided.

Results

Phase 1: Baseline audit

The percentages for compliance with each audit criterion from the baseline audit are shown in Figure 1. The best baseline performance was found for criterion 5, which measured the education on inhaler use to parents and showed that 100% of parents were educated on how to use inhalers. Furthermore, criterion 2 showed 55% compliance with educating parents about asthma triggers and prevention of asthma symptoms, and criterion 4 showed 40% compliance with informing effective asthma treatment options to parents. The performance of the remaining criteria were poor. Criterion 1, clinicians receiving training on how to educate children and parents, scored a compliance rate of 13%. Criterion 3, receiving education on how to recognize asthma warning signs, reached only 30% compliance. Criterion 6 and criterion 7



Criteria legend

1. Clinicians have received training on how to educate children and parents/caregivers about asthma self-management. (15 of 15 samples taken)
2. The child and parents/caregivers have received education regarding asthma triggers and prevention of asthma symptoms. (20 of 20 samples taken)
3. The child and parents/caregivers have received education regarding how to recognize asthma warning signs. (20 of 20 samples taken)
4. The child and parents/caregivers have received education regarding effective asthma treatment options. (20 of 20 samples taken)
5. The child and parents/caregivers have received training on how to use inhaler devices correctly, including inhaler technique, care and cleaning of devices and spacers. (20 of 20 samples taken)
6. The child and parents/caregivers have been provided with a written asthma action plan and received training on how to follow it. (20 of 20 samples taken)
7. The child's asthma action plan is reviewed periodically (approximately every six months) and whenever asthma control status or medications change. (20 of 20 samples taken)

Figure 1: Compliance with best-practice audit criteria in baseline audit

both recorded 0% compliance, as AAPs were not used in the clinic.

During the baseline audit, the knowledge of parents and clinicians on asthma self-management was assessed using questionnaires (Appendices I and II). The results showed that parents lacked critical knowledge regarding asthma self-management and that medical staff lacked essential knowledge to be able to effectively educate parents. Parents scored an average of 7.95 out of 20 (40%), while staff scored an average of 7.57 out of 14 (54%).

Phase 2: Strategies for getting research into practice (GRiP)

During this phase, four barriers were identified based on the baseline results and strategies to overcome these were developed by the project team (Table 3). The first barrier identified was that clinicians were not provided with any professional training regarding asthma self-management education. To address this, a training program, including face-to-face lecturing and electronic materials through WeChat (social media), was provided. All

nurses and doctors working in the respiratory clinic were asked to undergo the training, which was conducted by a respiratory specialist. After the lecture, the corresponding electronic materials were provided to each staff member. The training focused on multiple aspects according to the audit criteria, including the definition of asthma, trigger identification and prevention, warning signs recognition, effective asthma treatment options, the use of inhaler devices, the definition and clinical review of AAPs, lung function monitoring and asthma medication.

The second barrier identified was a lack of education materials for parents. Prior to the project, there were no education materials available to assist with education of parents. The team searched the literature for educational information and developed materials on different aspects of self-management including prevention, warning signs recognition, treatment options, inhaler use, AAPs, self-monitoring (lung-function monitoring) and medication.^{1,22} A patient education pamphlet on asthma prevention was developed (Appendix III; translated from Chinese for this implementation report), along with a

Table 3: Getting research into practice (GRiP) matrix

Barriers	Strategies	Resources	Outcomes
No professional training for clinicians on asthma self-management education	Provide professional training Offer electronic materials Test knowledge	Respiratory specialist 317 WeChat (social media) Questionnaire	100% of nurses were trained professionally and obtained necessary knowledge
Lack of education materials for parents	Develop education leaflets Make videos on use of inhaler device Establish an electronic education platform through 317 WeChat	Pamphlets Videos Electronic education platform	Comprehensive information was provided in materials
Limited time to educate	Modify the education process Provide pamphlets Provide access to electronic education platform on 317 WeChat for parents	Pamphlets 317 WeChat	Asthma self-management education was performed effectively and efficiently
AAP not considered essential by doctors	Educate doctors about potential benefits Make AAP easy to complete	Experienced asthma experts Simple-format AAP	Doctors expressed desire to use AAP

AAP: asthma action plan.

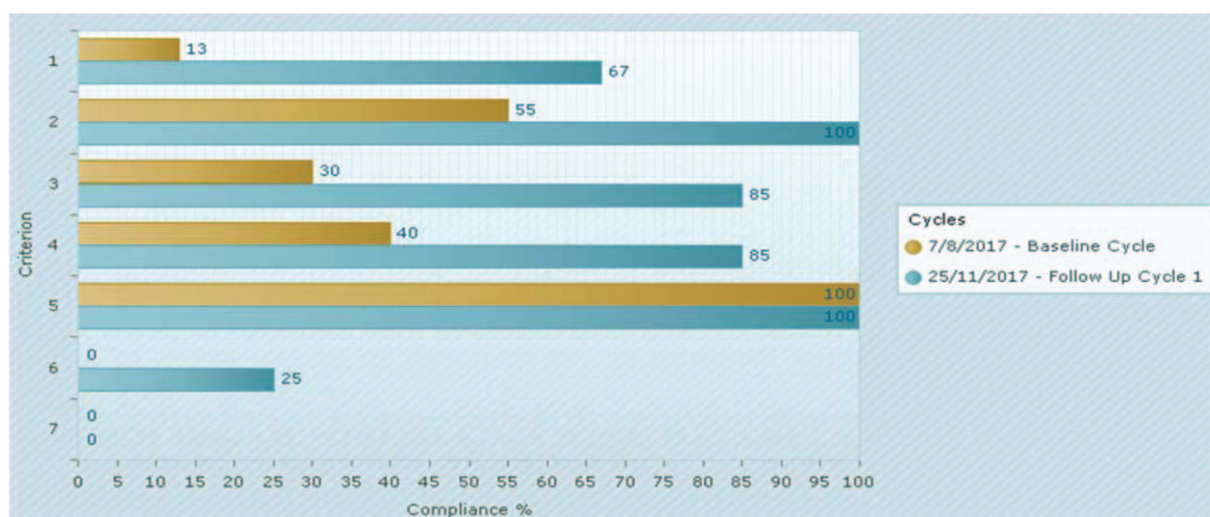
one-page leaflet covering warning signs, treatment and AAPs. In addition, four videos were produced for different inhaler devices used in the hospital. An electronic education platform through 317 WeChat was established, and all materials were uploaded so they were easily accessible to parents.

Another barrier was limited time for education to occur. Given that the doctors were too busy to spend more time to educate, we changed the education process. In the past, the doctors would give some verbal education to parents and children, and then the nurse educated parents how to use an inhaler device. In this project, we let nurses conduct the majority of education for parents and children. After the parents and children finished their consultation with a doctor, the nurse would supplement the verbal education by providing pamphlets, instructing parents on inhaler use, and scanning the QR code for 317 WeChat to allow parents to access education materials on their mobile phones. Thus, the parents had easy access to it and could refer to the information at any time.

The last barrier was that AAPs were not used in the hospital, and many doctors did not consider them to be essential. Some doctors thought AAPs took too much time to complete. To address this, we discussed the resolution with the asthma expert and designed a simple AAP sheet for doctors to use (Appendix IV; translated from Chinese for this implementation report). Then, we explained the potential benefits of AAPs to the respiratory doctors and showed them how to use the simple AAP sheet. When an AAP was provided, the doctor would write down the details of controller and reliever medications, including the name of the medicine, how much to use, when to use and how long to use, according to the child's individual situation. This provided a simple and efficient process for doctors to create individualized written AAPs.

Phase 3: Follow-up audit

In the follow-up audit, criteria 1, 2, 3, 4, and 6 showed improvements in compliance from baseline (Figure 2). Criterion 7 was unable to be audited in



Criteria legend

1. Clinicians have received training on how to educate children and parents/caregivers about asthma self-management. (15 of 15 samples taken)
2. The child and parents/caregivers have received education regarding asthma triggers and prevention of asthma symptoms. (20 of 20 samples taken)
3. The child and parents/caregivers have received education regarding how to recognize asthma warning signs. (20 of 20 samples taken)
4. The child and parents/caregivers have received education regarding effective asthma treatment options. (20 of 20 samples taken)
5. The child and parents/caregivers have received training on how to use inhaler devices correctly, including inhaler technique, care and cleaning of devices and spacers. (20 of 20 samples taken)
6. The child and parents/caregivers have been provided with a written asthma action plan and received training on how to follow it. (20 of 20 samples taken)
7. The child's asthma action plan is reviewed periodically (approximately every six months) and whenever asthma control status or medications change. (20 of 20 samples taken)

Figure 2: Compliance with best practice audit criteria in follow-up audit compared to baseline audit

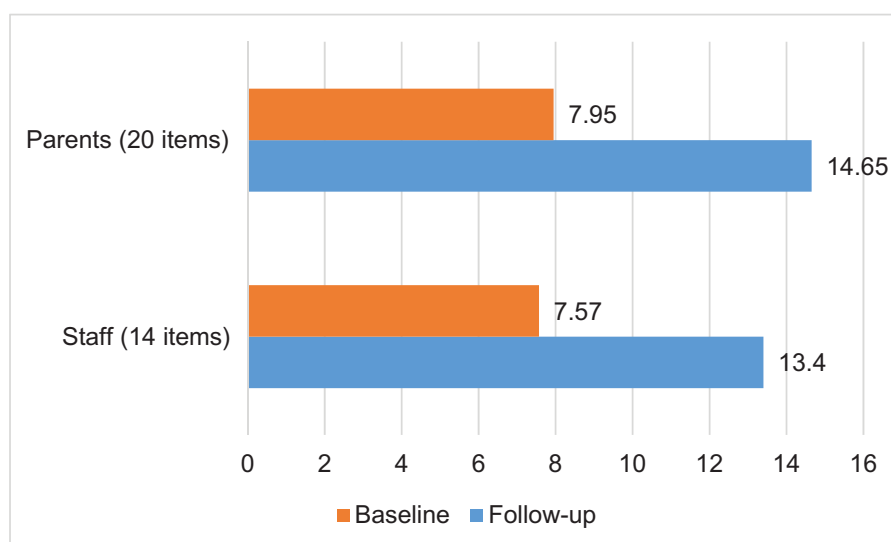


Figure 3: Average knowledge scores during the baseline audit and follow-up audit

the current cycle; because of the short period of time since AAPs were introduced, there were no AAPs due for review. The compliance for clinician training attained 67%, and parent education about triggers and prevention reached 100%. Education on warning signs recognition and treatment options both reached 85%. The compliance of inhaler use education remained at 100%. Regarding parents' receipt of AAPs, compliance improved from 0% to 25%.

In addition to the improvements in practice that were observed, the questionnaires showed dramatic improvements in knowledge for parents and clinicians following the implementation phase (Figure 3). The average score for parents increased from 7.95 (40%) to 14.65 (73%), while the average score for clinicians improved from 7.57 (54%) to 13.4 (96%).

Discussion

Effective self-management for asthma is vital to reduce the risks of morbidity and mortality. It is important for healthcare professionals treating children with asthma to ensure the parents and child have received relevant evidence-based education on asthma self-management and are supported to facilitate optimal asthma management.¹⁰ Evidence indicates that comprehensive education is recommended, covering aspects including asthma triggers, warning signs and treatment options.^{1,21,22} Furthermore, it is recommended that

the parents and child receive training on inhaler devices and a written AAP.^{21,22} This project aimed to promote best practice for children with asthma attending the respiratory clinic.

Following an audit and feedback cycle using the JBI PACES and GRiP tools, the project achieved improvements in compliance for the majority of audit criteria. At baseline, the audit showed that only two clinicians, who were chief respiratory doctors, had been trained in educating children and parents. No nurses were engaged in this process, which was attributed to the existing education process. Prior to the project, the main education of parents and children was performed by doctors, and only inhaler education was conducted by nurses. To address this issue, all nurses and doctors working in the respiratory clinic were asked to undertake face-to-face training, which was conducted by a chief respiratory specialist. After the lecture, the corresponding electronic learning materials developed on asthma recommendations were provided. Immediately after the education session, a questionnaire was used to test and boost the knowledge of each clinician. Following implementation of these strategies, all nurses and some of the doctors received training, but five doctors still claimed they were too busy to undertake the training session. The most likely reason for this limited compliance by doctors was a lack of engagement, as the project was not launched by the

chief doctor and support from doctors was not powerful enough. In the future, we hope to provide more useful information to convince doctors of the benefits of this project and secure their full engagement.

Education materials like pamphlets are recognized as an easy and effective patient education strategy.³³ Before the education materials were designed and developed, team meetings were held to decide on the most appropriate formats and content. Materials were developed into different formats including a pamphlet, leaflet and videos. An electronic education platform was established through 317 WeChat, which contained all essential education information. Given that the doctors were too busy to spend more time on education, the education process was changed. The main education of parents and children was conducted by nurses rather than doctors. When the parents and children finished their consultation in clinic, the nurse supplemented the education with pamphlets, instructed parents to scan the QR code for 317 WeChat and conducted the inhaler education. In addition, we posted the QR code to access the education materials at several places around the clinic where parents could see it and scan it at any time.

Due to these simple strategies, criteria 2 through 5 displayed good compliance with best evidence at the follow-up audit without taking too much extra time. Compliance with criterion 6, providing parents with an AAP, increased to 25%; however, a significant barrier remained, preventing higher compliance. It was clear that many of the doctors were not committed to completing AAPs, claiming it took too much time, even though a quick AAP leaflet was designed. The AAP leaflet showed three zones presenting levels of symptoms with different treatment options, but it became a personalized AAP only if doctors wrote down the specific name and dosage of medicine. In the future, we would like to talk with the chief respiratory doctor for further collaboration and possibly implement a hospital policy to promote the use of AAPs. In addition, to save time, we would list the name and dosage of all medicines on our AAP leaflet for doctors to tick the relevant treatment. Due to the short implementation period, there were no AAPs to review during the follow-up audit; however, we plan to assess this criterion in future audits.

There were some limitations to this project that should be considered when interpreting the results. First, the implementation time was relatively short

and sustainability is still unclear. Second, while improvements in practice were observed, the patients' outcomes were not measured in this project. More research should be conducted in the future to evaluate the effect of the evidence-based asthma self-management strategies.

To promote sustainability of the improvements observed during the project, the nurses will continue providing the majority of patient education, and the education materials and electronic education platform will be maintained. Staff training will be provided on a routine basis to ensure that education remains current and that any new staff receive the necessary training. Further implementation strategies will be designed to enhance the use of AAPs. Future audit cycles will be conducted to assess ongoing progress and long-term sustainability.

Conclusion

The evidence implementation project led to improvements in clinical practice behaviors. It demonstrated that the bundle of strategies successfully facilitated the implementation of evidence to improve asthma self-management. Further audits are still needed to improve and assess the use of AAPs and to promote sustainability of the behaviors.

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Appendix I: Asthma knowledge questionnaire (parents' version)

**This questionnaire has been translated from Chinese for the purposes of this implementation report*

1. Is an asthma attack caused by redness and swelling in the airways of the lung?
☐ yes ☐ no
2. With the right treatment, can a child with asthma live a normal life?
☐ yes ☐ no
3. Should medicines that prevent asthma be taken following the onset of symptoms?
☐ yes ☐ no
4. When asthma is okay, can all medicines be stopped?
☐ yes ☐ no
5. Can children with asthma play sport?
☐ yes ☐ no
6. Can the medicine for asthma hinder the growth of the child?
☐ yes ☐ no
7. Should antibiotics be used when a child has an asthma attack?
☐ yes ☐ no
8. Do triggers of asthma include animal dander, cold air, dry climate, dust mite, sports and so on?
☐ yes ☐ no
9. Is it necessary to keep children with asthma away from furry animals?
☐ yes ☐ no
10. Is it okay for children with asthma to keep feathered pets?
☐ yes ☐ no
11. How are allergens from mold prevented? (Tick all that apply)
☐ Keep furred or feathered pets out of your home. If you can't keep the pet outdoors, then keep the pet out of your bedroom and other sleeping areas at all times, and keep the door closed. Bathe the animal at least twice a week.
☐ Encase your mattress in a special dust-proof cover.
☐ Clean moldy surfaces with a cleaner that has bleach in it.
☐ Do not keep plants indoor.

12. How are allergens from pollen prevented when pollen or mold spore counts are high? (Tick all that apply)
- ☐ Try to keep your windows closed.
 - ☐ Stay indoors with windows closed from late morning to afternoon, if you can.
 - ☐ Wash the sheets and blankets on the bed each week in hot water.
 - ☐ Wear a mask when going outside and take a shower after coming back and change clothes.
13. How are allergens from animal dander prevented? (Tick all that apply)
- ☐ Keep furred or feathered pets out of your home. If you can't keep the pet outdoors, then keep the pet out of your bedroom and other sleeping areas at all times, and keep the door closed. Bathe the animal at least twice a week.
 - ☐ Remove carpets and furniture covered with cloth from your home. If that is not possible, keep the pet away from fabric-covered furniture and carpets.
 - ☐ Wash the sheets and blankets on the bed each week in hot water.
 - ☐ Reduce indoor humidity to below 60% (ideally between 30% and 50%).
14. How are allergens from dust mites prevented? (Tick all that apply)
- ☐ Reduce indoor humidity to below 60% (ideally between 30% and 50%).
 - ☐ Clean the home twice a week. Stay out of rooms while rooms are being vacuumed and for a short while afterward. Wear a dust mask when it is necessary to prevent dust.
 - ☐ Remove carpets from your bedroom and those laid on concrete.
 - ☐ Keep stuffed toys out of the bed or wash the toys weekly in hot water or cooler water with detergent and bleach.
15. How are allergens from cockroaches prevented? (Tick all that apply)
- ☐ Keep food and garbage in closed containers. Never leave food out.
 - ☐ Use poison baits, powders, gels, paste and traps to kill cockroaches.
 - ☐ Use an insecticide spray to kill cockroaches.
 - ☐ Block off the door-crack to avoid cockroaches entering.
16. How are allergens from strong odors prevented? (Tick all that apply)
- ☐ Do not allow smoking in your home or car. If you have to smoke, please use a fan.
 - ☐ Try to stay away from strong odors and sprays, such as perfume, talcum powder, hair spray and paints.
 - ☐ Do not use a wood-burning stove, kerosene heater or fireplace.
 - ☐ Use an air freshener spray.

17. What are the symptoms of asthma with good control? (Tick all that apply)
- ☐ Breathing is good
 - ☐ No cough or wheeze
 - ☐ Sleeping well at night
 - ☐ Can do some but not all usual activities
 - ☐ Can do usual activities
18. What are the worsening symptoms of asthma? (Tick all that apply)
- ☐ Tightness or shortness of breath
 - ☐ Waking at night due to asthma
 - ☐ Can do some but not all usual activities
 - ☐ Can do usual activities
19. What are the life-threatening symptoms of asthma? (Tick all that apply)
- ☐ Can do some but not all usual activities
 - ☐ Severe trouble breathing/walking/talking
 - ☐ Blue lips and fingernails
 - ☐ Drowsy/confused/unconscious
20. To relieve the difficulty of breathing during an asthma attack, should a quick reliever medicine be taken?
- ☐ yes ☐ no

Appendix II: Asthma knowledge questionnaire (clinicians' version)

**This questionnaire has been translated from Chinese for the purposes of this implementation report*

1. Is an asthma attack caused by redness and swelling in the airways of the lung?
☐ yes ☐ no
2. Can asthma be cured?
☐ yes ☐ no
3. Is rhinitis related to asthma occurrence?
☐ yes ☐ no
4. When asthma is okay, can all medicines be stopped?
☐ yes ☐ no
5. Is smoking related to asthma attacks?
☐ yes ☐ no
6. If asthma is triggered by exercise, how long prior to exercise should quick relief medicine be taken?
☐ 15 minutes
☐ 30 minutes
☐ 45 minutes
☐ 60 minutes
7. Can the medicine for asthma hinder the growth of the child?
☐ yes ☐ no
8. During an asthma attack, how often should quick relief medication be taken?
☐ Every 10 minutes
☐ Every 15 minutes
☐ Every 20 minutes
☐ Every 30 minutes
9. What are the triggers of asthma? (Tick all that apply)
☐ Animal dander
☐ Dust mites
☐ Indoor mold
☐ Cockroaches
☐ Pollen

10. How are allergens from dust mites prevented? (Tick all that apply)
- ☐ Water must be hotter than 55 °C to kill the mites. Cold or warm water used with detergent and bleach can also be effective.
 - ☐ Wash the sheets and blankets on the bed each week in hot water.
 - ☐ Reduce indoor humidity to below 60% (ideally between 30% and 50%). Dehumidifiers or central air conditioners can do this.
 - ☐ Clean the home twice a week. Stay out of rooms while rooms are being vacuumed and for a short while afterward. Wear a dust mask when it is necessary to prevent dust.
 - ☐ Keep stuffed toys out of the bed or wash the toys weekly in hot water or cooler water with detergent and bleach.
11. What are the symptoms of asthma with good control? (Tick all that apply)
- ☐ Breathing is good
 - ☐ No cough or wheeze
 - ☐ Sleeping well at night
 - ☐ Can do some but not all usual activities
12. What are the worsening symptoms of asthma? (Tick all that apply)
- ☐ Tightness or shortness of breath
 - ☐ Wake at night due to asthma
 - ☐ Can do some but not all usual activities
 - ☐ Can do usual activities
13. What are the life-threatening symptoms of asthma? (Tick all that apply)
- ☐ Can do some but not all usual activities
 - ☐ Severe trouble breathing/walking/talking
 - ☐ Blue lips and fingernails
 - ☐ Drowsy/confused/unconscious
14. To relieve the difficulty of breathing during an asthma attack, how should a quick reliever medicine be used? (Tick all that apply)
- ☐ Inhale short-acting beta 2-agonist
 - ☐ If the symptoms are not relieved in 20 minutes, try the relief medicine again
 - ☐ Go to see the doctor immediately if you have tried reliever twice but asthma is not getting better

Appendix III: Patient education pamphlet

Prevention of triggers of asthma

**This pamphlet has been translated from Chinese for the purposes of this implementation report*

Animal Dander

Some people are allergic to the flakes of skin or dried saliva from animals with fur or feathers. The best things to do:

- Keep furred or feathered pets out of your home. If you can't keep the pet outdoors, then keep the pet out of your bedroom and other sleeping areas at all times, and keep the door closed. Bathe the animal at least twice a week.
- Remove carpets and furniture covered with cloth from your home. If that is not possible, keep the pet away from fabric-covered furniture and carpets.

Dust Mites

Many people with asthma are allergic to dust mites. Dust mites are tiny bugs that are found in every home—in mattresses, pillows, carpets, upholstered furniture, bedcovers, clothes, stuffed toys, and fabric or other fabric-covered items.

Things that can help:

- Encase your mattress in a special dust-proof cover.
- Encase your pillow in a special dust-proof cover or wash the pillow each week in hot water. Water must be hotter than 55 °C to kill the mites. Cold or warm water used with detergent and bleach can also be effective.
- Wash the sheets and blankets on the bed each week in hot water.
- Reduce indoor humidity to below 60% (ideally between 30% and 50%). Dehumidifiers or central air conditioners can do this.
- Clean the home twice a week. Stay out of rooms while they are being vacuumed and for a short while afterward. Wear a dust mask when it is necessary to prevent dust.
- Remove carpets from your bedroom and those laid on concrete.
- Keep stuffed toys out of the bed or wash the toys weekly in hot water or cooler water with detergent and bleach.

Cockroaches

Many people with asthma are allergic to the dried droppings and remains of cockroaches. The best things to do:

- Keep food and garbage in closed containers. Never leave food out.
- Use poison baits, powders, gels, paste and traps to kill cockroaches.
- A spray is not recommended.
- Block off the door-crack to avoid cockroaches entering.

Indoor Mold

- Fix leaky faucets, pipes, or other sources of water that have mold around them.
- Clean moldy surfaces with a cleaner that has bleach in it.
- Do not keep plants indoor.
- Do not use humidifier.

Pollen and Outdoor Mold

When pollen or mold spore counts are high, the best things to do:

- Try to keep your windows closed.
- Stay indoors with windows closed from late morning to afternoon, if you can. Pollen and some mold spore counts are highest at that time.
- Wear a mask when going outside and take a shower after coming back and change clothes.

Strong Odors

- Do not allow smoking in your home or car. If you have to smoke, please use a fan.
- Try to stay away from strong odors and sprays, such as perfume, talcum powder, hair spray, and paints.
- Do not use a wood-burning stove, kerosene heater, or fireplace.
- Keep kitchen well ventilated.
- Stay at home when the air quality is not good.

Other Things That Can Make Asthma Worse

- Sulfites in foods and beverages: Do not drink beer or wine or eat dried fruit, processed potatoes, or shrimp if they cause asthma symptoms.
- Do not use ozone-producing air purifier.
- Cold air: Cover your nose and mouth with a scarf on cold or windy days.
- Other medicines: Tell your doctor about all the medicines you take. Include cold medicines, aspirin, vitamins and other supplements, and nonselective beta-blockers (including those in eye drops).

Appendix IV: Modified asthma action plan

**This asthma action plan has been translated from Chinese for the purposes of this implementation report*

This modified asthma action plan is to:

- Help control asthma for the long-term
- Exhibit zones to help you track your child's symptoms and know when the asthma is getting worse
- Explain when to go to the emergency department

Green zone (Well controlled) ✧ Breathing is good ✧ No cough or wheeze ✧ Sleeping well at night ✧ Can do usual activities	✧ Continue controller medicine as prescribed ✧ Take quick-relief medicine 30 minutes prior to exercise if asthma occurs with it
Yellow zone (Caution) ✧ Cough, wheeze, chest tightness or shortness of breath ✧ Waking at night due to asthma ✧ Can do some but not all usual activities	✧ Continue green zone medication and add short-acting beta 2-agonist ✧ If the symptoms are not relieved in 20 minutes, please try the relief medicine again ✧ Please see the doctor immediately if you have tried reliever twice but asthma is not getting better
Red zone (Danger) ✧ Severe trouble breathing/walking/talking ✧ Blue lips and fingernails ✧ Drowsy/confused/unconscious	✧ Take quick-relief medication every 20 minutes for one hour ✧ Call 120 for ambulance