



Effectiveness of providing health education to caregivers of hospitalized children with asthma for the prevention of recurrent attacks: a quasi-randomized trial

Niranjala Perera & Chrishantha Abeysena

To cite this article: Niranjala Perera & Chrishantha Abeysena (2019): Effectiveness of providing health education to caregivers of hospitalized children with asthma for the prevention of recurrent attacks: a quasi-randomized trial, Journal of Asthma, DOI: [10.1080/02770903.2019.1642350](https://doi.org/10.1080/02770903.2019.1642350)

To link to this article: <https://doi.org/10.1080/02770903.2019.1642350>



Published online: 26 Jul 2019.



Submit your article to this journal [↗](#)



Article views: 9



View Crossmark data [↗](#)



Effectiveness of providing health education to caregivers of hospitalized children with asthma for the prevention of recurrent attacks: a quasi-randomized trial

Niranjala Perera, MBBS, MSc, MD^a and Chrishantha Abeysena, MBBS, MSc, MD^b

^aPostgraduate Institute of Medicine, University of Colombo, Sri Lanka; ^bDepartment of Public Health, Faculty of Medicine, University of Kelaniya, Sri Lanka

ABSTRACT

Objective: To determine the effectiveness of health education intervention for caregivers of children with asthma, focused on preventing recurrent attacks and improving knowledge.

Methods: A quasi-randomized trial of 177 caregivers of asthmatic children was conducted in government hospitals in a district of Sri Lanka. At the time of discharge from the hospital, a health education booklet was prepared and given to the caregivers in the intervention group, along with individual explanation and discussion. The caregivers' knowledge of asthma and preventive practices was assessed. The primary outcome was the proportion of children with recurrent attacks of asthma who needed doctor visits during the three month post discharge period. The intention-to-treat principle was applied for data analysis.

Results: In comparison to the control group, the intervention group had a 76% significant reduction in visits to the doctor for recurrent attacks (95% CI:45%-90%) and a 75% significant reduction in hospital admissions required for asthmatic children (95% CI:16%-93%) at the end of three months of intervention. The mean score of knowledge of asthma in the intervention group was 1.73 units higher at three months ($p < 0.01$) and 1.47 units higher at six months ($p < 0.01$) than the control group. The mean score of preventive practices for asthma in the intervention group was 1.25 units higher at three months ($p = 0.02$) and 1.15 units higher at six months ($p < 0.01$) versus the control group.

Conclusion: Health education intervention significantly decreased doctor and hospital visits at three months. In addition, caregiver knowledge of asthma and preventive practices also improved.

Trial Registration Number: SLCTR/2010/007

ARTICLE HISTORY

Received 2 December 2018

Revised 25 June 2019

Accepted 7 July 2019

KEYWORDS

Hospital; intervention; management; pediatric; respiratory; symptoms; wheezing

Introduction

Health authorities in various countries have released many factsheets (1–3) to improve knowledge about asthma in the general population. While providing accurate information to children suffering from asthma is essential, particularly regarding the illness, and preventive and management strategies, educating the caregiver is crucial if asthma is to be controlled.

In Sri Lanka, the pediatric guideline emphasizes the importance of educating the caregivers for better control of the disease (4). Having an effective means for educating the caregiver is vital, as it helps tailor the information to individual needs and fosters respect for the cultural or ethical belief system and practices. Also, providing education about asthma, whether one-on-one or in groups with children and caregivers,

enhances family support and enables the medical staff to improve asthma care. The aim of asthma education is to teach the caregiver to identify triggers for individual patients, identify worsening signs and symptoms, understand the rationale behind taking long-term drugs daily to control the disease, and the measures to take when a sudden episode of asthma occurs.

One systematic review revealed that after an educational intervention was delivered to children, their parents, or both, there was a significantly reduced risk of subsequent Emergency Department (ED) visits and hospital admissions, plus fewer unscheduled doctor visits (5). In contrast, another systematic review found that when home-based educational interventions for asthma were delivered to children, caregivers, or both, the mean number of exacerbations requiring ED visits per person at six months was not significantly different

between the home-based intervention and control groups. Furthermore, they found significant changes in the rates of hospital admission between the groups in some trials, but in both directions (6). It is worth noting, however, that the evidence in the second review was inconsistent due to markedly different study designs. Also, the quality of the evidence was very low for the two outcomes, as determined by Grading of Recommendations, Assessment, Development and Evaluations (GRADE) (6). The above two reviews (5, 6) included both randomized and quasi-randomized trials with children < 18 years, along with extracted follow up data for two years. One randomized trial revealed that healthcare utilization and self-reported exacerbations were also not significantly different between the two groups but missed school days were significantly higher in the control group among the uncontrolled asthmatic children aged 5–18 years (7). These varied findings suggest that unlike drug trials, health educational interventions are not identical across studies. Nevertheless, even with identical interventions, their effectiveness would depend on the context in which the interventions are implemented and other sociocultural and behavioral patterns of the participants.

Asthma management in children results in substantial costs. One of the objectives of the World Health Organization was to identify cost-effective interventions for improving the quality of asthma pediatric care (8). Health education intervention for caregivers will be of great use as a low-cost method for improving the outcome of the children by reducing recurrent attacks. Moreover, if a uniform standard message could be delivered to all caregivers that would serve as a reference point, this would be a timesaver for health-care providers who are often tasked with delivering the education about asthma. The objective of our study was to determine the effectiveness of health education intervention for caregivers of hospitalized children suffering from asthma with a goal of preventing recurrent attacks and improving knowledge about caregiving.

Methods

This was a quasi-randomized trial conducted in pediatric wards of the District General Hospital Gampaha (DGHG) and the District General Hospital Negombo (DGHN) from September 2010 to March 2011. The study population included caregivers of children aged 2–12 years admitted for the treatment of asthma and referred for follow up at a pediatric clinic after discharge. The children were diagnosed with asthma by the consultant pediatrician. Exclusion criteria were

nonresidents in the district of Gampaha and caregivers not willing to attend clinics for follow up at the same hospitals.

The intervention included a booklet on asthma and a one-on-one clarification session with the booklet's first author and the caregiver. The booklet emphasized the following subjects; risk factors and triggering factors for asthma; measures that could be taken to minimize exacerbations; method of use of the inhaler; and the importance of continuing prophylactic treatment. After assessing their knowledge of asthma, the booklet was given to caregivers to read, and they were given adequate time to absorb the information, the first author reviewed with the content with them. This intervention was carried out during the morning on the day of discharge.

Preparation of the draft booklet was done in English, and was based on literature (4, 9–13). Its content was assessed by four experts in pediatrics and health education. With their consensus, the second draft booklet was prepared, and once agreed, it was translated to Sinhala with the help of a health education expert. When translating the booklet, the language used was kept as simple as possible and was free of medical terms in order to make the content clear and easy for the caregiver to remember. The booklet was pre-tested in a group of 21 caregivers, the objective of which was to ensure the clarity of its content. On the day of discharge, the control group of caregivers received routine (informal) health education, which included brief vocal communication by the medical officer in the ward.

The study's primary outcome was the proportion of children with recurrent attacks of asthma who required visits to the consultant pediatrician, the general practitioner, or the outpatient department (GP/OPD) during the three month post discharge period.

Eight secondary outcomes were also assessed as follows:

1. The proportion of children with hospital admissions in the preceding three months.
2. Knowledge about asthma, which was calculated by tallying the marks scored for all 15 questions on the questionnaire, with a possible total score of 34. (The mean score of knowledge about asthma was calculated prior to the start of the study.)
3. Knowledge of eight preventive practices, evaluated by Likert scale, with responses ranging from 1 to 4, allowing for a maximum score of 32. (The mean score of knowledge of preventive practices was calculated prior to the start of the study.)

4. The mean number of days of missing controller drugs in the preceding three months was determined by assessing the total number of days the controller medication was not administered to the children in each group. Missing a dose of inhaled steroid was assessed based on failing to receive at least one dose of inhaled steroid drug during the day.
5. The mean number of days of daytime symptoms was calculated based on assessing daytime coughing and wheezing if the caregiver reported that the child was suffering from these symptoms when involved in day-to-day activities.
6. The mean number of days of nighttime symptoms was calculated by assessing night time coughing and wheezing if the caregiver reported that the child exhibited these symptoms while sleeping at night or waking up from them at night.
7. The mean number of days that symptoms lasted for more than six hours a day was measured based on assessing chest tightness, wheezing, and discomfort while breathing at any time of the day, and disrupting the child's daily activities.
8. The mean number of days the symptoms were present continuously was calculated based on assessing continuous coughing or wheezing during the day and night, lasting for more than twelve hours and hindering the child's daily activities.

All outcomes were assessed after three months and six months post-intervention.

The sample size calculation found the percentage of recurrent attacks in the control group and intervention group as 37%, and 15% respectively (14). The level of significance used for detecting a difference was set at < 0.05 . Power was set at 80%, resulting in a calculated sample size of 62 in each group. To compensate for the patients who were loss to follow-up, an extra 20% was added to the sample size. As a result, the final sample size in each group totaled 80.

The DGHG was selected randomly to carry out the intervention on the first day. For the selected hospitals, the seven days of the week were allocated alternatively to offer intervention or control. On an interventional day at DGHG, all selected caregivers received the intervention. On a control day at DGHG, the selected caregivers received only routine health education from the ward medical officers, and on that same day, selected caregivers at DGHN received the intervention.

The caregivers in the intervention group and control group were blinded as to their group designation.

Specifically, the intervention group was not informed that they were being evaluated on the effectiveness of their education intervention. On a particular day, all eligible caregivers in one hospital were either included in the health education intervention or control intervention, so the status of the other group was concealed from both groups. This process prevented contamination bias. Similarly, the outcome assessors were blinded as to whether the participants belonged to the intervention or the control group.

Pre-interventional data were collected using an interviewer administered-questionnaire (IAQ I). This included personal details and contact information for the caregiver. The caregiver's knowledge about asthma and preventive practices were assessed using a self-administered questionnaire (SAQ). This was administered to the caregiver while the child was in the ward. A second IAQ (IAQ II) was used at the post-interventional stage to collect data on day-and nighttime symptoms of the child, the continuation of drugs, information on recurrent attacks, and hospital admissions. This was administered during clinic visits at the third month and the sixth month. All IAQs and SAQs were created in simple, straightforward language, and the test-retest method was used for assessing their reliability, with all kappa statistics exceeding 0.70. After obtaining expert opinion, the final versions of the questionnaires were prepared in English and translated into Sinhala. The data collecting tools were evaluated by experts to assess the content, face, and consensual validity.

In addition to the questionnaires, caregivers of both groups were given six Daily Clinical Progress Summary (DCPS) sheets (one sheet per month) to record day and night signs and symptoms of the child's asthma status, any GP/OPD visits, hospital admissions, and any discontinuation of drugs. They were instructed to be completed daily. All questionnaires and summary record sheets were pre-tested using a group of caregivers. The SAQ, which was used to assess the caregiver's knowledge of asthma and preventive practices at the pre-intervention phase, was administered at the third month and the sixth month clinic visits.

A special card was given to the caregivers of both groups at the ward before discharge. Their serial number of the study was recorded in the clinic book. Caregivers were instructed to produce the card at the third- and sixth-month clinic visits to the attendant who registers patients at the clinic. Those registrations were marked on the clinic register, making it easy for

the research assistants to trace the caregivers who attended the clinic.

For the research assistants, a two-day training program was conducted one week prior to the start of the study. They identified the eligible caregivers according to the criteria and then administered the questionnaires. The intervention was then conducted on the intervention group and the six copies of DCPS were given to the caregivers to complete during the following six months. Similarly, the caregivers of the control group were also given six copies of DCPS to be filled out over the same time period. Caregivers of both groups received instructions on the content of the summary sheet and how to complete it.

Two trained pre-intern medical officers, who did not collect pre-interventional data at DGHG or DGHN, were recruited to collect data from clinics at the three month and six month follow up appointments. They collected data using the IAQ II and gathered the DCPS sheets. The caregivers also administered the SAQ to assess the knowledge of asthma and preventive practices. A call was made or a letter was sent once a month reminding them to fill in the summary sheet before their scheduled clinic visits at the third and sixth months. If they failed to make the clinic visits, they were given a reminder call and an appointment was made for their next clinic visit. In all cases, participants of both groups were followed up in a comparable manner.

We assessed the reliability of data in the IAQ II and the DCPS sheets. The variables in 30 DCPS sheets were assessed using kappa statistics, and yielded results that were > 0.90 for all variables. A pilot study was conducted in pediatric wards and clinics in another hospital to estimate the average time needed to administer each questionnaire to 20 caregivers. This enabled identification of logistic and administrative issues that could arise when conducting the actual study.

Data entry and analysis were done by using a statistical computer package, SPSS version 16. Intention-to-treat analysis was performed. For the categorical outcome variables, relative risks (RR), relative risk reduction (RRR), absolute risk reduction (ARR) and 95% confidence intervals (CI) were calculated. For the continuous outcome variables, mean differences and 95% CI were calculated.

Ethical clearance for the study was obtained from the Ethical Review Committee of the Faculty of Medicine, University of Kelaniya, and written informed consent was obtained from caregivers. Administrative clearance for the data collection was

obtained from the Regional Director of Health Services of the Gampaha District. Permission was obtained from the directors of the involved hospitals and the consultants in charge of each ward. The trial registration number was SLCTR/2010/007.

Results

At the time of recruitment from both hospitals, there were 86 caregivers in the intervention group and 91 caregivers in the control group. Of the two hospitals, 40 (46.5%) caregivers recruited from the DGHG and 46 (53.5%) recruited from the DGHN entered the intervention group.

Between the intervention and control groups, there were no significant differences in socio-demographic factors such as the relationship of the caregiver to the child, age, the level of education, occupation, marital status, and basic family income of the caregiver. There were no significant differences between the two groups in age at onset of asthma, duration of asthmatic history, history of nebulization and hospitalization, duration of prophylaxis, and acute and chronic asthma classification (Table 1).

At the three-month follow-up clinic visit, 11 caregivers failed to attend (Figure 1), namely six caregivers from the intervention group, three from each hospital. Five caregivers from the control group (three from DGHG and two from DGHN) were not present. At the six month follow up, five more participants from the intervention group (two from DGHG and three from DGHN) and four participants from the control group (three from DGHG and one from DGHN) were lost to follow up. Ultimately, 12.7% of the intervention group and 9.8% of the control group were lost to follow up.

There was a 76% significant reduction of the visit to GP/OPD for recurrent attacks in the interventional group as compared to the control group at three months of intervention. For every one hundred caregivers who received the intervention, 20 visits to GP/OPD were averted, and for every five caregivers entered into the intervention group, one GP/OPD visit was prevented (Table 2). There was a 58% significant reduction of the visit to GP/OPD for recurrent attacks in the intervention group compared to the control group at the second three months post-intervention. For every 100 caregivers who received the intervention, 13 visits to GP/OPD were averted, and for every seven caregivers with the intervention, one GP/OPD visit could be prevented at the second three months of post-intervention (Table 2).

Table 1. Comparison of sociodemographic characteristics of caregivers and selected characteristics of asthmatic children in the intervention and control groups.

Baseline characteristics	Intervention n = 80		Control n = 86	
	Number	%	Number	%
Relationship of caregiver to child				
Mother	81	94.2	83	91.2
Grandmother and Other	5	5.8	8	8.8
Number of years of education of caregiver				
2–10 years	25	29.0	20	22.0
11 years	40	46.5	39	42.9
12 years and above	21	24.4	32	35.2
Category of employment of caregiver				
Professional, clerical and skilled	8	9.3	9	9.9
Semiskilled	11	12.8	13	14.3
Unskilled and unemployed	67	77.9	69	75.8
Category of employment of spouse				
Professional, clerical and skilled	24	27.7	29	31.9
Semiskilled	38	44.2	48	52.7
Unskilled and unemployed	24	27.9	14	15.4
Category of family monthly income per person ((Rupees)				
0–3000	10	11.6	8	8.8
3001–5000	34	39.5	35	38.5
5001–10000	30	34.9	40	44.4
10000 and above	12	13.9	8	8.8
Age at onset of asthma				
Before 3 years	32	32.0	40	44.0
After 3 years	54	54.0	51	56.0
Duration of past history of asthma				
≤ 2 years	61	70.9	58	63.7
More than 2 years	25	29.1	33	36.3
History of previous nebulization				
Present	79	91.9	87	95.6
Absent	7	8.1	4	4.4
History of previous hospitalization				
Present	47	54.7	52	57.1
Absent	39	45.3	39	42.9
Duration of prophylaxis				
≤ 1 year	62	72.1	70	76.9
More than 1 year	24	27.9	21	23.1
Chronic asthma classification				
1 and 2	67	80.7	77	86.5
3 and 4	16	19.3	12	13.5
Acute asthma classification				
Moderate	75	87.2	80	87.9
Sever	11	12.8	11	12.1
Total	86	100.0	91	100.0

The RR for hospital admissions required for asthmatic children is 0.24 (Table 3). The RRR for hospital admissions required for asthmatic children is 75% [95% CI, 16% to 93%] at the first three months of post-intervention. For every 100 caregivers who received the intervention, approximately 11 hospital admissions could be averted (ARR = 0.11, 95% CI: 0.02 to 0.21). When the intervention is carried out by nine caregivers, one hospital admission is prevented (NNT = 8.84, 95% CI: 5 to 43) at the first three months post-intervention.

At the three-month follow up, the mean score of knowledge on asthma in the intervention group was 1.73 units higher than the mean score of knowledge on asthma in the control group, and the difference was highly statistically significant ($p < 0.01$). At the three-month follow up, the mean score of preventive

practices on asthma in the intervention group was 1.25 units higher than the control group and the difference was highly statistically significant ($p < 0.01$). Additional findings appear in Table 3.

The RR for hospital admissions required for asthmatic children is 0.32 (Table 4). The RRR for hospital admissions required for asthmatic children is 67% [95% CI, −15% to 91%] during the second three months of post-intervention. For every 100 caregivers who received the intervention, approximately eight hospital admissions could be averted (ARR = 0.082, 95% CI: −0.008 to 0.17). When the intervention is carried out by 12 caregivers, one hospital admission is prevented [number needed to treat (NNT) = 12, 95% CI, 6 to −132] at the second three months post-intervention. At the six-month follow up, the mean score of knowledge on asthma of the intervention

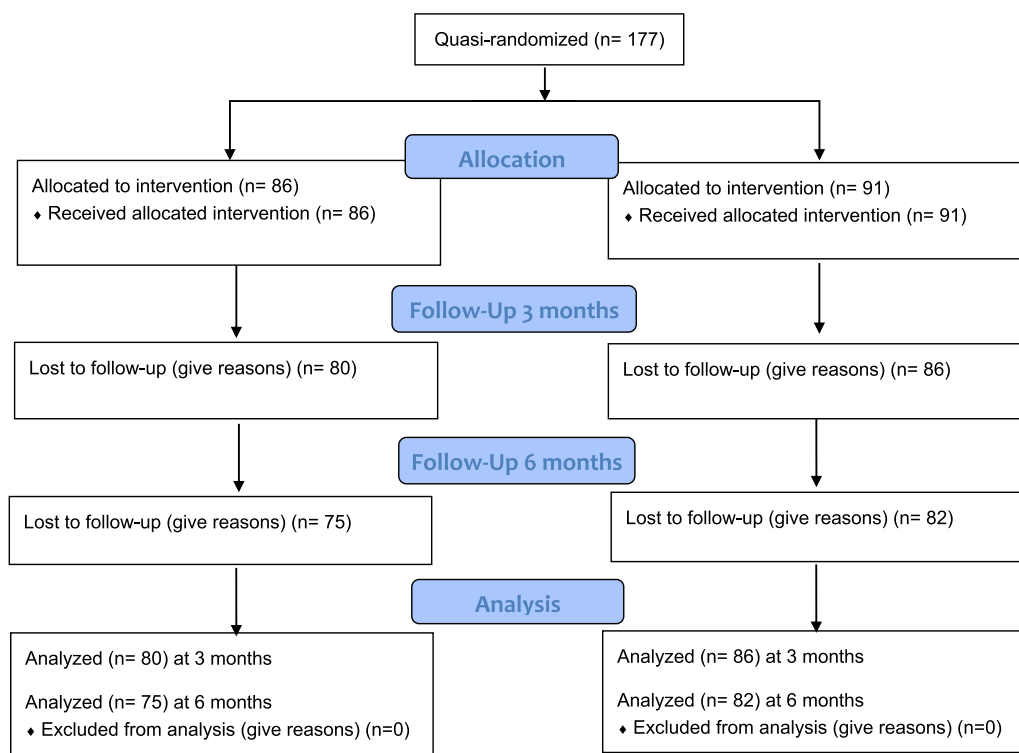


Figure 1. Flow chart of participants followed up for six months.

Table 2. Comparison of primary outcome between the intervention and the control groups during the first three months and the second three months of post intervention.

	GP/OPD visits for recurrent attacks during 0 to 3 months				GP/OPD visits for recurrent attacks during 3 to 6 months			
	Yes	%	No	%	Yes	%	No	%
Intention to treat analysis								
Control group	24	27.9	62	72.1	20	23.3	66	76.7
Interventional group	6	6.0	85	94.0	9	9.8	82	90.2
RR (95%CI)		0.24 (0.10–0.54)				0.42 (0.20–0.88)		
RRR (95%CI)		0.76 (0.45–0.90)				0.58 (0.12–0.79)		
ARR (95%CI)		0.21 (0.10–0.32)				0.13 (0.02–0.24)		
NNT (95%CI)		5 (3.0–10.0)				7.0 (4.0–42.0)		
Per protocol analysis								
Control group	24	27.9	62	72.1	20	24.4	62	75.6
Interventional group	6	7.5	74	92.5	9	12	66	88
RR (95%CI)		0.27 (0.11–0.62)				0.49 (0.24–1.01)		
RRR (95%CI)		0.73 (0.38–0.88)				0.51 (–0.012–0.76)		
ARR (95%CI)		0.20 (0.09–0.31)				0.12 (0.001–0.24)		
NNT (95%CI)		5 (3.0–11.0)				8.0 (4.0–682.0)		

ARR: absolute risk reduction; GP/OPD: general practitioner/outpatient department; NNT: number needed to treat; RR: relative risks; RRR: relative risk reduction.

Table 3. Comparison of secondary outcomes between the intervention and the control groups at three months of post intervention.

	Intervention		Controls		Relative risk (95%CI)
	n = 80		n = 86		
Hospital admissions Yes	3	3.8%	13	15.1%	0.24 (0.07–0.83)
No	77	96.3%	73	84.9%	
Mean (SD) knowledge score on asthma	23.96	3.6	22.23	3.96	1.73 (0.57 to 2.89) $p < 0.01$
Mean (SD) preventive practices score	28.88	2.04	27.63	2.44	1.25 (0.56 to 1.94) $p < 0.01$
Mean (SD) days of missing controller drugs	0.19	0.55	0.37	0.88	–0.18 (–0.41 to 0.047) $p = 0.11$
Mean (SD) days of day time symptoms	3.85	2.39	4.95	2.08	–1.1 (–1.78 to –0.41) $p < 0.01$
Mean (SD) days of night time symptoms	3.39	2.13	3.93	2.15	–1.8 – 2.5 to –1.1 $p < 0.01$
Mean (SD) days of symptoms lasting for more than six hours a day	0.73	0.79	1.19	1.09	–0.46 – 0.75 to –0.16 $p < 0.01$
Mean (SD) days of presence of continuous symptoms	0.15	0.39	0.41	0.54	–0.26 – 0.40 to –0.11 $p < 0.01$

Table 4. Comparison of secondary outcomes between the intervention and the control groups during three to six months of post intervention.

	Intervention		Control		Relative risk (95%CI)
	n = 75		n = 82		
Hospital admissions Yes	3	4.0%	10	12.2%	0.32 (0.09-1.1)
No	72	96%	72	87.8%	
Mean (SD) knowledge score on asthma	24.04	4.09	22.57	3.83	1.47 (0.22 to 2.72) $p = 0.02$
Mean (SD) preventive practices score	28.80	2.01	27.65	2.44	1.15 (0.44 to 1.88) $p < 0.01$
Mean (SD) days of missing controller drugs	0.16	0.44	0.23	0.50	-0.07 (-0.22 to 0.08) $p = 0.35$
Mean (SD) days of day time symptoms	1.43	1.23	2.72	1.55	-1.29 (-1.73 to -0.85) $p < 0.001$
Mean (SD) days of night time symptoms	1.37	0.983	2.13	1.15	-0.76 (-1.1 to -0.42) $p < 0.001$
Mean (SD) days of symptoms lasting for more than six hours a day	0.25	0.43	0.78	0.75	-0.53 (-0.72 to -0.33) $p < 0.01$
Mean (SD) days of presence of continuous symptoms	0.08	0.27	0.24	0.43	-0.16 (-0.27 to -0.045) $p < 0.01$

group was 1.47 units higher than mean score of knowledge on asthma of the control group and the difference was statistically significant (Table 4). At six months of follow up, the mean score of preventive practices on asthma of the intervention group was 1.15 units higher than the control group and the difference was statistically significant. The mean number of days of missing controller drugs at second three months were 0.07 days lower for the intervention group, and the difference was not statistically significant.

Discussion

There was a 76% significant reduction in visits to the GP/OPD for recurrent attacks and at three months of intervention, there was a 75% significant reduction of hospital admissions required for asthmatic children in the interventional group as compared to the control group. Similar to our study, a systematic review found that educational interventions for children and parents had a significant reduction in ED visits (RR = 0.73) and hospital admissions (RR = 0.79) compared to the control group (5). Yet another systematic review on educational interventions for asthma was unable to find a significant difference in the mean number of exacerbations requiring ED visits per person at six months (6). A randomized control trial conducted in three Spanish speaking countries found that recurrent attacks were significantly higher in the control groups compared to all three intervention groups at six months follow up (15). A study in Taiwan comparing a self-management asthma education intervention to standard health education in the ward showed the number of visits for treatment reduced from 4.75 to 3.55 per six months in the experimental group, and from 5.8 to 3.48 in the control group (16). A similar study found that an educational intervention to adolescents reduced the rate of ED visits for asthma by 73% in the intervention group (17). A Turkish randomized trial also found that asthma control,

which was measured with a validated “asthma control test” was improved among the intervention group compared to baseline and one and three months, but the difference was not significant (7).

In the present study, the mean number of days of daytime symptoms, the mean number of days of nighttime symptoms, the mean number of days with symptoms lasting for more than six hours a day, and the mean number of days with continuous symptoms were significantly lower in the intervention group than in the control group at third and sixth month follow up. Likewise, another study on asthma educational intervention among adolescents also revealed significant improvement in day and night symptom score (17).

The mean score of knowledge about asthma in the intervention group was 1.73 units higher at three months ($p < 0.01$) and 1.47 units higher at six months ($p < 0.01$) than the control group. The mean score of preventive practices on asthma in the intervention group was 1.25 units higher at three months ($p = 0.02$) and 1.15 units higher at six months ($p < 0.01$) than the control group. A study in Belgrade (18) found that a 2½ day session of asthma education intervention in children and their parents significantly improved asthma knowledge compared to standard practice (63%, 82% after 12 months), compliance with management (70% and 90%), and inhalation technique (20% and 70%). Another two studies (19, 20) also reported that educational interventions improve the knowledge of asthma. Overall, different types of interventions have been carried out from simple short duration interventions (19) to extensive programs, which ran into days or months (18).

In our study, there was no significant difference between socio-demographic or other factors related to asthma among the intervention and control groups. Furthermore, at pre-intervention, mean scores of asthma knowledge and preventive practices were not significantly different between the two groups.

To select participants for intervention and control groups, we used a quasi-randomized design. Randomization minimizes the selection bias and confounding in interventional studies, yet pure randomization of participants was not done due to a chance of contaminating the intervention. The studies that used true randomization carried out the intervention either after discharge (18) or individually at home settings (6).

In our study, blinding was carried out for participants of both groups because knowledge of group allocation could have affected the behavior during the trial period and the responses to subjective outcome measures could have been impacted. However, most of the outcomes were not subjective and were based on the information on the summary sheet given to participants. Moreover, research assistants were also blinded to group allocation, which minimized detection bias. During the follow-up phase, both groups were followed up in a comparable manner. To prevent contamination of the intervention into the control group, the intervention was conducted on the day of discharge in one hospital for all the eligible caregivers. On that day, eligible caregivers in the other hospital were taken as controls.

One of the limitations of this study was the performance of repeated statistical tests for several secondary outcome variables for the first and second three months of post-intervention separately, which may inflate the alpha error. Second, some secondary outcomes were not normally distributed and may have affected the results. Third, even though the outcome variables were assessed using both the IAQ II and the DCPS, the risk of bias for reporting and recording was difficult to quantify.

Conclusion

Using a standard health education intervention for asthma reduces GP/OPD visits and hospital admissions and improves caregiver knowledge of asthma and preventive practices. There is a need for providing adequate health education to caregivers regarding management of asthma. Asthma handbooks or fact sheets should be available in pediatric wards in local language for caregiver use and should be made public.

Acknowledgements

We are grateful to the participant children, caregivers, and research assistance of the study.

Disclosure statement

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

Notes on contributors

NP participated in the design of the study, coordinated data collection, conducted the intervention, drafted the first version of the manuscript. CA participated in the design of the study, performed the statistical analysis, interpreted the data and helped to draft the manuscript. Both of us read and approved the final manuscript.

References

1. Healthy Schools Network. Asthma and environment fact sheet for parents and schools. Healthy Schools Network, Inc. 2012: 2003–4. Available from: <http://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=ED541344&lang=ja&site=ehost-live> [last accessed 17 March 2019].
2. Centers for Disease Control and Prevention (CDC). Asthma's Impact on the Nation Data from the CDC National Asthma Control Program. 2010.
3. American Lung Association. Asthma and Children Fact Sheet. [cited October 3 2010]. Available from: <https://www.lung.org/lung-health-and-diseases/lung-disease-lookup/asthma/learn-about-asthma/asthma-children-facts-sheet.html> [last accessed 17 March 2019].
4. Asthma Guideline Sub Committee. Management guidelines for Paediatric Asthma - Health Sector Development project. Ministry of Health, Sri Lanka College of Paediatricians. 2008.
5. Boyd M, Lasserson TJ, McKean MC, Gibson PG, Ducharme FM, Haby M. Interventions for educating children who are at risk of asthma-related emergency department attendance. *Cochrane Database Syst Rev* 2009;2:CD001290.
6. Welsh EJ, Hasan M, Li P. Home-based educational interventions for children with asthma. *Cochrane Database Syst Rev* 2011;10:CD008469.
7. Arıkan-Ayyıldız Z, Işık S, Çağlayan-Sözmen Ş, Anal Ö, Karaman Ö, Uzuner N. Efficacy of asthma education program on asthma control in children with uncontrolled asthma. *Turk J Pediatr* 2016;58:383–388. doi:10.24953/turkjp.2016.04.006.
8. WHO. Asthma: WHO's role and activities. WHO. 2011 [cited February 5 2011]. Available from: <http://www.who.int/respiratory/asthma/activities/en/> [last accessed 17 March 2019].
9. World Health Organization. Fact Sheet Asthma [Internet]. 2008 [cited October 5 2002]. Available from: <http://www.who.int/news-room/fact-sheets/detail/asthma> [last accessed 17 March 2019].
10. Global Initiative for Asthma (GINA). Global strategy for asthma management and prevention. [cited November 2

- 2009]. Available from: www.ginasthma.org [last accessed 17 March 2019].
11. Ferrone M, MacPherson A, Wilton Mas P, Woychysyn J. All about asthma triggers. Lung Association. 2007. Available from: https://www.saswh.ca/.../All_About_Asthma_Triggers_singlesFinal2A...%0A [last accessed 17 March 2019].
12. Yueng C. About asthma. British Coloumbia Children's hospital - Asthma education services. 2014. 1–13.
13. CHEST. Controlling your asthma patient education guide. 2004 [cited November 2 2009]. Available from: www.chestnet.org [last accessed 17 March 2019].
14. Forshee JD, Whalen EB, Hackel R, Butt LT, Smeltzer PA, Martin J, et al. The effectiveness of one-on-one nurse education on the outcomes of high-risk adult and pediatric patients with asthma. *Manag Care Interface* 1998; 11:82–92.
15. Cano-Garcinuño A, Díaz-Vázquez C, Carvajal-Urueña I, Praena-Crespo M, Gatti-Viñoly A, García-Guerra I. Group education on asthma for children and caregivers: a randomized, controlled trial addressing effects on morbidity and quality of life. *J Investig Allergol Clin Immunol* 2007;17:216–226.
16. Chiang L-C, Huang J-L, Yeh K-W, Lu C-M. Effects of a self-management asthma educational program in Taiwan based on PRECEDE-PROCEED model for parents with asthmatic children. *J Asthma* 2004;41: 205–215. doi:10.1081/JAS-120026078.
17. Cowie RL, Underwood MF, Little CB, Mitchell I, Spier S, Ford GT. Asthma in adolescents: A randomized, controlled trial of an asthma program for adolescents and young adults with severe asthma. *Can Respir J* 2002;9:253–259. doi:10.1155/2002/106262.
18. Živković Z, Radić S, Cerović S, Vukašinić Z. Asthma School Program in children and their parents. *World J Pediatr* 2008;4:267–273.
19. Butz A, Pham L, Lewis L, Lewis C, Hill K, Walker J, Winkelstein M. Rural children with asthma: impact of a parent and child asthma education program. *J Asthma* 2005;42:813–821. doi:10.1080/02770900500369850.
20. Elliott JP, Marcotullio N, Skoner DP, Lunney P, Gentile DA. Impact of student pharmacist-delivered asthma education on child and caregiver knowledge. *Am J Pharm Educ* 2014;78:188. doi:10.5688/ajpe7810188.