

Medication education program for Indian children with asthma: A feasibility study

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Abstract

Objective: It is postulated that children with asthma who receive an interactive, comprehensive, culturally relevant education program would improve their asthma knowledge (AK), asthma control, and adherence compared with children receiving usual care. The aim of this study was to develop, implement, and evaluate the efficacy of a culturally relevant asthma education intervention for children with asthma and their parents in India.

Methods: Children with asthma (7–12 years) and their parents were recruited from an outpatient clinic in a Chest Diseases Hospital in New Delhi, and were randomly assigned to either an intervention or usual care group. At baseline, outcome data collected included pediatric asthma caregiver quality of life (PACQL, primary outcome), AK, asthma control, adherence, inhaler technique, action plan ownership, and goal achievement. These data were collected again at 1 and 6 months after baseline. Outcomes were compared within and between groups using ANOVA techniques.

Results: Forty parent-child pairs were recruited. Of these, 24 pairs of children with asthma and their parents received the educational intervention. The PACQL significantly improved from baseline to 6 months in the intervention (5.87 ± 0.94 – 7.00 ± 0.03) versus the usual care group (5.90 ± 0.52 – 6.34 ± 0.56) ($P < 0.001$). Other outcomes such as the parents' and child's AK, child's asthma control and inhaler technique were significantly improved in the intervention group across the study. All the participants possessed a written asthma action plan at the end of the intervention. Eighty-five goals were set by children with asthma across all the visits and were achieved by completion.

Conclusion: An asthma educator delivered interactive program simultaneously involving children with asthma and their parents, improved quality of life, empowered and promoted better self-management skills.

Key words: Asthma education, asthma knowledge, asthma usual care, caregiver quality of life, childhood asthma, hospital-based program, program evaluation

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Introduction

Inappropriate medication use in children with asthma is a current issue of concern worldwide. Most clinical guidelines recommend patient education to combat this problem.^[1-5] Diverse forms of patient asthma education presented in different studies demonstrates that it reduces hospital admissions and improves the quality of life (QoL).^[4-6] While many educational interventions have been effectively implemented for improving

pediatric asthma control and adherence,^[7] only a few studies focus specifically on medication use.^[7]

In developing countries like India, asthma affects more than 17.23 million people,^[8,9] childhood prevalence ranges between 3.5% and 29.5%.^[10-13] Publicly available, reliable asthma information is scarce in India. In our previous work

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where children with asthma and their parents attending an outpatient clinic in two major Teaching Hospitals in New Delhi, were interviewed, it appeared that no asthma education sessions were offered to patients, beyond a clinical consultation session with the physician even in the tertiary care setting.^[14] Respondents in the previous study lacked self-management support.^[14] Thus, in this setting, there is a need to design practical and child-friendly educational programs focusing on asthma medication use in India, with clear objectives to meet local needs.^[14] The literature also suggests that interventions for asthma need to be culturally appropriate in order to be sustainable and effective.^[15]

The aim of this study was to develop, implement, and evaluate the efficacy of a culturally contextualized asthma education program designed for Indian parents and children with asthma in terms of asthma-related clinical (asthma control, asthma knowledge [AK], asthma medication use,

action plan ownership) and humanistic outcomes (caregiver QoL and satisfaction with care).

Methods

Intervention development

The intervention was designed based on key principles of pedagogy and health education [Table 1] and was named as the “Sehatmand Saanse Program” (“Healthy Breathing Program”). The three key structural components of the program included: (1) A PowerPoint presentation™ (2) a child workbook and (3) related activities interspersed at appropriate spots [Figure 1]. Elements 1 and 2 were designed to be age appropriate, graphically appealing, and culturally relevant. A predetermined open-ended communication style between the educator and parent-child pair was used based on the Food and Drug Administration’s 10 principles of communicating with

Table 1: Summary the key principles utilized in the intervention

Health education/ pedagogical principle	Definition	Example of how principle was used in the education program	Examples of cultural context
Meaningful learning	This is defined as learning with a purpose, that is, learning which allows those who engage in it to attach more meaning to the world around them, learning things which make more sense and is not simply an acquisition of knowledge ^[16]	The asthma fact presentation and depiction in the workbook were molded around real life situations the child has faced or is likely to face. Activities in the program included getting the child to describe “asthma” and their experience thereof, in 5 descriptive words. This allowed the child to reflect on their experience and think about their own asthma	
Art therapy	In art therapy, patients are encouraged to express their thoughts and feelings through art materials. It helps to improve emotional health and quality of life for children with asthma ^[16]	Activities using this idea were part of the program. Children were provided with materials for poster making (crayons, sketch pans, colored pencils, A3 paper), and they were asked to make a drawing/sketch of their asthma experiences	
Problem solving	PBL is an approach to involve the learner in a specific case or problem, and in solving this problem, the learner acquires case-specific problem-solving skills. The learner applies their own previous knowledge and gains new information while solving these problems using critical thinking skills ^[17,18]	Problem based games were incorporated in the child workbook e.g., a trigger activity where the child was presented with a picture of a bedroom (stylized to represent a typical middle income group - North Indian home), and the child was asked to identify possible asthma triggers, and asking the child to create strategies to minimize trigger exposure during such festivals	The bedroom sketch used in the game had triggers such as an incense burner, flower garlands at altar, family pet etc., Similarly, case studies where the child with asthma and intended to participate in celebrations such as Holi (festival of colors involving people playing with powdered dyes, or dyed solutions which are splattered onto each other), or Diwali (festival of lights, where all homes are lit up with candles, oil burners, and electric light displays)
Goal setting	Goal setting was used as the tool for implementing self-management empowerment	At the end of the education, the child was requested to independently set 2-3 personal goals to improve their asthma. If the child appeared unable to take this initiative, the parents were encouraged to discuss with the child, what the child’s possible goals would be, and if both parties were hesitant, then the asthma educator provided some possible direction. However the child was requested to write the goals discussed in their own words in their asthma workbook	

PBL=Problem-based learning

children about medicines.^[19] The intervention was delivered by two allied health (pharmacists) asthma educators (researcher CG and BS). Global initiative for asthma (GINA) guidelines underpinned the asthma education content.

Ethics

Ethics approval was granted by the Human Resource and Ethics Committee at the University of Sydney (HREC - 14801), Australia and from the Ethics Committee of the Participating Hospital, University of Delhi, Delhi, India. All documents were translated into Hindi after Ethics Committee approvals.

Research design

A randomized controlled repeated measures design was used to pilot test the effectiveness of the specially designed intervention. The trial was conducted between July and December 2012.

The parent-child pair was allocated to either the intervention group or usual care group using a random number sequence generated using the RAND function in Microsoft Excel. The research sampling strategy involved the research team requesting health care professional participation in identifying parent-child pairs who met the inclusion criteria either through personal knowledge of the physician or by scrutinizing their medical record databases. [Figure 2] outlines the research design, including participant recruitment.

Sample size

In a previous 52 weeks randomized trial comparing different medications in a sample of 335 children with mild to moderate persistent asthma, Pediatric Asthma Caregiver QoL Questionnaire (PACQLQ) changed from 4.9 ± 1.2 to 6.0 ± 0.45 .^[20] Hypothesizing a similar change in our sample, the sample required to detect a 1-point change in PACQLQ, a sample of 14 in both control and intervention group would be required. Correcting for a conservative 40% drop out, the number required was 20 (19.6) children in each group. We thus aimed to recruit 20 parent-child pairs in each group.

Outcomes measured

Table 2 highlights the summary of outcomes measured at baseline, 1 and 6 months. The validated PACQLQ (pediatric asthma caregiver QoL [PACQL]),^[21] was used as the primary outcome for the study. Other outcomes measured were asthma knowledge^[22-27], asthma control^[28], medication adherence^[29] and inhaler technique.

Procedure

In the “intervention group:” At baseline, at the start of each session with the individual parent-child pair, the parents were asked to complete a detailed asthma research record comprising the key outcomes [Table 2]. The asthma educator then delivered the education using the PowerPoint

slides and the child workbook. Education delivery was interspersed with key activities [Figure 1]. When the slides reached the point of discussing medications, the child was requested to demonstrate the technique of the inhaler device/s they used, and this was scored by the researcher using manufacturer recommended correct steps. Finally, the child was asked to set 2–3 goals they would like to achieve by the next visit. The researcher facilitated the goal setting process to ensure goals set were related to asthma and were achievable in the time frame. The process of intervention delivery has been highlighted in Figure 1.

In the “usual care group:” parents and children were given a standard information pack as they moved on to see their doctor for a ‘usual appointment’. During these usual appointments, the children were provided with medication regimen compliant with GINA guidelines.

Data analysis

The SPSS version 20.0 (SPSS, IL, USA) was used for data analysis. Test for normality was performed using the one sample, Kolmogorov-Smirnov test. For between groups comparisons, if the data were normally distributed student’s *t*-test for independent samples or one way ANOVA (e.g. to compare more than two groups) was used. For nonnormal data Fisher exact test or Mann–Whitney U-test were used. For within group comparisons, if the data were normally distributed repeated measures *t*-tests for paired samples or Wilcoxon signed ranks test were used. The level of significance was set at 0.05 for all statistical tests.

Results

Forty participant pairs ($n = 80$, i.e. $n = 40$ children with asthma and their $n = 40$ parents) were recruited. There were $n = 24$ pairs in the intervention and $n = 16$ pairs in the usual care group at baseline. All the recruited participants were retained in the program till 6 months. The demographic characteristics of the participants are summarized in Table 3. There were no significant differences between the groups at baseline. Given this case, between group differences were compared using the magnitude of change values in outcomes of interest across the time span (e.g. outcome change over time = final visit values minus baseline values).

Primary outcome measured

Pediatric asthma caregiver’s quality of life

The individual scores for each participant have been highlighted in Figure 3. The within group statistical changes have been highlighted in Table 4. Table 5 compares the overall differences in the magnitude of change in PACQL (and other outcomes) between groups.

The actual magnitude of change in PACQL in the intervention group ($n = 24$) was 1.13 ± 0.91 , and this

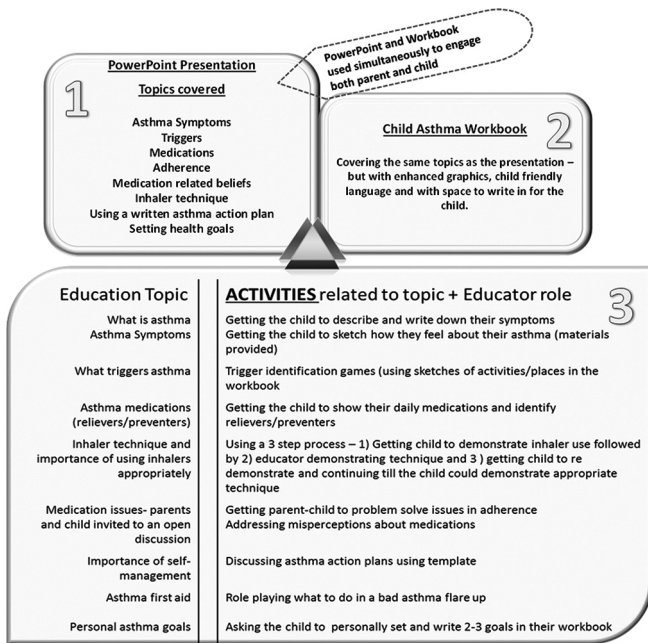


Figure 1: The three structural components of the asthma education intervention

was significantly higher as compared to the usual care group ($n = 16$) where the mean PACQL change over time was 0.44 ± 0.04 ($P < 0.001$). For the PACQL score, a repeated measure ANOVA indicated a significant interaction between group (intervention vs. control) and time (baseline vs. 6 months), $F(1, 15) = 8.76$, $P = 0.01$, partial $\eta^2 = 0.37$, power = 0.79, indicating that the intervention led to a significant improvement in caregiver QoL over the period of time. Furthermore, a main effect of time was observed, that is, $F(1, 15) = 29.13$, $P < 0.001$, partial $\eta^2 = 0.66$, power = 0.99, implying that all else being constant participating parents had improved QoL.

Other clinical outcomes

Asthma knowledge

The AK scores have been highlighted in Tables 4 and 5.

For the AK scores, a repeated measure ANOVA showed a significant interaction between type of group (intervention vs. control) and time (baseline vs. 6 months), $F(1, 15) = 2267.50$, $P < 0.001$, which demonstrates that the intervention led to a significant improvement in AK over the period of time. Furthermore, there was a significant main effect for both type of group, $F(1, 15) = 374.98$, $P < 0.001$, and time, $F(1, 15) = 2267.50$, $P < 0.001$.

Asthma control

The asthma control scores have been highlighted in Tables 4 and 5. For the Asthma Control Questionnaire (ACQ) a repeated measure ANOVA showed that there was a significant difference on ACQ scores for the 3 time periods (baseline, 1 and 6 months), $F(1.02, 25.52) = 8.79$, $P < 0.01$.

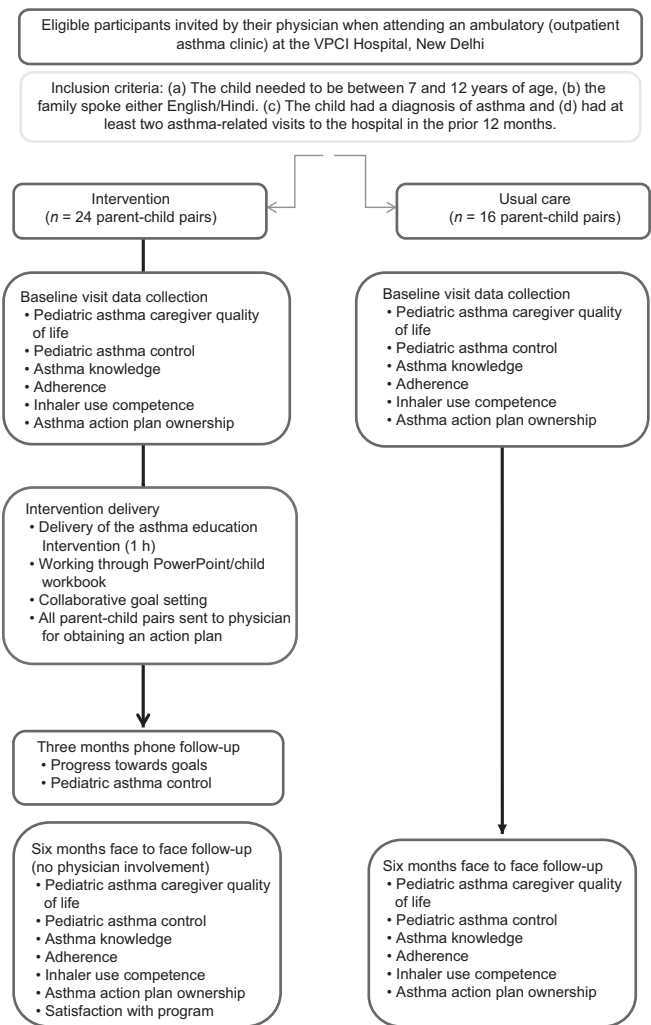


Figure 2: The research design

Inhaler technique

In the usual care group, 25% of the participating children ($n = 6$) used Lupihaler® while the rest of them used a spacer with a pressurized metered dose inhaler (pMDI). Fifty-four percent of the children ($n = 13$) in the intervention group used a spacer device with a pMDI, 38% ($n = 9$) used the Lupihaler® and 8% used the Rotahaler® devices. An improvement in inhaler use scores was observed in all cases in the intervention group. (Lupihaler® and the Rotahaler® are single unit dry powder devices).

Medications used and adherence

All the participants reported their medication usage (name, dose, regimen, the number of missed doses) over the last week. All the children were using short-acting beta agonists (88% salbutamol and 12% levosalbutamol) at baseline in the usual care and intervention groups. Fifty percent of the participating children were using budesonide in the usual care group and 38% in the intervention group. A combination inhaler (budesonide + formoterol) was being used by 50% and 62% in the usual care and intervention groups respectively. When individual

Table 2: Summary of outcomes measured at baseline, 1 and 6 months

PACQL	The PACQLQ, a previously validated questionnaire available in Hindi and English ^[16,21] was used. Responses were given on 7-point scales where the score range was between 1 (severe impairment for each item life) and 7 (no impairment to quality of life)
AK of caregiver	A customized knowledge questionnaire AKQ was developed by scrutinizing the literature about key information gaps related to asthma and asthma medications, from available questionnaires. ^[22-25] The score range was 0-34, and higher scores indicated higher levels of knowledge. The AKQ was translated from English to Hindi and back translated. While, there are a few tools available in western countries for evaluating AK in children with asthma; ^[17,18,26,27] however they cannot be directly extrapolated to Indian children due to sociocultural differences and behavioral/life-style variations
Asthma control in children	We used the validated Hindi and English version of the ACQ developed by Juniper <i>et al.</i> ^[28] The ACQ comprised 7 items, 0-6. The final score is the mean of the 7 items and therefore the score range is between 0 (well controlled) and 6 (extremely poorly usual controlled)
Medication beliefs and adherence	The adherence and barriers to adherence were mapped by using sections of a previously validated BMQ. ^[29] These 2 sections comprise 9 items. The score range is between 0 (not hard at all) and 2 (very hard)
Usage technique for prescribed device	It was scored using recommended usage steps highlighted by manufacturers of devices and previous research. The scores were presented as percentage of steps completed correctly for each device
WAAP ownership	A section was developed in the patient asthma record to investigate whether the child had an action plan, if they had it, then they were further queried about who wrote the plan and how confident the parent and the child were in using it. The ownership of action plans is presented as a proportion (proportion owning a plan), and confidence in using it is presented as a score range 1-5 (1 - not confident at all, 5 - very confident)
Goal setting	The children were asked to write goals - "Think about things that are easy to do to help your asthma get better. You should decide the three goals you want to set but you can ask your mummy/papa to help." Queries about goals attainment was made at follow ups. Children were asked - "What will you do to obtain these goals?" results are presented as numbers of goals set and proportion of set goals obtained
Patient satisfaction	An 8 items customized questionnaire was developed to explore the reach and effectiveness of the program. The responses allowed parents to choose from no impact 0 to large impact 4. Thus the score range was 0-32, and higher scores indicate higher levels of satisfaction. At the end of the questionnaire parents were invited to provide feedback in an open ended way by adding comments or suggestions about ways to improve the program

PACQL=Pediatric asthma caregiver quality of life; PACQLQ=Pediatric Asthma Caregiver Quality of Life Questionnaire; AKQ=Asthma Knowledge Questionnaire; AK=Asthma knowledge; BMQ=Brief Medication Questionnaire; WAAP=Written asthma action plan; ACQ=Asthma Control Questionnaire

Table 3: Summary of participant demographics at baseline

General demographics	Mean \pm SD		P** (intervention vs. usual care group)	Result of Chi-square test
	Usual care (n=16) (%)	Intervention (n=24) (%)		
Child age	10.4 \pm 1.2	10.2 \pm 1.8	0.9	t (37.99)=0.42, P=0.68
Child gender				
Male	10 (63)	16 (67)	0.3	χ^2 (1)=0.07, P=0.79
Years of diagnosed illness*	4.1 \pm 1.4	3.6 \pm 2.2	0.3	t (38)=0.79, P=0.437
Time symptoms occurred prior to diagnosis (in years)	2.4 \pm 1.0	1.9 \pm 1.3	0.1	t (38)=1.23, P=0.22
Comorbid illnesses				
No other	8 (50)	10 (42)	0.6	χ^2 (3)=1.16, P=0.762
Allergic rhinitis	5 (31)	08 (33)		
Eczema	2 (13)	02 (08)		
Sinusitis	1 (06)	04 (17)		
Father occupation				
Government job	1 (06)	7 (30)	0.3	χ^2 (4)=4.5, P=0.338
Private job	9 (56)	8 (33)		
Professional	0 (00)	1 (04)		
Business	4 (25)	6 (25)		
Daily wages	2 (13)	2 (08)		
Mother occupation				
Private job	-	1 (04)	0.7	χ^2 (2)=0.76, P=0.686
Professional	1 (06)	1 (04)		
Housewife	15 (94)	22 (92)		

*Years of diagnosed illness means number of years child had been diagnosed for asthma; **P<0.05 is significant, child age and symptoms before diagnosis is in years; **Occupation of the parents have been represented according to Indian employment classification. 83% of children in intervention group and 81% in usual care group were diagnosed with moderate persistent asthma. 17% of children in intervention and 19% in usual care group were diagnosed with mild persistent asthma. SD=Standard deviation

medications were compared in terms of proportions of children using them, there were no differences between groups ($P > 0.05$). The regimens being used were

appropriate as per the GINA guidelines. No changes in regimen occurred over the course of the trial. Self-reported adherence to the prescribed medication

Table 4: Comparison of outcomes at baseline and endpoint (6 months) between intervention and usual care group

Measured outcomes	Mean ±SD		P value intergroup difference baseline	Mean ±SD		P value intergroup difference 6 months
	Usual care group baseline (n=16)	Intervention group baseline (n=24)		Usual care group 6 months (n=16)	Intervention group 6 months (n=24)	
PACQL						
Score range (1-7)	5.90±0.52	5.87±0.94	0.50	6.34±0.56	7.00±0.03**	<0.001*
AK						
Score range (0-34)	10.81±2.53	12.04±2.09	0.12	10.81±2.53	33.9±2.00**	<0.001*
Asthma control						
Score range (0-6)	1.19±2.43	3.00±4.73	0.17	1.19±2.43	0.08±0.41***	<0.001*
Inhaler technique						
MDI with spacer (n=25) (%)	11.17±1.34	10.54±1.26	0.24	11.17±1.34	13.0±0.00***	<0.001*
Score range (0-13)	(86)**	(81.1)**		(86)**	(100)**	
Lupihaler® (n=15) (%)	14.00±2.16 (73.4)**	13.67±2.28 (72.0)**	0.84	14.00±2.16 (73.4)**	19.0±0.00*** (100)**	<0.001*
Score range (0-19)						
Rotahaler® (n=2)*** (%)	-	16.33±0.57 (86)**	-	-	19.0±0.00*** (100)**	-
Score range (0-19)						

*Significance; **Percentage correct steps performed (Lupihaler® and the Rotahaler® are single unit dry powder devices); ***Some children used types of devices. SD=Standard deviation; MDI=Metered dose inhaler; AK=Asthma knowledge; PACQL=Pediatric Asthma caregiver quality of life

Table 5: Magnitude of change from baseline to endpoint (6 months) in outcomes of interest in the intervention and usual care group

Outcomes	Magnitude of change		Significance of difference in the "magnitude" of specified changes between groups that occurred through baseline to final visit
	Final value - baseline value in usual care group (n=16) (difference in mean ±SD)	Final value - baseline value in intervention group (n=24) (difference in mean ±SD)	
PACQL	0.44±0.46	1.13±0.95	<0.001*
AK	0**	21.92±2.0	<0.001*
Asthma control	0**	2.92±4.80	<0.001*
Inhaler technique score			
MDI with spacer (n=25)	0**	2.46±1.27	<0.001*
Lupihaler® (n=15)	0**	5.33±2.78	<0.001*
Rotahaler® (n=2)***	-	2.67±0.58	-

*Magnitude of difference ignored – or + sign; **The zero values mean the score was identical on both occasions; ***Some children used two types of devices. SD=Standard deviation; MDI=Metered dose inhaler; AK=Asthma knowledge; PACQL=Pediatric asthma caregiver quality of life

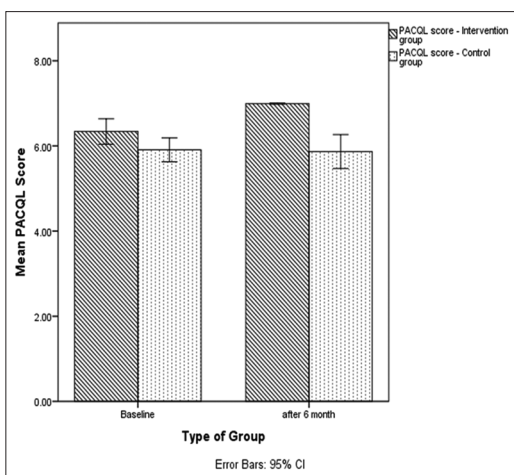


Figure 3: Caregiver quality of life scores at baseline and 6 months in intervention group and usual care group respectively (score range between 1 and 7 at baseline and at 6 months, higher score = better quality of life) IT = inhaler technique, AT = Avoid triggers FR = follow regimen, MH = maintain hygiene, CD = clean device, SM = self-management

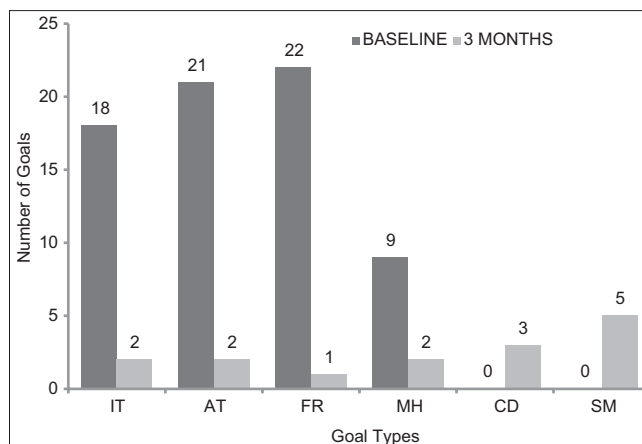


Figure 4: Goals set by 24 participant pairs (intervention group) at baseline, total = 70 goals and at 3 months, total = 15 goals

regimen was high based on the modified Brief Medication Questionnaire (BMQ) completed by patients. Mean modified BMQ scores were 1.5 ± 0.51 and 1.4 ± 0.63

for intervention and usual group respectively at baseline, which improved to 0.26 ± 0.44 for the intervention group while there was no change in the usual care group.

Possession of written asthma action plan

None of the children in either intervention or usual care group reported having a written asthma action plan (WAAP) at baseline. All the children in the intervention group were provided with a customized WAAP at baseline after the education session. All the participants (child with asthma + their parent, $n = 24$) in the intervention group reported that they were confident in using WAAP at 1 and 6 months. All children/parents in the usual care group had a blank template of an action plan in their information pack at baseline (and advice to ask their treating physician to complete it at their next appointment).

Art therapy and goal setting exercise

The artworks created by the children during the educational activities were thematically analyzed. A majority of children drew about things that triggered their asthma ($n = 16$), some of them drew/sketched their medications ($n = 5$) and the remaining ($n = 3$) portrayed how they felt about having asthma. The thematic representations here were “burden” (i.e. picture of self with a large boulder on the chest), “family” and “needing to use medication.”

The goals types are depicted in Figure 4. Eighty-five goals set by children with asthma across all the visits 93 (93%) were achieved by completion.

Patient satisfaction

The scores of the satisfaction questionnaire (mean = 31.0 ± 0.9) demonstrated that the asthma education program met almost all needs of the participants ($n = 24$) and had a large impact on their understanding of their child’s asthma, knowledge of asthma medications, inhaler technique, confidence in managing their child’s asthma, asthma control and QoL in the intervention group. They also suggested that if the program was continued, it would be beneficial for other children with asthma ($n = 16$). All the participants also mentioned that they felt obtaining a written action plan ($n = 24$), getting to talk to someone about their asthma ($n = 16$) and receiving comprehensive information ($n = 24$) were the most useful components of the program.

Discussion

This is one of the first studies conducted in India that has assessed the feasibility and efficacy of an asthma education intervention for children and their parents. The asthma education program (Sehatmand Saanse Program) embedded several key principles of health education for children and also addressed context specific needs that were identified in an earlier qualitative phase.^[15] In our randomized controlled design with follow-up for 6 months, the intervention group

demonstrated significant improvement in both clinical and humanistic outcomes as compared to the usual care group. This pilot study demonstrated that an intensive, culturally relevant, multi-component, individualized education intervention delivered by allied health care professionals was highly effective when used in an Indian tertiary health care setting.

Compared to the control group, there was a statistically and clinically significant improvement in the QoL scores in the intervention group at 1-month, which was sustained to 6 months. The minimum clinically significant change in the PACQL is considered to be > 1 point (0.5 for each domain), which was attained in the intervention group but not for the usual care group.^[22] This is a significant outcome as the literature highlights that chronic pediatric diseases influence QoL of children and parents/caregivers.^[22,23] Further, research indicates that there is a correlation between QoL of parents of children with asthma and the actual clinical parameters of children with asthma.^[29,24,25] It has also been demonstrated that there is a correlation between children’s lung function^[30] and asthma control,^[31-33] and parents’ (caregivers) QoL. These considerations emphasize the importance of the QoL gains that the intervention brought about.

The WAAP possession by all intervention group children is also an important outcome. A previous physician-led Indian study compared a cohort of children with a WAAP against a usual care group without a plan. The results of this previous study highlighted that children receiving a WAAP had fewer acute asthma attacks, fewer lost school days, lower symptom score, and less nocturnal awakening than those who did not receive a plan.^[34] In addition to WAAPs, another process that may be used to facilitate self-management of asthma in patients and their families is patient directed goal setting. In this study, goal setting was used as a tool to enhance self-efficacy in the child with asthma. A study by Smith *et al.* highlighted that goal specificity and ease makes them more achievable in the case of adult asthma patients.^[35-38] This goal setting approach was used by us and may have facilitated achievement of goals and resultant increased confidence, evident in the intervention group and reported by parents in their close out satisfaction questionnaire. Future child asthma intervention programs should utilize similar techniques, as this study indicates that children with asthma are willing to invest in the process. This study is one of the few to utilize the goal setting process to facilitate self-management with pediatric asthma patients.

Within the research project, the asthma education delivery personnel were allied health research professionals with extensive clinical experience in asthma, this program alone will be of value only if there are systems to sustain it. As the doctor to patient ratio is 0.7/1000 peoples in India,^[39] which is quite low, involving other health personnel in

patient education models such as the one in the current study should be considered. Effective use of outpatient clinical nursing staff may be another option for better provision of asthma education to parents/carers and children with asthma^[40,41] and to sustain the program. A nurse led asthma education study conducted in India was recently reported. This study employed multi-component education strategies and found improved adherence to the treatment as compared to usual physician care.^[42] Clearly allied health supported asthma education programs have value in the Indian tertiary/outpatient clinic setting.

Our study had several limitations that should be acknowledged. We used a small convenience sample of parents who were well versed with Hindi/English and children with asthma from one specialty hospital. Therefore generalizability cannot be assumed. There could be a social class difference in people to those whose assessment was delivered in Hindi versus English. Computer based randomization using RAND function was performed, but allocation concealment was not implemented in the process. An unequal number of pairs resulted in the control and intervention groups (i.e. 16 vs. 24), as recruitment was stopped at 40. Another limitation is the lack of longer-term follow-up, so it is not clear whether the program has sustained for more than 6 months.

Conclusion

The intervention was a context specific, educational program that had the ability to affect caregiver QoL, AK and self-management behaviors in 7 through 12-year-old Indian children with asthma. Overall, the intervention had a positive effect on asthma-related outcomes and humanistic outcomes in children. Such interventions are particularly important in the context of developing countries where lesser public education expenditure into conditions such as asthma is invested.

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