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# Parental knowledge and attitudes regarding asthma in their children: Impact of an educational intervention in an Indian population

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## Abstract

**Introduction and Objectives:** Research shows positive effects of asthma education in improving parental knowledge, self-management skills, and reducing healthcare costs. Such studies are lacking in resource-limited countries. We studied the effectiveness of educational intervention in improving the knowledge and attitudes of parents/caregivers of asthmatic children.

**Methods:** The study was conducted in the pediatric chest clinic of tertiary hospital (India) over 21 months after ethics committee approval. Recruited parents were randomized into the interventional group (A) receiving education module and control group (B). Parents' asthma knowledge and attitudes were assessed at baseline and 5 months postenrollment using 25-item questionnaire. Detailed demographic data, clinical data, and exacerbations during study were noted.

**Results:** A total of 75 parents/guardians fulfilling inclusion criteria were analyzed (cases/group A: 37 and controls/group B: 38). 8.3 percent of parents/caregivers were illiterate. Around 36.9% of patients had a family history of allergy/asthma. Mean knowledge scores at follow-up were 12.24 and 9.89 for groups A and B, respectively ($P < .05$). Parents did better on knowledge items related to chronicity, family history, chronic cough, home administration of steroids in acute severe asthma, and maintaining records of clinical/medications for good control. Intervention group (A) showed significant improvement in most attitude-based questions postintervention as compared with the nonintervention group (B). There was no statistically significant difference in asthma severity and control between the two groups at follow-up.

**Conclusions:** Small group education on asthma in parents/caregivers improves their knowledge and attitudes. Healthcare plans should invest in pediatric asthma education and identify key personnel/opportunities to impart the same in routine care.

Chhaya Divecha and Milind S. Tullu are co-first authors.

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KEYWORDS
asthma, attitudes, children, education, exacerbations, inhalation therapy, knowledge, parents, respiratory, steroids

## 1 | INTRODUCTION

The irony of asthma is that despite advances in therapy and improved comprehension of the pathophysiology, its prevalence and burden to healthcare and community has not changed considerably.[1] This morbidity could be attributed to poor healthcare access, improper medication utilization, or lack of self-management and preventive policies.[2] Management in asthma generally centers on acute treatment of exacerbations, thus ignoring the importance of preventive care by health education, proven to be cost-effective (by reducing costs of hospitalizations and emergency visits).[3] Though education is a fundamental component of all asthma guidelines, its potential in improving asthma management remains untapped.

Parents/caregivers play an important role in the management of chronic diseases in children. For optimal asthma management, the involvement of parents/caregivers in asthma self-management education is essential. It entails the understanding of the disease process and factors influencing exacerbations, trigger avoidance, recognition of symptoms and flare ups, medications, adherence, and seeking medical care.[4,5] Thus, many studies have attempted to study the effect of educational intervention on knowledge and attitudes of parents/caregivers of children with asthma, which would indirectly affect health outcomes positively.[6–9] Studies on educational interventions in asthma have described successful programs to cover a wide spectrum, such as specific factors influencing childhood asthma and control, individual customization as per deficiencies [shortcomings in patient environment (such as parental support, environment trigger control), inadequacies in care (medication availability, proper technique, and compliance), and deficiency in information about the disease] and needs, family involvement, accounting for physical and social backgrounds, identifying those with severe disease and conducting the educational process in an optimal setting.[10]

Research in developed countries have shown positive effects of asthma education in improving parental knowledge and self-management skills and reduction in healthcare costs by reducing emergency visits and hospital admissions.[3] In a resource-limited country like India with inadequate healthcare access and suboptimal doctor to patient ratios, the influence of educational intervention on parent/caregiver knowledge and attitudes could be a cost-effective measure to improve asthma control. Thus, we decided to evaluate the knowledge and attitude of the parents/guardians toward inhalation therapy in pediatric asthma in a tertiary healthcare center in western India and re-evaluate the same after administration of a module-based patient education intervention in the education intervention group.

## 2 | MATERIALS AND METHODS

This study was a two-group, repeated measure, randomized clinical trial studying the effect of intervention on improvement in knowledge and attitude of parents/guardians with regard to asthma in their child and therapy. It was planned in the pediatric chest clinic of a tertiary care hospital attached to a premier tertiary level urban medical college in western India. After institutional ethics committee approval, the study was conducted over a period of 21 months (from January 2012 to September 2013).

### 2.1 | Subject recruitment and randomization

Patients suffering from pediatric asthma and under treatment (for at least 3 months) and one parent/guardian were enrolled after obtaining written informed consent from the parent/guardian and assent from the child. Patients and parents/guardians who refused to participate in the study were excluded. All families and children were followed for 5 months after enrollment. The study population was randomized into two groups: group A (N = 42) where the parent/guardian received patient educational intervention module (the "Case" or "Intervention" group) and group B (N = 42) where the parent/guardian did not receive the patient educational intervention module (the "Control" or "Nonintervention" group). These two groups were made to minimize bias arising due to parental counseling at every visit/health contacts during symptomatic periods and during routine follow-ups at the pediatric chest clinic. Recruitment to the study continued for 16 months, avoiding seasonal selection.

### 2.2 | Intervention/instrumentation and measures

A knowledge and attitude questionnaire was constructed after reviewing relevant literature and validated using standard methods.[a-15] The 25-item questionnaire was designed to explore various aspects of asthma care and education including the etiology, pathophysiology, symptoms, triggers, treatment, use of inhalers, prevention, and action plans. The "Questionnaire" included 15 knowledge-based questions with responses of "Yes," "No," and "Don't know" (discouraging guessing). Remaining 10 questions were based on attitude and responses were marked on a Likert scale of "strongly disagree" to "strongly agree" continuum, as 1 to 6, respectively (1—strongly disagree, 2—disagree, 3—somewhat disagree, 4—somewhat agree, 5—agree, 6—strongly agree). The validity and reliability of the questionnaire were determined by content and face validity and Test-Retest Reliability, respectively. The Test-Retest Reliability was good with correlation coefficient of 0.9. The questionnaire has been labeled as the "Tullu Questionnaire" (Annexure 1) (named after the principal investigator). Cross-cultural adaptation of validated questionnaire in Hindi and Marathi (local native languages in western India) was done. The knowledge

and attitude questionnaire was administered to the parent/guardian actively involved in routine care and follow-up of the child through face-to-face interviews, encouraging them to answer it independently with clarification (only if required). The responses in first visit were recorded as baseline data for both groups A and B (visit 1) and "Patient Education Module" (Tullu Module; Annexure 2) was administered to the parent/guardian (group A) in small groups of five to seven by one of the investigators. The previously administered knowledge and attitude questionnaire was readministered to the same parent/guardian in both groups, once again after 5 months of the educational intervention (visit 2). At visit 2, the same knowledge and attitudes questionnaire was also administered to group B after 5 months of the initial visit 1. Detailed demographic data, clinical data (asthma triggers, severity of asthma, symptoms, and examination findings) and the number of exacerbations that the patient developed over study period were also noted in the Case Record Form.

### 2.3 | Outcomes

The main outcomes were the knowledge and attitude of parents/guardians regarding inhalational therapy in pediatric asthma at baseline and at 5 months after the administration of a module-based patient education intervention (module administered only to the intervention group, ie, group A). The secondary outcome measured was the effect of educational intervention on child's asthma severity and control.

### 2.4 | Statistical analysis

The answers to the knowledge-based questionnaire were evaluated as "Yes," "No," and "Don't know." Regarding the attitude questionnaire, the percentage of participants with a particular Likert scale response (1 to 6) was computed. Also, the answers to the knowledge and attitude questionnaires were compared in each individual patient for both visits to assess the improvement/change in knowledge and attitude of the parent/caretaker (done separately in groups A and B). Also, the responses to the questionnaires were compared between the two groups, A and B (visits 1 and 2 data). Hence, intragroup (within the group) and intergroup (between the two groups) comparisons were done. Question-wise analysis of the responses was also done within the groups and between the two groups. Quantitative data were represented using the mean ± standard deviation (SD) and median and interquartile range. The analysis of quantitative data between the two groups was done using the unpaired *t* test if data passed "Normality test" and by Mann–Whitney Test if data failed "Normality test." The analysis of quantitative data measured over two times was done using the paired *t* test if data passed "Normality test" and by the Wilcoxon signed-rank test if data failed "Normality tests." Analysis of quantitative data measured over more than two times was done using repeated measures ANOVA if data passed "Normality test" and by Friedman's Repeated Measures ANOVA on ranks test if data failed "Normality test," with the application of appropriate post hoc test if *p* value of ANOVA came statistically significant. Qualitative data were represented in the form of frequency and percentage. The association between qualitative variables was assessed by the $\chi^2$ test with continuity correction for all 2 × 2 tables and Fisher's exact test for all 2 × 2 tables where *p* value of the $\chi^2$ test was not valid due to small counts. Adjacent row data of more than 2 × 2 tables was pooled and the $\chi^2$ test reapplied in case more than 20.0% cells having expected count less than 5. The comparison of response to qualitative questions between visits 1 and 2 was done using the McNemar test for all 2 × 2 tables of comparison and by the McNemar-Bowker test for tables with more than two rows/columns. SPSS version 13 was used for analysis.

## 3 | RESULTS

### 3.1 | Sociodemographic and child health characteristics at baseline

A total of 84 children and parents/guardians fulfilled the inclusion criteria and were recruited for the study [42 in case group with intervention (group A) and 42 in the noninterventional control group (group B)]. Of these, nine patients did not complete the follow-up visits and were excluded from final analysis. Thus, a total of 75 patients/guardians (N = 75) were analyzed (cases [A]-37 and controls [B]-38). The sociodemographic characteristics of both groups are summarized in Table 1.

There was a male preponderance in the study population. Maximum patients belonged to the 5 to 12 years age group (46/84), accounting for 54.76% of the total study population. Only seven (8.3%) parents/caregivers were illiterate. Around one-third (36.9%) had a family history of allergy or asthma and almost half (46.4%) had history of atopy. All the parameters in Table 1 were comparable in both the groups with no statistically significant difference.

### 3.2 | Knowledge of parents regarding asthma

The highest score could be 15, with correct answers to all the knowledge items in the questionnaire. The highest score that the caregivers could achieve was 14 while the lowest score was 4. The mean scores at baseline and follow-up were 8.45 and 11.06, respectively. Only 32% (27/84 cases) of the caregivers had adequate knowledge of asthma (>9 score or >60%).[15,16] After intervention in just one group, it increased to 59/75 (78.67%). Three caregivers could not answer even five questions correctly. Table 2 presents the parental knowledge attributes and scores of both groups at baseline (visit 1) and follow-up (visit 2).

Out of total 84 patients analyzed at visit 1, 35 (41.7%) parents thought that asthma is a chronic disease, 44 (52.4%) parents believed that asthma has a genetic predisposition, and 31 (36.9%) parents perceived that chronic cough can be a sign of asthma. With regard to treatment, only 16 (19%) parents were of the opinion that oral

**TABLE 1** Sociodemographic characteristics of both (intervention and nonintervention) groups

| Variable | Group A (N = 42) | Group B (N = 42) | *P* | Total (N = 84) |
|---|---|---|---|---|
| Age of child, years | | | | |
| 1-3 | 01(2.38%) | 09 (21.42%) | | 10 (11.9%) |
| 3-5 | 16(38.09%) | 12 (28.57%) | *P* = .3814 | 28 (33.33%) |
| 5-12 | 25(59.52%) | 21 (50%) | | 46 (54.76%) |
| Mean ± SD | 6.71 +/− 2.48 | 6.20 +/− 2.82 | | |
| Gender of child | | | | |
| Female | 20 (47.6%) | 13 (31.0%) | *P* = .118 | 33 (39.3%) |
| Male | 22 (52.4%) | 29 (69.0%) | | 51 (60.7%) |
| Age of parent (Years) | | | | |
| Mean + SD | 27.7 ± 3.68 | 28.2 ± 2.41 | *P* = .4635 | |
| Gender of parent | | | | |
| Female | 25 | 23 | *P* = .6613 | 48 |
| Male | 17 | 19 | | 36 |
| Parent educational qualification | | | | |
| Illiterate | 2 (4.8%) | 5 (11.9%) | *P* = .728 | 7 (8.3%) |
| Primary | 3 (7.1%) | 3 (7.1%) | | 6 (7.1%) |
| Secondary | 26 (61.9%) | 22 (52.4%) | | 48 (57.1%) |
| Higher secondary | 5 (11.9%) | 7 (16.7%) | | 12 (14.3%) |
| Graduate | 6 (14.3%) | 5 (11.9%) | | 11 (13.1%) |
| Socioeconomic status (per-capita income in Rupees) | | | | |
| <5000 | 33 | 33 | | 66 |
| 5000-10 000 | 7 | 9 | *P* = .8887 | 16 |
| >10 000 | 2 | 0 | | 2 |
| Family history of allergy/asthma | 17 (40.5%) | 14 (33.3%) | *P* = .498 | 31 (36.9%) |
| History of atopy | 22 (52.4%) | 17 (40.5%) | *P* = .274 | 39 (46.4%) |

Abbreviation: SD, standard deviation.

steroids can be given at home during acute severe attack of asthma and 19 (22.6%) parents considered that inhalational therapy does not have more side effects as compared with the oral therapy.

Mean parental scores were significantly higher by group at follow-up (visit 2); however, at follow-up, the intervention group (A) had significantly higher scores than the control group (B). Parents did better on knowledge items related to chronicity, family history, chronic cough, and home administration of steroids in acute severe asthma. Almost all parents (both groups) reported correct response to maintaining records of clinical/medications for good asthma control. Maximum improvement in knowledge item was seen in awareness of asthma as a chronic disease.

### 3.3 | Attitudes of parents regarding asthma

Group A showed significant improvement in most (8 out of 10) attitude-based questions on the visit subsequent to intervention while group B showed hardly any change in attitude (significant improvement in only 1 attitude-based question) on their subsequent visit. On comparing both groups on follow-up, there was a significant difference in attitudes in questions related to use of inhalational devices, non-addiction to inhalational medications, improved quality of life after inhalation therapy, and improved prognosis after childhood in the intervention group. Parental attitude toward the disease and treatment can influence the childcare and thus have an impact on disease control. Table 3 presents parental attitude attributes and scores of both the groups at baseline (visit 1) and follow-up (visit 2).

Though there was an improvement in severity of asthma in group A posteducational intervention, there was no statistically significant difference between both groups on follow-up visit. Similarly, there was no significant difference in asthma control between two groups at follow-up. Table 4 gives the asthma severity and control of both groups at follow-up (visit 2).

## 4 | DISCUSSION

Our study showed a significant improvement in parental knowledge and attitudes after the educational intervention; however, there were no differences in asthma severity and control. These results are comparable with other studies that showed improvement in knowledge, self-efficacy, and attitudes after educational intervention; however, evidence regarding postintervention clinical outcomes has been conflicting.[3,6-9,16-25]

### 4.1 | Knowledge

With an increase in the prevalence of asthma, awareness of asthma amongst caregivers is expected to be increasing, especially in those

**TABLE 2** Parental knowledge attributes & scores of both groups at baseline (Visit 1) and follow-up (Visit 2).

| Asthma Knowledge Questionnaire attributes | Grp A visit 1 (N = 42) | Grp A visit 2 (N = 37) | Grp B visit 1 (N = 42) | Grp B visit 2 (N = 38) | Grps A and B significance (visit 2) |
|---|---|---|---|---|---|
| Mean score on knowledge at follow-up (mean range 4 to 14) | 8.62 | 12.24 | 8.29 | 9.89 | **< .00001** the Wilcoxon rank sum test with continuity correction **W: 1145** ***P*: .000002** |
| Standard deviation | 2.31 | 1.65 | 2.33 | 1.98 | |
| Parents/caregivers with adequate knowledge ( > 60% score) | 35.71% | 94.51% | 28.57% | 63.16% | |
| **Asthma knowledge items (correct/expected response—Yes/No)** | | | | | |
| Is asthma a chronic disease? (Yes) | 20 (47.6) | ***34 (91.9)***[a] | 15 (35.7) | ***18 (47.4)***[b] | **.00015**[c] |
| Is a child at higher risk for having asthma if the near relatives also suffer from asthma/allergic diseases? (Yes) | 25 (59.5) | ***31 (86.1)***[a] | 19 (45.2) | ***23 (60.5)***[b] | **.023**[c] |
| Can a child with asthma have recurrent episodes of runny nose/sneezing (allergic rhinitis) frequently? (Yes) | 22 (52.4) | ***29 (78.4)***[a] | 27 (64.3) | ***29 (76.3)***[b] | 1.000 |
| Can avoidance of exposure to dust prevent an acute attack of asthma? (Yes) | 29 (69) | 31 (83.8) | 20 (47.6) | ***24 (63.2)***[b] | .079 |
| Can chronic cough be a sign of asthma? (Yes) | 17 (40.5) | ***30 (81.1)***[a] | 14 (33.3) | ***18 (47.4)***[b] | **.005**[c] |
| Is it advisable to take the child to hospital/medical facility immediately, when he/she suddenly becomes breathless/starts wheezing and does not respond well to the salbutamol inhaler (blue inhaler) given at home? (Yes) | 34 (82.9) | ***35 (97.2)***[a] | 34 (81) | 34 (89.5) | .358 |
| Is salbutamol (blue inhaler) metered dose inhaler (MDI) useful in controlling an acute attack of asthma? (Yes) | 28 (66.7) | ***34 (91.9)***[a] | 26 (61.9) | ***30 (78.9)***[b] | .208 |
| Can steroid tablet/s or syrup be given at home during acute severe attack of asthma to reduce the severity of the acute attack? (Yes) | 7 (16.7) | ***16 (43.2)***[a] | 9 (21.4) | ***7 (18.4)***[b] | **.011**[c] |
| Is oral therapy better than inhalational (MDI) therapy in long- term management of asthma? (No) | 15 (35.7) | ***23 (62.2)***[a] | 14 (33.3) | ***17 (44.7)***[b] | .104 |
| Can inhalational therapy (nebulization or MDI with spacer)[6] provide good relief in an acute attack of asthma? (Yes) | 29 (69) | ***36 (97.3)***[a] | 31 (73.8) | 33 (86.8) | .214 |
| Can stopping of steroid (red inhaler) metered dose inhaler- MDI (without physician's advice) cause worsening of asthma control? (Yes) | 31 (73.8) | 31 (83.8) | 28 (66.7) | 28 (73.7) | .432 |
| Does inhalational therapy for asthma have more side-effects as compared to oral therapy? (No) | 6 (14.3) | ***18 (48.6)***[a] | 13 (31) | ***15 (39.5)***[b] | .067 |
| Is it important to follow up regularly with the doctor once even if the patient is asymptomatic? (Yes) | 23 (54.8) | ***32 (86.5)***[a] | 26 (61.9) | 31 (81.6) | .791 |
| Is it necessary to continue inhaled medications even after recovery from an acute attack of asthma? (Yes) | 31 (73.8) | ***33 (89.2)***[a] | 29 (69) | 32 (84.2) | .736 |
| Is maintaining records of all clinical details and medications important in controlling asthma and deciding future therapy? (Yes) | 40 (95.2) | 37 (100) | 40 (95.2) | 36 (94.7) | .493 |

*Note:* Figures in parentheses/brackets () indicate percentages.

The bold and italic values indicate significant intragroup improvement.

[a]Compares visits 1 and 2 in group A and indicates significant improvement (intragroup).

[b]Compares visits 1 and 2 in group B and indicates significant improvement (intragroup).

[c]Compares groups A and B at visit 2 and indicates significant improvement (intergroup).

**TABLE 3** Parental attitude attributes and scores of both groups at baseline (visit 1) and follow-up (visit 2)

| Attitude attributes | Group A visit 1 | Group A visit 2 | Group A(visits 1 and 2) (Wilcoxon signed-rank test)*P* | Group B visit 1 | Group B visit 2 | Group B(visits 1 and 2) (Wilcoxon signed-rank test)*P* | Groups A and B at visit 2 (Mann-Whitney test) | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | *Z* | *P* |
| Asthma can be well controlled with the currently available inhaled medications | 5.31 | 5.65 | .025[a] | 5.52 | 5.74 | .068 | −0.131 | .896 |
| It is easy and comfortable to use the inhalational devices and I am satisfied with the use of inhalational therapy in controlling asthma in my child | 5.55 | 5.97 | .023[a] | 4.95 | 5.26 | .010[b] | −3.687 | .00023[c] |
| Correct technique of using inhalational devices is important in ensuring adequate drug delivery of inhaled medications for asthma | 5.55 | 5.84 | .046[a] | 5.55 | 5.76 | .206 | −0.05 | .960 |
| My child will get addicted to inhalational medications and devices | 2.02 | 1.49 | .017[a] | 3.17 | 3.24 | .253 | −3.854 | .00012[c] |
| It is important to consult the treating doctor before increasing/decreasing/stopping inhalational medications for asthma | 5.64 | 5.92 | .008[a] | 5.69 | 5.78 | .285 | −1.377 | .169 |
| I have an important role to play in ensuring compliance and adequate dosing of medications in my child | 5.67 | 5.81 | .157 | 5.57 | 5.78 | .132 | −0.875 | .382 |
| A child with asthma can live a normal day to day life (including routine sports and exercise) | 5.40 | 5.78 | .057 | 5.12 | 5.41 | .186 | −1.301 | .193 |
| Inhalational therapy has been useful in improving quality of life of my child with asthma (absence of symptoms, routine daily activities, adequate play, adequate schooling, proper study, no disturbances of sleep, etc) | 5.52 | 5.89 | .011[a] | 5.74 | 5.65 | .248 | −2.27 | .023[c] |
| Many children having asthma outgrow their asthma in adulthood | 5.26 | 5.62 | .044[a] | 4.93 | 4.84 | .333 | −2.665 | .008[c] |
| Having asthma is a social stigma | 1.95 | 1.57 | .040[a] | 2.50 | 2.27 | .121 | −1.294 | .196 |

[a]Compares visits 1 and 2 in group A and indicates significant improvement (intragroup).
[b]Compares visits 1 and 2 in group B and indicates significant improvement (intragroup).
[c]Compares groups A and B at visit 2 and indicates significant improvement (intergroup).

**TABLE 4** Asthma severity and control of both groups at follow-up (visit 2)

| Characteristic | Group A N = 37 N (%) | Group B N = 38 N (%) | Total (N = 75) | Significance |
|---|---|---|---|---|
| Severity of asthma (Visit 2) | | | | |
| Mild intermittent | 17 (45.9) | 11 (28.9) | 28 (37.3) | $x^2$=4.664, df = 3 |
| Mild persistent[a] | 18 (48.6) | 20 (52.6) | 38 (50.7) | $P$ = .198 |
| Moderate persistent[a] | 2 (5.4) | 5 (13.2) | 7 (9.3) | $x^{2a}$ = 1.646, df = 1, $P$ = .200 |
| Severe persistent[a] | 0 | 2 (5.3) | 2 (2.7) | * |
| Level of control (Visit 2) | | | | $x^2$=0.860, df = 2 $P$ = .650 |
| Uncontrolled[b] | 3 (8.1) | 5 (13.2) | 8 (10.7) | $x^{2b}$ = 0.349 |
| Partially controlled[b] | 12 (32.4) | 14 (36.8) | 26 (34.7) | df = 1 |
| Well controlled | 22 (59.5) | 19 (50.0) | 41 (54.7) | $P$ = .555 ** |

*Note:* *Four cells (50.0%) have expected count less than 5. **Two cells (33.3%) have expected count less than 5.
[a]Row data pooled and the $\chi^2$ test reapplied with continuity correction.
[b]Row data pooled and the $\chi^2$ test reapplied with continuity correction.

with long-standing disease. However, baseline knowledge in our study population was low (only 32.14% had adequate knowledge score of >9 or >60%).[15,16] This was in-spite of multiple visits, frequent contacts with physicians (physicians in asthma clinic inform about the child's illness regularly), and family history of asthma/allergy and atopy in one-third. This is similar to observations in other studies from India, Pakistan, and other countries, thus implying a need for interventions to improve parental knowledge.[12,16,17,26-28] Since most parents/caregivers were literate (92%), poor parental education cannot be blamed for lack of knowledge.

Only one-third (36.9%) parents recognized that a chronic cough may indicate asthma. Children with persistent cough should be considered for a diagnosis of cough-variant asthma and parental awareness enables early seeking of healthcare and preventing missed diagnosis.[4] On the other hand, high baseline awareness amongst both groups to maintain records sincerely reflects on the existing health practices encouraging good record keeping.

Questions about home administration of oral steroids during an acute attack and fewer side effects of inhalational therapy compared with oral therapy were incorrectly answered by more than 75% of parents; reflecting "steroid phobia" seen in most caregivers. This lack of awareness of early home management increases emergency department visits, hospital admissions, and overall burden of healthcare costs. The misconception about side effects of inhalation therapy has been a major detriment to parental confidence in use of inhalers.[14,28] Educational intervention showed a significant improvement in both the knowledge attributes.

Mean knowledge scores in the intervention group were significantly better than controls ($P$ < .05) at follow-up in our study. This is similar to many earlier studies and provides further evidence to the fact that education about asthma improves knowledge about asthma.[6,7,9,17,24] In our study, both groups showed improvement in parental knowledge items related to chronicity, genetic disposition, asthma trigger by dust, asthma masquerade as chronic cough, use of inhalers for acute attack, and efficacy of long-term inhalation. This could be attributed to pre-existing atopy or family history of allergy/asthma in many (more than one-third) and long-standing disease course, both of which presented multiple opportunities for treating physician to impart health education. Besides, long-term care enables the parents to perceive/acknowledge the improvement in their child's asthma symptoms due to inhaler therapy, thereby increasing confidence in inhalational therapy. Since the questionnaire was repeated, many of the control parents may have obtained information through doctors/media/or other materials in the interim period and scored better.

## 4.2 | Attitudes

Parents in intervention group showed a significant improvement in 8 out of 10 attributes in attitude questionnaire postintervention as compared with hardly any change in the control group. This was similar to studies showing association between educational intervention and improved attitudes/self-management skills.[6,8,16,24] In the Global Initiative for Asthma guidelines, it is proposed that an indicator of asthma control is being able to participate in as much sport as healthy children.[4] In our study, educational intervention failed to improve parental attitudes toward encouraging children to participate in routine daily activities (like sports and exercise). This could be due to caregiver's ingrained beliefs about limiting physical activities, perceiving them to be harmful in asthma control. With improved asthma control through proper medication adherence, parents may be encouraged to change their perception. Besides, adherence to inhaled corticosteroid has been consistently linked to parental/caregiver beliefs and perceptions about asthma and its medications, with studies proving that factual knowledge is inadequate to promote treatment adherence in absence of motivation and ability to use the acquired information.[29,30]

We did not observe significantly changed attitudes of caregivers regarding their role in ensuring compliance and adequate dosing of medications posteducational intervention; it could be attributed to the intervention being a single event; whereby repeated sessions would be needed for parents to show significant attitude changes. Also, achieving adherence in children is a complex process and can remain poor despite absence of socioeconomic deterrents and high concordance between parents and medical team in terms of illness/medication beliefs and adherence.[31]

### 4.3 | Severity and control of asthma

Though the interventional group showed significant improvement in the asthma severity from baseline; differences between groups were insignificant. Since the follow-up assessment was at 5 months, seasonal variations could have attributed to changes in severity. There was no significant change in asthma control, results that are similar to other studies that showed no significant differences in clinical outcomes after educational intervention.[20,21]

Patient symptom assessment for severity and control depend on parent's subjective assessment, and since parents often underestimate severity of asthma and overestimate control, there is a wide margin for error.[27,32] Thus, alternative measures such as clinician's assessment, emergency room visits, and hospital admissions need to be used as a marker to evaluate asthma severity. Providing pediatric asthma education has been shown to reduce the mean number of hospitalizations, emergency department visits, lesser oral corticosteroid courses, symptom domain of the questionnaire on pediatric asthma quality of life, and the activity domain of the questionnaire on caregivers' quality of life, thus implying better asthma control.[3,8,22,25]

### 4.4 | Strengths of this study

Not many studies have been conducted from India to study the effect of educational intervention on knowledge and attitudes of parents/caregivers of asthmatic children. In a resource-limited setting like ours, the improvement of asthma control and indirect reduction in healthcare costs by educational intervention may prove economical in the long run. We used small group teaching, multimedia, and an interactive environment to encourage participation, experience sharing, and opportunities for problem solving.

### 4.5 | Limitations of this study

Studies that compare educational interventions have shown multiple sessions and interactive settings to be more effective.[3] A single session as ours, may be insufficient to bring long-term improvement in parental knowledge and attitudes.[17] Also, the educational format and content was similar for all, while family's requirements may not be similar, thus highlighting the need to customize the content after reviewing the child's medical charts, medications, and family resources.[3] The asthma guidelines recommend asthma education interventions be repetitious, which requires reinforcement by all members of the healthcare team at various points of care.[7] An intervention period of 5 months could be insufficient to measure lasting benefits in patient behavior and follow-up after a year could, maybe more effective to study continuing effects of the education.

Our questionnaire had not undergone rigorous validation progress and may have left many parental concerns uncovered/untouched. Caregiver's history may be unreliable and subjected to recall bias, which is a limitation of our questionnaire. Only caregivers were involved in intervention in our study. Most children in our study belonged to the school age group (5 to 12 years) and could have been included in the educational exercise. Studies have shown better outcomes when children are involved in asthma education, whereas group education of caregivers alone was found to be ineffective.[18] Besides information, inhaler technique plays an important role in achieving good asthma control and reinforcing correct inhaler technique should be a part of asthma education as recommended in all asthma guidelines.

## 5 | CONCLUSIONS

Small group education on asthma in parents/caregivers improves their knowledge and attitudes, though it may not significantly improve asthma control in children. Promoting positive caregiver knowledge and attitude should be stepping stones to reinforce self-management skills and promote treatment adherence. Healthcare plans should invest in pediatric asthma education and identify key personnel and opportunities in routine care to impart the same. The use of healthcare services can be used as a measurable outcome of asthma education. Additional research is required to identify the most important and cost-effective components of interventions concerning native patient population and their needs.

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### CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

### AUTHOR CONTRIBUTIONS

CD and MST were involved in conceptualization of the manuscript, supervising collection of data, conducting literature search, and drafting the manuscript. DUJ collected patient data, helped in literature search, and revised the manuscript for scientific content.

All the authors were involved in clinical management of the patients. MST will act as the guarantor of the paper.

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## SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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