**The impact of a school-based, nurse-delivered asthma health education programme on quality of life, knowledge and attitudes of Saudi children with asthma**

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## ABSTRACT

### Background

More than two million people have asthma in Saudi Arabia: 13% aged 6-10 years. Asthma is one of the most common childhood illnesses. Little has been explored about children's ability to learn more about their own asthma in Saudi Arabia.

### Aims

The study was designed to assess the impact of a school-based, nurse-delivered asthma health education programme on asthmatic children's knowledge and attitude towards asthma, quality of life, anxiety level, and school absenteeism.

### Methods

A quasi-experimental, non-equivalent groups, pre-test post-test design was used. The education programme was developed from existing evidence. The Paediatric Asthma Quality of Life Questionnaire, Spence Anxiety Tool, Asthma Knowledge Questionnaire, and Asthma Attitude Questionnaire were employed for data collection. Intervention (n=130) and control (n=98) groups were drawn from 10 schools in Ha'il region, Saudi Arabia. Descriptive and inferential statistics were used to examine differences within and between groups.

### Results

Knowledge of asthma increased significantly more in the intervention group than in the control group. Attitude toward asthma was not changed by the intervention. Anxiety scores reverted to pre-test level by post-test II. The intervention group had significantly better total quality of life scores

than the control group, and school absenteeism reduced significantly after delivery of the programme.

**Conclusion**

The asthma education programme impacted positively on students' knowledge, quality of life, and school attendance. However, asthma education did not change attitudes towards the condition, and the impact on anxiety was not persistent. The results emphasise the benefits of provision of health education directly to children. Asthma education should be integrated into the Saudi national child health programme.

**Key words:** Asthma, Children, Education programme, Self-agency

## BACKGROUND

Asthma is a common chronic inflammatory disease of the airways portrayed by variable and recurring symptoms, reversible airflow obstruction, and bronchospasm. Symptoms include shortness of breath, chest tightness, wheezing, and coughing (Issa-El-Khoury et al 2015).
The prevalence of asthma varies across countries. For example, one in eleven children in the United Kingdom (UK) complain of asthma symptoms,11.6% of American children suffer from asthma, and 12% of Australian children report asthma as a current long-term condition (Asthma UK 2014, Australian Bureau of Statistics 2015, Centres for Disease Control and Prevention 2019).

Health education is an integral part of the management of asthma in children (Alotaibi 2015). Asthma education programmes for children, based on behaviour modification, have shown an improvement in health outcomes such as a reduction in asthma symptoms, a reduction in the frequency of attacks, reduced absenteeism, less health care use, and an increased ability to perform activities of daily living (Alharbi et al 2018). A Brazilian study has shown that the extent of benefit derived from asthma education programmes for individual children depends partly on the characteristics and severity of the disease (Cruz et al 2007).

The discovery of oil in the Kingdom of Saudi Arabia (KSA) in the late 1930s launched the country on a path of rapid social and economic development causing a marked positive impact on health (Central Department of Statistics and Information 2012). However, within the KSA, more than 2 million people complain of asthmatic symptoms or are diagnosed as having asthma, and 13% of Saudi children between 6 and 10 years complain of asthma. This makes asthma one of the most common chronic illnesses in the KSA (Alreshidi 2017, Alamoudi 2006, Ministry of Health (MoH) 2010).

The Saudi government has included asthma as a major concern in its strategic health plan and has encouraged researchers to work in this area (MoH 2010). To date, the focus has been on establishing the prevalence of asthma among Saudi children. Both internal and external

environmental elements have been identified as risk factors. Being a Saudi national was found to be one of main risk factors associated with asthmatic symptoms (Al Ghobain et al 2018). Saudi children have specific genes associated with asthma (5 single-nucleotide polymorphisms in the interleukin 17). Living in urban areas and in cities at sea level was another significant risk factor (Al-Ghamdi et al 2008, Al Ghobain et al 2018). Having a parent who smokes has been demonstrated to be a risk factor for respiratory symptoms in general and asthma in particular in KSA (Al-Dawood 2002) and in Spain (Gonzalez-Barcala 2013).

Infections, air pollutants, inhaled allergens, weather changes, chemicals, living in disadvantaged areas, occupational hazards, drugs, smoking, levels of exercise, educational status, economic status, emotional stress and certain foods have all been implicated in KSA (MoH, 2000, Al-Ghamdi et al 2008) and the US (Hamilton 2005). Thai researchers established that indoor factors (in the home, school, and work place) are most commonly reported, as most asthmatic children tend to spend more time indoors (Kanchongkittiphon et al 2014). For Portuguese children, additional factors that aggravate asthma included under-diagnosis, lack of education, and poor health facilities and choice of treatment, along with poor adherence to therapeutic regimes (Nunes et al 2017). Other risk factors are also associated with a high prevalence of asthma among Saudi children such as parental illiteracy, the use of coal and wood for heating, living in a mud house or tent, lack of electricity, and the presence of sheep in living areas (Al-Ghamdi et al 2008, Alshehri et al 2000). Many risk factors could be avoided by providing families and their children with sufficient knowledge about how to avoid the triggers that cause asthmatic symptoms (Al-Ghamdi et al 2008, Al Ghobain et al 2018).

To improve care, international guidelines have been developed (Global Initiative for Asthma (GINA) 2020, British Thoracic Society 2019, National Asthma Council Australia 2019, Canadian Thoracic Society 2012) as well as national guidelines from the Saudi Initiative for Asthma (Al-Moamari et al 2019). These guidelines, based on robust evidence, have helped to improve diagnosis and treatment of asthma. However, other studies indicate that asthma management falls well short of that recommended by the guidelines (American Lung Association, 2020).

## STUDY DESIGN

### Aim

The aim of this study was to establish the impact of a school-based asthma health education programme on outcomes for asthmatic children in KSA as indicated by changes in quality of life, school absences, anxiety, knowledge of asthma, and attitude to asthma.

### Objectives

• To recruit a sample of at least 150 boys and 150 girls with asthma from schools in the Ha'il region of Saudi Arabia and intervention and control schools.

• To establish pre-test measurements of children's knowledge, attitude, quality of life, anxiety, and school absences, and to repeat these at two post-test points.

• To implement a stable programme of health education in a child-friendly and age-appropriate manner.

• To explore the relationship between socio-demographic data and the outcomes data.

### Overview

A non-equivalent pre-test post-test quasi experimental design was employed. Random allocation of children within the same school would have risked contamination between the groups as experiences would, inevitably, be discussed. Instead, randomisation was applied at school level: all participants within a school would be allocated together to the experimental or the control group. The first visit to the school included the pre-test and started the intervention. The educational programme was applied in each school on three days, each session lasting 2 hours. A second data collection visit enabled the first post-test at one month, and a third provided for the second post-test at three months. Two research assistants were recruited and trained, one male and one female since education in KSA is strictly segregated between male and female staff and students.

**Ethics approval**

A risk-analysis approach was taken to identify the potential risks to participants and to set out planned measures to avoid, minimise, or treat any possible risk that ensued (Long 2007). To counter the risk of perceived coercion, printed information sheets, one for children and one for parents were offered in Arabic, the common language of Saudi Arabia. The voluntary nature of participation, the right to withdraw at any time, and what participation would entail were all detailed. For parents who were illiterate (n=10), the researchers provided verbal explanation of the study. Signed consent was secured from parents, and children were also asked to signal their consent by signing or making a mark on the consent form. Concern about potential breach of confidentiality was addressed by the use of research numbers to preserve identity, secure storage of all personal and study data, and careful anonymisation in reports and publications. Formal research ethics approval was secured (ref HSCR13/85).

**Sample and recruitment**

Children of 7-12 years (inclusive) who were resident and attending primary school in Ha'il City and who had asthma met the inclusion criteria. Of these, any who were unable to speak Arabic or who were currently attending or had previously attended an asthma education programme were excluded. It has been estimated that there are 10,000 children aged 7-12 years in the Ha'il region of Saudi Arabia and that 2200 (22%) of these have asthma (Al-Frayh & Hasnain 2007, Ministry of Education (MoE) 2014). Based on Juniper et al (1996), the smallest clinically significant difference in the total score for one of the study instruments is 0.42 points, with an SD of 0.71 points. To reach 80% power and significant level of p=0.05, the minimum sample size to ensure statistically significant results would be 45 in each group. However, since there were more boys than girls in Ha'il region in the age group of interest and gender issues might be relevant factors, the sample size was increased in potential mitigation. In total, 228 participants(122 boys and 106 girls) were recruited, of which 130 were allocated to the experimental group (75 male and 55 female) while the remaining 98 (51 male and 47 female) were allocated to the control group. To achieve this, five schools were required in each group. The researcher met the school principal and the social worker (employed to provide psychosocial counselling for pupils). Identification of potential

participants began with assessment of the school-held medical records by school staff. Eligibility criteria were applied to these, and then the school sent out letters to parents inviting participation. The attrition rate was less than 2% (intervention group, n=3, control group n=1).

**Intervention: The Asthma Education Programme**

The aim of the asthma education programme was to increase the ability of children with asthma to self-assess and self-manage their asthmatic symptoms appropriately and independently. A programme was designed consisting of 2-hour daily sessions over three consecutive days. The five schools in the intervention group received the programme during a period of six weeks. The sessions were based on evidence-based recommendations from the British Thoracic Society in 2012 (now replaced by a 2019 version) and the Saudi Initiative for Asthma (SINA 2012), but it also took account of Social Cognitive Theory (Bandura 2001) and three domains of learning (Gilbert et al 2011). Cognitive, affective, and psychomotor learning objectives were developed to determine specific outcomes. These are detailed in Figure 1. The sessions were designed to maximise the children's learning not only in relation to knowledge but also in relation to observations of their symptoms and responses to medication, personal judgments and reacting to change.

The first day addressed objectives A and B (Figure 1). Following a team-building game, a demonstration of the physical characteristics of asthma was given using models and pictures taken from SINA (2012) materials. There was explanation about inhaler therapy and different inhalers, with the opportunity to use a practice inhaler. Objectives C and D attached to the second day. This included an explanation of the impact of asthma on daily living activities. Asthma triggers were considered, using a model kit and accompanying worksheet, also advised by SINA and the British Thoracic Society. The remaining three objectives were the focus of the third day: how to recognise and prevent asthma complications, how to anticipate serious exacerbation of asthma, and ways of managing asthma attacks. Case scenarios and role play were used, including the importance of adherence to therapy and how this increases independence. The health education programme was also delivered to the control group on completion of the final measures so that these children could benefit, too. **[Insert Figure 1 here]**

**Outcome Measures**

***Paediatric Asthma Quality of Life Questionnaire (PAQLQ)***

This instrument was designed by Juniper et al (2006) specifically for children between 7 and 17 years of age, and can be completed by children themselves. The reliability of this instrument has been tested in several countries: Sweden (Reichenberg & Broberg 2000), Spain (Tauler et al 2001), the Netherlands (Raat et al 2005), Thailand (Poachanukoon et al 2005), and Singapore (Clarke et al 1999). It was available in Arabic. There are 23 items measuring symptoms (10 items), emotional function (8 items), and activity limitation (5 items). Children are asked to answer on a 7-point scale (7=not bothered at all, 1=extremely bothered) referring to the previous week.

***Spence Children's Anxiety Scale (SCAS)***

The SCAS (Spence 1998) was available in Arabic and had been shown to be culturally acceptable. The 44-item,4-point Likert scale (0=never, 3=always),scale has six sub-scales of separation anxiety (6 items), social phobia (6 items), obsessive compulsive problems (6 items), panic (6 items), and generalized anxiety/over-anxious symptoms (6 items), agoraphobia (3 items), and fear of physical injury (5 items), with a further six items designed to neutralise negative response bias.

***Asthma Knowledge Questionnaire (AKQ)***

A derivative of the Newcastle Asthma Knowledge Questionnaire, this instrument measures the level of knowledge about asthma in 8-10 years old primary school children (Al-Motlaq & Sellick 2011). Twenty-three true/false items and one open-ended question make up the questionnaire. An Arabic version was not available.

***Asthma Attitudes Questionnaire (AAQ)***

Gibson et al's (1995) instrument is based on 15 questions in a 6-point Likert scale (1=Strongly Agree to 6=Strongly disagree) and scores attitude towards asthma in the domains of tolerance towards asthmatics (8 items), locus of control (2 items), powerful others (3 items), and chance domain (2 items). The latter relates to the notion of chance alone predicts asthma and its impact. Translation into Arabic was needed.

### *School attendance*

Attendance records were monitored for three months, with anonymised data provided to the researcher by school staff.

### *Translating instruments*

Two instruments were translated into Arabic and tested using the World Health Organization rigorous process of translation and adaptation of instruments (WHO 2020).This included a committee of the translators, a paediatrician with expertise in asthma, a bilingual teacher and the researcher. An example of the committee's function related to the Arabic translation of "asthma" ("al rabo"); a term that is not understood universally in KSA. Accordingly, both terms were used together in all documents and instruments (the Arabic word in brackets). Content validity analysis showed high representativeness(R-CVI 99%) and clarity (C-CVI98%).

### **Data analysis**

Since the instruments produced continuous data which met the assumptions of parametric statistics, especially normality, parametric statistics were applied. Normality was assessed in each individual variable based on the value of skewness which was appeared as follows: knowledge 0.176; attitude 0.345; anxiety 0.202; quality of life 0. 198. Comparisons of groups means over serial measurements was undertaken by one-way ANOVA tests. Paired samples t-test was adopted to assess demographic characteristics against other variables in the intervention group. IBM SPSS version 20 was used, and significance level was set at 0.05. Since non-equivalence was found at pre-test in the fields of knowledge, anxiety, and quality of life, the comparisons between intervention and control groups were recalculated using analysis of covariance (ANCOVA), considering the pre-test score as a covariate to eliminate this source of potential systematic bias.

## RESULTS

### Research Questions

1. Is there a significant difference in the pre-test measurements of asthma-related in knowledge, attitude, quality of life, anxiety, and school attendance between children in the control and intervention groups?
2. Is there a significant difference in the post-test I measurements of asthma-related in knowledge, attitude, quality of life, anxiety, and school attendance between children in the control and intervention groups?
3. Is there a significant difference in the post-test II measurements of asthma-related in knowledge, attitude, quality of life, anxiety, and school attendance between children in the control and intervention groups?
4. Is there a significant difference between the measurements of the three phases (pre-test, post-test I, post-test II) in both groups in relation to the study variables?
5. Is there a significant difference between demographic categories (gender, age, income levels) in relation to the study variables (knowledge, attitude, quality of life, anxiety, and school attendance) before and after implementing the education programme?

### Participant Demographics

Table 1 shows the distribution of the study participants in regard to their demographic details: gender, age, and income level. There was no significant difference in income levels (Chi-square: 8.189, df 3, p=0.085).

The control group had a slight female bias (males 48%), while the intervention group had a more noticeable male bias (males 58%). However, the Chi-square test for independence (with Yates' continuity correction for 2x2 table), indicated that this difference in gender balance was not significant (Chi-square: 2.128, df 1, p=0.145). In Saudi Arabia there is strict segregation between boys and girls even in primary school, so there was no interaction effect to be taken into account.

Most participants were over 9 years old. However, there was a significant difference between groups, with more students in the intervention group being older than those in the control group (Chi-square: 6.463, df 2 p=0.04). This heterogeneity might have threatened the validity of results as age could impact on ability to acquire knowledge and to modify lifestyle. The difference in age would be expected to matter only in that the children in the intervention group which had an older bias by approximately one year might be expected to have more knowledge and understanding of asthma, and might have more opportunity to modify lifestyle. The literature suggests that lifestyle modification to enhance health and quality of life is unusual in asthmatics in Saudi Arabia. The additional testing for the effect of enhanced pre-test knowledge on post-test scores was undertaken and the result was confirmed.

**[Table 1 here]**

**Pre-test measurements of asthma-related knowledge, attitude, quality of life, anxiety, and school attendance (Research Question 1)**

Table 2 shows that there were some significant differences between the intervention and control groups at the pre-test phase. Students in the intervention group scored higher in knowledge about asthma and had higher quality of life compared to students in the control group. They also reported less anxiety than students in the control group. However, they did not differ in attitude toward asthma. This non-equivalence could introduce systematic bias, so additional testing was conducted to counter this with correction for the differences identified at pre-test.

**[Table 2 here]**

**Post-test measurements of asthma-related knowledge, attitude, quality of life, anxiety, and school attendance (Research Questions 2, 3, 4)**

***Asthma-related knowledge***

The level of participants' asthma-related knowledge did not differ significantly in the control group over the three phases, whereas it increased significantly in the experimental group (*F* 26.5746, df 2, p<0.001) (Table 3). A Tukey HSD post hoc test showed that there was a statistically significant difference between pre-test and post-test I, and between pre-test and post-test II (mean

differences, 2.54 and 1.81, p<0.001 and <0.001, respectively). Although there was a decline in knowledge at post-test II from post-test I, this was not statistically significant (p=0.107). Retesting with ANCOVA to correct for pre-test error showed persistence of the statistically significant difference between groups. The intervention had a significant impact on knowledge, leading to sustained, increased awareness and knowledge of asthma.

**[Insert Table 3 here]**

***Attitude towards asthma***

Neither the intervention group nor the control group showed any significant change in attitude toward asthma over the three phases of assessment (p>0.05). See Table 4.

**[Insert Table 4 here]**

***Anxiety***

Although anxiety reduced at first in the intervention group, this reduction was not statistically significant, and the improvement was not maintained at post-test II. There was no statistically significant difference in the total Spence's anxiety score between pre-test and either post-tests in both groups. There were mixed results from the sub-domains scores. The intervention was associated with statistically significant changes in the Panic, Physical, Separation, and Social sub-domains, while no significant changes occurred in the Generalized and Obsessive Compulsive sub-domains (Table 5). The same check for systematic error with ANCOVA was conducted, and the outcome was unchanged. The control group showed no statistically significant changes in any sub-domains. Further research is needed to investigate these elements of anxiety. It seems likely that more prolonged and intensive intervention might be required to produce a significant and lasting result.

**[Insert Table 5 here]**

***Quality of Life***

As shown in Table 6, there was a statistically significant increase in quality of life for the intervention group after receiving the educational programme (p<0.001), with no corresponding

change in the control group (p=0.30). Total quality of life scores demonstrated statistically significant differences between pre-test and both post-test I & post-test II (means 29.88 & 31.40, both at p<0.001). The difference between post-test I and post-test II was not statistically significant (p=0.839), but the improvement was sustained following the intervention. The control group showed no changes in any sub-domain scores. There were significant differences between pre-test and post-test I in all quality of life sub-domains in the intervention group. Scores increased from pre-test to post-test I in sub-domains of Symptoms, Activity limitation, and Emotional affection. No significant changes occurred in these sub-domains between post-test I and post-test II, indicating stability in raised quality of life after delivering the programme. The results remained unchanged when retested with ANCOVA accounting for pre-test differences.

**[Insert Table 6 here]**

**Differences between demographic categories in relation to study variables**

This section represents the results gained from comparisons between the each demographic category of gender, age, and income in regard to the study variables of knowledge, attitude, anxiety, quality of life and school attendance.

***Gender***

Male and female participants had roughly equal knowledge levels at pre-test. At post-test I and post-test II, both male and female participants showed an improvement in knowledge. However, female participants scored statistically significantly higher than male participants at both points. In addition, female participants sustained the increase in knowledge to post-test II in contrast to male participants whose knowledge fell back to near the pre-test measure at post-test II. Female students scored significantly higher on attitude compared to male participants (t=2.359, p=0.0198), but there was no significant difference in the subsequent phases. Students' anxiety level was similar for males and females at pre-test. There was a statistically significant difference between male and female in regard to anxiety in both post-test I and post-test II, with females showing reduced anxiety and males an increase in anxiety. There were no statistically significant gender

differences in relation to quality of life measurement, though both genders showed improvement (Table 7).

**[Insert Table 7 here]**

***Age group***

There was no statistically significant difference due to age in knowledge of asthma in pre-test or post-test phases, though all intervention group participants exhibited a marked increase in knowledge at post-test I, with scores declining slightly at post-test II. Inconsistent and unstable associations were noted between age groups and attitude toward asthma. While there was a statistically significant difference in anxiety at pre-test between age groups, no statistically significant differences were found at either post-test. It was clear that older children (11-12 years old) had notably higher quality of life scores compared to younger children. There was a statistically significant difference between age groups at pre-test. Quality of life was improved in all categories after delivering the educational programme though not statistically significant.

***Income level***

Income level had little or no impact on scores for any domain.

***Absenteeism***

Paired samples t-test showed that male participants in the control group had no significant change in means for absenteeism before and after the programme. On the contrary, male participants in the intervention group had significantly reduced rate of absenteeism from 3.6 to 2.8 ($t=2.98$, $p=0.003$). There was no significant difference between females assigned to the control group before and after the programme. However, female participants assigned to the intervention groups showed a significant reduction in absenteeism after the programme (mean difference: 4.2 to 2.7 days, $t=2.82$, $p=0.007$). These results confirm that the educational programme had a significant impact on school attendance in both male and female children (Table 8).

**[Insert Table 8 here]**

## LIMITATIONS

The necessity of sampling by schools rather than allocating by individuals and being unable to extend the follow-up beyond three months were limitations. Non-equivalence between groups at baseline in several characteristics could have introduced systematic bias, but additional testing with correction for this difference demonstrated that the results remained valid. We assume that the difference in age between the groups was restricted in effect to the variable “asthma-related knowledge”, and that this was accounted for in the additional regression testing.

## CONCLUSION

Knowledge of asthma was increased significantly and sustained through post-testing by the asthma education programme. The programme also promoted a significant reduction in most domains of anxiety, though not all. Quality of life was improved significantly by the intervention, and school absenteeism was significantly reduced, too. However, the asthma education programme proved to be ineffective in manipulating children’s attitudes towards asthma. Female students sustained knowledge increase more than males, and their anxiety reduced while male students experienced greater anxiety in some fields. Older children tended to experience better quality of life, but all experienced an improvement. For the most part, children in the control group showed no improvement in any of the variables. The intervention was successful in three areas, partly successful in a fourth, but ineffective in the remaining area (attitude).

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**Table 1: Participant demographic detail**

| | Control Number (%) | Intervention Number (%) | Total Number (%) | Chi Square | Significance |
|---|---|---|---|---|---|
| Gender | | | | | |
| Male | 47 (48%) | 75 (57.7%) | 122 (53.5%) | | |
| Female | 51 (52%) | 55 (42.3%) | 106 (46.5%) | 2.1279 | 0.145 |
| Total | 98 (100%) | 130 (100%) | 228 (100%) | | |
| Age (years) | | | | | |
| 7-8 | 35 (35.7%) | 28 (21.5%) | 63 (26.6%) | | |
| 9-10 | 35 (35.7%) | 49 (37.7%) | 84 (36.8%) | 6.4632 | 0.040 |
| 11-12 | 28 (28.6%) | 53 (40.8%) | 81 (36.6%) | | |
| Total | 98 (100%) | 130 (100%) | 228 (100%) | | |
| Income in SR (Saudi Rial) | | | | | |
| <3000 | 20 (20.4%) | 13 (1.0%) | 33 (14.5%) | | |
| 3000-4999 | 18 (18.4%) | 23 (17.7%) | 41 (18.0%) | | |
| 5000-6999 | 16 (16.3%) | 32 (24.6%) | 48 (21.1%) | 8.1886 | 0.0849 |
| 7000-8999 | 20 (20.4%) | 37 (28.4%) | 57 (25.0%) | | |
| ≥9000 | 24 (24.5%) | 25 (28.3%) | 49 (21.4%) | | |
| Total | 98 (100%) | 130 (100%) | 228 (100%) | | |

**Table 2: Comparison between groups at pre-test**

| | Intervention group | | | | Control group | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Variable** | **Obs** | **Mean** | **SD** | **Cronbach's Alpha** | **Obs** | **mean** | **SD** | **Cronbach's Alpha** | **p value** |
| **Knowledge** | 130 | 13.6 | 2.5 | 0.74 | 98 | 11.5 | 2.9 | 0.50 | <0.001 |
| **Attitude** | 130 | 47.5 | 13 | 0.72 | 98 | 49.5 | 12 | 0.77 | 0.22 |
| **Anxiety** | 130 | 42.4 | 18.5 | 0.92 | 98 | 50.0 | 13.3 | 0.79 | <0.001 |
| **Quality of life** | 130 | 90.4 | 32.1 | 0.96 | 98 | 75.9 | 19.8 | 0.89 | <0.001 |

**Table 3: Change in Knowledge**

| | Intervention Group | | | | | | ANCOVA | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Obs | Mean | SD | ANOVA F | Df | p | Adjusted R Squared | df | Mean Square | F | Sig. |
| Pre-Test | 130 | 13.5615 | 2.5089 | | | | | | | | |
| Post-Test I | 127 | 16.1024 | 3.0468 | 26.5746 | 2 | <0.001 | 0.452 | 1 | 405.77 | 58.57 | <0.001 |
| Post-Test II | 127 | 15.3701 | 3.0571 | | | | | | | | |
| **Control Group** | | | | | | | | | | | |
| Pre-Test | 98 | 11.5306 | 2.8546 | | | | | | | | |
| Post-Test I | 97 | 11.5773 | 2.8425 | 0.3936 | 2 | 0.6750 | | | | | |
| Post-Test II | 97 | 11.2474 | 2.7120 | | | | | | | | |

**Table 4: Change in Attitude**

| | Intervention Group | | | | | |
|---|---|---|---|---|---|---|
| | Obs | Mean | SD | ANOVA F | Df | p |
| Pre-Test | 130 | 47.4692 | 12.9550 | 0.0490 | 2 | 0.9522 |
| Post-Test I | 127 | 47.7165 | 7.9780 | | | |
| Post-Test II | 127 | 47.8504 | 7.8650 | | | |
| | **Control Group** | | | | | |
| | Obs | Mean | SD | ANOVA F | Df | p |
| Pre-Test | 98 | 49.5204 | 11.9036 | 2.0789 | 2 | 0.1269 |
| Post-Test I | 97 | 46.3402 | 11.1532 | | | |
| Post-Test II | 97 | 47.2990 | 10.4205 | | | |

**Table 5: Change in Anxiety Score Domains (Intervention Group only)**

| | Pre-test | | | Post-test I | | | Post-test II | | | ANOVA | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Obs | Mean | SD | Obs | Mean | SD | Obs | Mean | SD | F | Df | p |
| Generalized | 130 | 6.5615 | 3.8640 | 127 | 6.3622 | 3.3230 | 127 | 6.8268 | 3.0553 | 0.5850 | 2 | 0.5576 |
| Obsessive Compulsive | 130 | 7.2462 | 3.9258 | 127 | 6.6142 | 3.4366 | 127 | 7.2913 | 3.4159 | 1.4065 | 2 | 0.2463 |
| Panic | 130 | 9.2231 | 5.0074 | 127 | 8.3386 | 4.6738 | 127 | 10.0157 | 4.7191 | 3.8737 | 2 | 0.0216 |
| Physical | 130 | 5.9154 | 3.1501 | 127 | 5.0000 | 2.8922 | 127 | 5.6535 | 2.4507 | 3.5079 | 2 | 0.0309 |
| Separation | 130 | 7.2692 | 4.0073 | 127 | 5.9055 | 3.3910 | 127 | 7.0630 | 3.2629 | 5.4095 | 2 | 0.0048 |
| Social | 130 | 6.2000 | 3.8265 | 127 | 5.5433 | 3.1767 | 127 | 6.6063 | 3.2223 | 3.1163 | 2 | 0.0455 |
| Cumulative Anxiety | 130 | 42.4154 | 18.4529 | 127 | 37.7638 | 17.6336 | 127 | 43.4567 | 16.7530 | 3.7599 | 2 | 0.0242 |

**Table 6: Change in Quality of Life Score**

| | Intervention Group | | | | | | ANCOVA | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Obs | Mean | SD | ANOVA F | Df | p | Adjusted R Squared | df | Mean Square | F | Sig. |
| Pre-Test | 130 | 90.3923 | 32.06 | 87.6534 | 2 | <0.001 | 0.778 | 1 | 366.39 | 35.38 | <0.001 |
| Post-Test I | 127 | 120.2756 | 12.53 | | | | | | | | |
| Post-Test II | 127 | 121.7953 | 13.64 | | | | | | | | |
| | **Control Group** | | | | | | | | | | |
| Pre-Test | 98 | 75.8980 | 19.79 | 1.1979 | 2 | 0.3033 | | | | | |
| Post-Test I | 97 | 72.9381 | 19.29 | | | | | | | | |
| Post-Test II | 97 | 71.5567 | 20.94 | | | | | | | | |

**Table 7: Comparisons between gender and study variables (intervention group)**

| | | Male | | | Female | | ANOVA | |
|---|---|---|---|---|---|---|---|---|
| Variable | Obs | Mean | SD | Obs | Mean | SD | T | p |
| Knowledge | | | | | | | | |
| Pre-Test | 75 | 13.24 | 2.46 | 55 | 14.0 | 2.53 | 1.719 | 0.088 |
| Post-Test I | 73 | 14.4 | 2.13 | 54 | 18.4 | 2.54 | 9.646 | <0.001 |
| Post-Test II | 72 | 13.4 | 1.73 | 55 | 18.0 | 2.33 | 12.867 | <0.001 |
| Attitude | | | | | | | | |
| Pre-Test | 75 | 45.2 | 13.9 | 55 | 50.5 | 10.9 | 2.359 | 0.019 |
| Post-Test I | 73 | 47.4 | 6.7 | 54 | 48.2 | 9.5 | 0.545 | 0.587 |
| Post-Test II | 72 | 46.6 | 3.67 | 55 | 49.5 | 11.1 | 2.034 | 0.044 |
| Anxiety | | | | | | | | |
| Pre-Test | 75 | 40.71 | 18.5 | 55 | 44.75 | 18.3 | 1.235 | 0.219 |
| Post-Test I | 73 | 44.7 | 15.7 | 54 | 28.4 | 15.7 | 5.806 | <0.001 |
| Post-Test II | 72 | 53.3 | 5.7 | 55 | 30.6 | 17.7 | 10.210 | <0.001 |
| Quality of life | | | | | | | | |
| Pre-Test | 75 | 93.5 | 34.4 | 55 | 86.1 | 28.4 | 1.308 | 0.193 |
| Post-Test I | 73 | 120.4 | 10.3 | 54 | 120.1 | 15.2 | 0.126 | 0.899 |
| Post-Test II | 72 | 123.3 | 13.7 | 55 | 119.9 | 13.4 | 1.406 | 0.162 |

**Table 8: Changes in absenteeism rate between males and females**

| | Control group | | | | Intervention group | | | |
|---|---|---|---|---|---|---|---|---|
| | Pre-Test Mean (SD) | Post-Test II Mean (SD) | T | p | Pre-Test Mean (SD) | Post-Test II Mean (SD) | T | p |
| Male | 3.9 (1.6) | 4.2 (1.1) | 1.031 | 0.306 | 3.6 (1.8) | 2.8 (1.5) | 2.98<br>CI: 0.94-1.473 | 0.003 |
| Female | 4.6 (1.8) | 4.6 (1.7) | 0.130 | 0.897 | 4.2 (2.2) | 2.7 (1.8) | 2.82<br>CI: 0.414-2.512 | 0.007 |

| **Objective** | | **Domain(s)** | **Day of Programme** |
|---|---|---|---|
| A | To improve children's knowledge of the causes, symptoms and medications used to manage asthma | Cognitive | 1 |
| B | To improve children's effective use of prescribed medications using appropriate devices effectively | Psychomotor<br>Cognitive | |
| C | To help children to identify their common asthma triggers and possible strategies to avoid these | Cognitive<br>Psychomotor | 2 |
| D | To help children to control environmental factors that aggravate their asthmatic symptoms | Cognitive<br>Affective | |
| E | To help children to detect early warning signs as well as related symptoms of asthma, such as shortness of breath and paroxysmal nocturnal dyspnoea | Cognitive<br>Affective | 3 |
| F | To enhance adherence to the therapeutic regime and increase knowledge related to the importance of medical therapy | Affective<br>Cognitive | |
| G | To increase self-confidence in affected children and decrease social alienation | Affective | |

**Figure 1: Objectives, domains and timing in Asthma Education Programme**