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Evaluating the Effectiveness of Caregiver-led Asthma Management Programs among Preschool Children with Uncontrolled Asthma in Makkah: A Quasi-Experimental Study

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Abstract

Uncontrolled asthma remains a common problem among preschool children aged 3-5 years in Makkah, often resulting in repeated emergency visits and hospital admissions. This quasi-experimental pretest-posttest study, which includes intervention and control groups (120 caregivers in total, 60 in each group), aims to assess whether a caregiver-led asthma management program can improve symptom control among these children in Makkah, Saudi Arabia. Participants will be identified through the use of the Raqeem database of the Makkah Health Cluster's Primary Health Care Department and recruited using total population sampling from the Hadda center for the intervention group and the Alnawarryah center for the control group. Caregivers will complete a structured Knowledge and Practice Questionnaire, while children's asthma control will be measured at baseline; after the intervention using age-appropriate tools: the Childhood Asthma Control Test for children aged 4-5 years and the Test for Respiratory and Asthma Control in Kids for those aged 3-4 years. The intervention will consist of interactive sessions on asthma basics, trigger avoidance, correct medication use, symptom monitoring, and home management. The collected data will be analyzed using descriptive and inferential statistics, and is expected that better caregiver knowledge and practices will lead to improved child outcomes, lower symptom burden, and reduced healthcare use. This study is expected to provide useful evidence for family-centered asthma programs in primary care settings.

Keywords: Asthma, Caregiver Education, Makkah, Preschool Children, Primary Healthcare, Quasi-Experimental Study

Introduction

Asthma is a lifelong, non-infectious disease that impacts the respiratory system. It is characterized by airway inflammation and increased airway sensitivity. It is the most common chronic disease in children and young adults around the world. Asthma poses a major public health issue globally and is among the leading 20 conditions associated with morbidity and mortality worldwide (approximately 180,000 deaths per year) (Alansari & Mirza, 2020). Medical care alone cannot address the effects of asthma because of the substantial economic burden of healthcare costs, as well as social consequences stemming from job losses, children not attending school, and the psychological/physical stress on caregivers (Díaz, 2020; Tosca & Voigt, 2024).

There are still many asthma patients with poorly controlled asthma and recurrent exacerbations despite recent advances in the field of medicine (Pham et al., 2023). This demonstrates the inadequacy of medication in achieving asthma control and highlights the need for effective self-management strategies and caregiver involvement. In India, a randomized controlled trial on asthma education showed that discovery-based asthma education improved parental awareness and beliefs about asthma but did not produce significant changes in asthma control or severity (Divecha et al., 2020). Additionally, Sharma et al. (2021) conducted a quasi-experimental design pre-test/post-test study with parents/caregivers in Western India. Results showed that education materials for parents/caregivers improved knowledge and management practices; however, the clinical outcomes associated with caregiver education were still inconsistent across study participants.

Saudi Arabia also has a high prevalence of childhood asthma that is often poorly managed. In a study of children aged 4-11 years, Alhammad et al. (2020) found that 61.6% had poorly controlled asthma, as assessed by the C-ACT. One quarter of the caregivers surveyed reported receiving an asthma action plan, indicating a significant lack of education among caregivers (Wu et al., 2020). Children are at high risk for suffering from asthma due to many reasons; symptoms are often not specific; the diagnosis is sometimes ambiguous; caregivers are an important resource, and so much research on asthma excludes children, which makes management of children challenging. The research indicates that children under five years old have a particularly high degree of vulnerability in managing their asthma. It also demonstrates non-adherence to controller medications and an increased risk for exacerbations and hospitalizations for children ages four to six (Liu et al., 2024). The research illustrates that parental education can increase a caregiver's knowledge and attitudes about caring for a child with asthma; however, there is no correlation between improved scores on objective measures of asthma control, ICS adherence, or use of healthcare long-term for preschool children (Tang et al., 2024; Thach et al., 2024). This lack of correlation continues to create challenges for caregivers, such as ongoing debate over the optimal asthma medication regimen, particularly between combination controller-reliever medications and ICS monotherapy (Cicco et al., 2025). In Makkah, the number of asthma cases reported in 2022 is at its lowest level since reporting began in 2001. An estimated 9364 asthma cases were documented, which could be due to an underreporting of the number of asthma cases, and a lower number of people accessing health care services.

By comparison, asthma diagnoses and reporting increased dramatically in 2023, with 17887 cases documented. This could also be attributed to persons with asthma having greater access to medical services, increased awareness of asthma symptoms by family members or caregivers, improved diagnostic abilities, and/or increased exposure to environmental or lifestyle factors that result in an increased incidence of asthma. There are also unique characteristics of Makkah that may affect asthma outcomes for individuals living with asthma, such as high population density, overcrowding, caregivers using extended family members to provide daily assistance, and environmental factors. These unique characteristics underscore the need for asthma management programs tailored to the specific context.

Asthma detection and prevalence are on the rise in Makkah, as evidenced by the highest number of diagnosed asthma cases in 2024 at 2026. The reported increase in asthma may be due to a growing population, increased exposure to asthma triggers such as air

pollution, allergens, and/or irritants, or improvements in the identification of asthma IVTC cases through better healthcare services. This reported increase in asthma cases is much higher than the 2022 baseline; however, reports from 2025 indicate a drop in asthma cases to 15454. The decline in asthma cases may indicate that a trend has started due to the early-impact of improved asthma management resources (e.g., the Asthma and Allergy Foundation of America, or AAFA) as well as the existence of new public education campaigns regarding preventative health (e.g., SINA 2024), differences between the time periods selected for data collection, and missing data for the 2024 year, not to mention changes to DBA information through DHHS and other data sources.

The 2024 implementation of SINA's Asthma Guidelines aligns with much of this research, identifying the relationship between asthma, physician-patient relationships, shared decision-making, and individualized, well-structured self-management plans for the successful management of asthma in children. Parental-led asthma management through home-based asthma education aims to incorporate these same principles, specifically targeting children who do not yet manage their own asthma (i.e., those 4 years and younger), as they depend entirely on caregivers for daily asthma management.
The intervention enhances the continuity of care among healthcare providers and families by promoting the caregiver's knowledge related to the ongoing monitoring of asthma symptoms, the identification and avoidance of triggers, proper medication usage, and adherence to the prescribed treatment (Al-Harbi et al., 2024).

In addition, much of the research related to asthma in Saudi Arabia has focused on broader age ranges and/or longitudinal studies or reports about general caregiver knowledge about asthma rather than the evaluation of any specific parent-led interventions in a quasi-experimental (i.e., pretest-posttest) design specifically to parents/caregivers of preschool-aged children with asthma who live within the unique sociocultural and healthcare context of Makkah, Saudi Arabia. This lack of research evaluating the effectiveness of empowering parents/caregivers to assume primary responsibility for their child's asthma control and management practices and related health outcomes leaves unanswered the question of whether this will improve asthma control, management, and outcomes for preschool-aged children.

Accordingly, this quasi-experimental study will evaluate the effectiveness of a parent-led asthma management program for preschool-aged children with uncontrolled asthma in Makkah, Saudi Arabia, through the examination of changes in symptoms of asthma, caregiver knowledge of asthma management, and caregiver practices for asthma management, the number of healthcare visits related to asthma, and quality of life relative to asthma in preschool-aged children with uncontrolled asthma.

Review of Related Literature

Overview of Asthma in Pre-school age in Saudi Arabia

Asthma is still an important global health issue, and it has become an increasingly significant health issue for children in Saudi Arabia (see Taherian et al., 2023). Young children (particularly those aged less than five) are at high risk of developing respiratory illness because developmental factors directly affect the structure of the airways and the immune response (Zhou & Tang, 2025). So there are serious clinical, public health, and scientific implications related to the increasing incidence of asthma among children in Saudi Arabia.

Also, the number of patients with asthma seeking healthcare has increased. Asthma is one of the top reasons people visit their primary care providers in Saudi Arabia and the number one reason for avoidable hospitalization (Alharbi et al., 2022). In addition to the increase in patients accessing the hospital system for asthma during the height of the respiratory virus season, asthma also places a drain on the hospital system and strains hospital services (Alatawi & Alanazi, 2020). The costs incurred by hospitals due to asthma exacerbations and hospital admissions clearly demonstrate that the current strategies for managing asthma are ineffective or insufficient (Alatawi & Alanazi, 2020).

Caregiver-Initiated Asthma Education Program

Caring for and educating about childhood asthma has been the focus of many studies over time. The evidence demonstrates a strong association between caregivers' participation in asthma management and successful outcomes for children (Alotaibi et al., 2021; Smith & Brown, 2022). Many studies have established that educational programs delivered by parents improve youth asthma symptoms, reduce the frequency of emergency department visits, and increase adherence to therapy among young children. There are several structured, caregiver-directed asthma education programs in Saudi Arabia, implemented through the primary health care (PHC) and school systems and through governmental agencies such as the Saudi Initiative for Asthma (SINA). These programs teach caregivers how to effectively manage asthma, including avoiding triggers, using their medication appropriately, and developing action plans, but do so in such a manner as to assume that if the caregiver understands asthma, they will be able to manage asthma at home successfully.

The positive findings of a recent randomized trial by Khan et al. (2023) reinforce that when caregivers are given a structured caregiver training program, they are more confident in monitoring their children's asthma at home. Collectively, the above references highlight that promoting caregiver empowerment is an essential element for achieving optimal asthma management in young children.

Effectiveness of Caregiver-Directed Asthma Management Programs

As several experts have noted, asthma is difficult to manage. Over time, the literature has demonstrated that despite advances in pharmacotherapy (Hynes et al., 2019; Cujilema et al., 2024), children continue to develop new limitations due to asthma. Everhart et al. (2020) have shown that differences in functional ability related to asthma, as well as additional economic and cultural factors within the family, explain why children have higher-than-expected asthma morbidity and healthcare utilization.

Finally, asthma in young children can negatively interfere with day-to-day function and children's quality of life. Kamp et al. (2023) illustrate that an effective parent-led program for the management of this condition has the greatest impact on improving health status while reducing the burden of care on the family. The use of appropriate asthma medications, combined with caregiver-directed management strategies, can help control symptoms and improve quality of life for both children and their families (Dardouri et al., 2022; Mendes et al., 2024).

Effectiveness of Caregivers/Parents Knowledge on Management of Asthma

Caregiver knowledge, attitude, and practice have long been established as determinants of a child's asthma status. It has been demonstrated in numerous studies, that when a

parent understands the identified triggers for asthma, consistently ensures that the child's medications are being taken properly (adherence), and has an action plan, the child's symptoms are effectively controlled and there are fewer exacerbations (the child's quality of life will improve) (Shaheen et al., 2025; Alsayed et al., 2023). Caregivers' low adherence to their child's treatment and/or poor asthma control has been identified as being related to a lack of knowledge regarding asthma management and medication use (Tang et al., 2024). Developing a comprehensive education and empowerment program for caregivers will benefit both caregivers and children with asthma. If the caregiver knows asthma pathophysiology, triggers, and management, the child will experience improved disease control (Com et al., 2022; Cujilema et al., 2024). According to the study by Alhazmi et al. (2022), Asthma control was measured in a large-scale, cross-sectional study of the education program and flu vaccine among children with asthma (bronchial asthma) at six primary health centers in Madinah, Saudi Arabia. Researchers analyzed data from 804 asthmatic children using valid tools: the (C-ACT) Childhood Asthma Control Test for children aged 5–12 years and the TRACK tool for children aged <5 years. Data collected from both tools showed that school education and flu vaccination had a significantly positive impact on asthma outcomes for children in the education program. Post-education children showed reduced ED visits, hospital admissions, and PICU admissions compared with pre-education children. With regard to asthma control, post-education children had higher C-ACT scores and TRACK scores, and a higher percentage of children had their asthma controlled.

Additionally, children who received the flu vaccine had lower rates of ED visits and hospital admissions for asthma. The authors state that in children with asthma, the combination of an organized asthma education program and receipt of the flu vaccine has a positive effect on asthma control and on decreased health service utilization rates. However, the authors feel that longitudinal and experimental studies are needed to validate these results.

Pediatric Asthma Quasi-Experimental Studies in Saudi Arabia and Other Countries

Pediatric asthma continues to be a public health issue in Saudi Arabia, where the increasing prevalence and high rate of exacerbations place a heavy burden on families and the healthcare system. In Saudi Arabia, researchers mostly use quasi-experimental designs to evaluate educational and behavioral interventions that educate caregivers about their roles in knowledge creation and in improving the asthma symptoms and treatment of children with asthma. Researchers have found in other areas of the world (Asia, the Middle East, etc.) that quasi-experimental studies have consistently shown that asthma education, caregiver training, written action plans, and ongoing support result in reductions in emergency department visits and improved use of asthma medications (by either children or their caregivers) and asthma disease management. Current studies from Saudi Arabia are consistent with international research showing that culturally relevant community-based pediatric asthma programs improve clinical outcomes. This accumulation of international and local quasi-experimental research studies provides evidence to support that well-planned, context-appropriate asthma programs reduce asthma morbidity and support long-term control for children with asthma.

Overall, an extensive body of literature supports the notion that supporting caregivers through culturally sensitive asthma programs can improve asthma outcomes for preschool children. However, there is a significant gap in quasi-experimental research targeting preschool children with uncontrolled asthma in Saudi Arabia. This study addresses this

gap by evaluating the outcomes of a caregiver-on-lead asthma program using a quasi-experimental pre-test/post-test control-group design, thereby providing context-specific data to organizations working in this area and aiding in the development of new programs and policy recommendations.

Objectives

The purpose of this study is to evaluate the effectiveness of a caregiver-led asthma management program on asthma symptom management in preschool children with uncontrolled asthma residing in Makkah, Saudi Arabia. Using a quasi-experimental pre-test/post-test design and consisting of an intervention group and control group, the purpose of this study is to evaluate if an evidence-based, culturally appropriate educational program that empowers caregivers can translate into self-management (i.e., amount and frequency of prescribed asthma medications), reduced overall asthma symptoms, and improved clinical outcomes (i.e., frequency of medical appointments, medication compliance).

The specific research questions of the study are as follows.

1. What is the level of knowledge and practices of caregivers/parents regarding asthma management in the intervention and control groups before and after the implementation of the caregiver-led asthma management program?
2. What is the level of asthma symptom control of the children, as reported by caregivers, in the intervention group and the control group before and after the implementation of the caregiver-led asthma management program?
3. Is there a significant difference in the level of asthma symptom control between the intervention group and the control group from pretest to posttest?
4. What is the magnitude of change of the caregiver-led asthma management program on asthma symptom control compared with the control group from pretest to posttest?
5. Which components of the caregiver-led asthma management program are most strongly associated with improved asthma symptom control in the intervention group compared to the control group?

Methodology

Research Design

A quasi-experimental research design enables the researchers to determine the efficacy of an intervention on a known outcome when random assignment of subjects to intervention (experimental) and control groups is not feasible. Quasi-experimental designs may be beneficial in real-world settings when randomization is impractical or unethical, yet the researchers still want to assess links between variables (Thomas, 2024Therefore, this investigation will utilize a quasi-experimental design with a non-equivalent control group. Researchers can compare groups while accounting for the ethical and practical constraints of healthcare settings. There will be two groups of caregivers in this study: one will receive caregiver-led asthma management program interventions (the experimental group). At the same time, the other will continue to receive standard caregiving services (the control group). Both groups will have their levels of caregiver knowledge, caregiver behaviours, and child asthma control assessed before the study and again after the study concludes.

By comparing pre- and post-intervention scores across both groups, the researchers can determine program efficacy by controlling the factors such as seasonal variations and environmental triggers that may affect the variables of this study.

Participants

According to data collected from Hadda's Primary Health Care Center, where the intervention will take place, 60 preschool-age children aged 3-5 years have been diagnosed with uncontrolled asthma, have all their medical records on file (current), and are being treated accordingly. In the last quarter of 2025, the center's health information system indicated that 60 cases were confirmed as having uncontrolled asthma. In addition to the Hadda Center, Alnawarryah's Primary Health Care Center — designated as the control group — has reported an average number of 57 preschool-age children diagnosed with uncontrolled asthma. The average number of cases may vary; thus, the 57 currently diagnosed will continue until they reach 60, and the total number of participants will be equal in both experimental and control groups.

Caregivers associated with both intervention sites were limited by the low number of preschool-age children (3-5 years) diagnosed with uncontrolled asthma; therefore, 60 caregivers from the intervention site will represent participants, and 60 caregivers from the control site(s) will as well. A census sampling method will be used for both groups. All eligible participants from the Makkah Health Cluster who meet the inclusion criteria will participate, thereby increasing the study's statistical power while creating a comprehensive sample of the target population to enhance the effectiveness of this quasi-experimental study. Furthermore, equal sample sizes in both groups will reduce the likelihood of bias and improve the validity of the results by creating comparable groups that enable more accurate statistical analyses when evaluating the effectiveness of the caregiver-management program. Inclusion criteria include: 1) Caregiver to children ages 3-5 years of age; 2) Children have been diagnosed by their pediatricians as having asthma; and regularly visit their medical home consistently; 3) Caregivers are willing to participate in the caregiver-led asthma management program; and 4) Caregivers speak Arabic and have a sufficient level of understanding to be able to participate effectively. Inclusion criteria ensure that caregivers who meet these criteria are suitable candidates to receive the intervention and are therefore able to participate fully in the caregiver-led interventions.

Instrumentation and Data Collection

To evaluate whether the Asthma Management Program improved preschool children's asthma symptoms and to assess caregivers' asthma knowledge and participation, the researchers will collect quantitative data on caregivers' knowledge and participation using self-administered questionnaires. Caregivers' asthma knowledge and practice will be measured using two main instruments: the Caregiver Knowledge and Practice Questionnaire and the Childhood Asthma Control Test (C-ACT or TRACK) modified for Saudi Arabia. The questionnaire utilized to collect this data will also include some demographic information about both participants (the child and the caregiver). The significance of this demographic information will be threefold: it will be used to describe the sample for statistical purposes, to identify possible confounding variables, and, if necessary, to conduct subgroup analyses.

The Caregiver Knowledge and Practice Questionnaire will facilitate the assessment of caregiver knowledge regarding asthma, medications, triggers, symptoms, and daily

management practices. Before caregiver-led program implementation, the researchers will administer a pre-program knowledge assessment (to all participants) along with a post-program knowledge assessment (to all participants) to determine whether or not any change has occurred. Caregiver knowledge will be assessed based on participants' responses to closed-ended questions, either true or false. There may also be questions regarding how frequently caregivers have followed the recommended practices, and participants will respond to these questions using a 4-point Likert Scale (4- Always, 3- Often, 2- Occasionally, and 1- Never). The same assessment tool will be used for both the intervention and control groups.

In addition to assessing caregivers' knowledge of asthma and its control in childhood, the researchers will use valid, age-appropriate measurement tools to assess asthma control in the study. Specifically, for children aged 3-5, the researchers will utilize the Childhood Asthma Control Test (C-ACT). For children younger than 5 who are unable to self-report accurately, the investigator will utilize the Test for Respiratory and Asthma Control in Kids (TRACK). Recently published data from the International Journal of Pediatrics could be helpful for the investigator when measuring asthma-related morbidity. There are two different assessments: the C-ACT scores 0-27, and a score of 19 or less indicates poor asthma control, with frequent unwanted events. The TRACK assessment has a higher score (0-100), so a score below 80 indicates uncontrolled asthma. Both the C-ACT and TRACK are well-known, validated tools; therefore, both assessments should provide very accurate and reliable data. In this study, caregivers who are already administering either the C-ACT or TRACK will assess their child's asthma symptoms pre- and post-intervention (parent-led asthma control plan) for any change in symptom severity and/or functional status. The comparison of baseline and post-intervention will provide an objective measure of the improvement of asthma control and thus assess how effective the caregiver-led intervention program has been at controlling or limiting asthma symptoms in preschoolers.

Content Validity and Reliability

To establish the validity of the questionnaire tools used in this study, the content will be reviewed by experts for the Caregiver Knowledge and Practice Questionnaire and the childhood asthma control/management (C-ACT)/TRACK. This review will be conducted by a multidisciplinary expert panel (a pediatric nurse specialist, a pediatric pulmonologist/asthma specialist, a family physician consultant with experience in chronic disease management, and a public health expert with experience developing questionnaires). Through their analysis, the investigators will be able to determine whether the measured items accurately reflect the constructs of candidates' typical responses and whether their knowledge of asthma management practices for children is adequate.

To assess the reliability of the instruments, a pilot study will be conducted with caregivers who are eligible to participate (but not included in the actual study). The pre-test will assess the internal consistency and stability (reliability) of the instrumental assessments. The internal consistency reliability (reliability) of the caregiver's knowledge/practice and/or assessment instruments will be calculated using Cronbach's alpha (i.e., a statistical measure of reliability). A Cronbach's alpha value of at least 0.70 is considered to be acceptable.

In addition, the psychometric properties of the C-ACT and TRACK instruments from previous studies support the reliability. This will also be assessed for local adaptation. When the reliability and validity of the collected data are ensured, the data or information will be deemed consistent and accurate and, therefore, suitable for evaluating the familial or parental-led asthma management program.

Because the sample participants will be predominantly Arabic-speaking, the questionnaires will require forward and backward translation. That is, two independent translators will independently produce two different Arabic-language versions of the questionnaire. One translator and the researchers will perform a back-translation of the final Arabic version into English to ensure that the final back-translated version is semantically and conceptually consistent with the original English version. The Arabic-language version of the final research report will be pre-tested to ensure clarity, cultural appropriateness, and understanding, thereby validating and ensuring the reliability of the research instrument.

Data Collection Methods

Data collection will be systematic and organized. There are 3 phases in the study — Phase 1: Pre-intervention assessment; Phase 2: Implementation of a caregiver-led asthma management program; and Phase 3: Post-intervention assessment for the treatment group. To assess caregivers' baseline knowledge and practice regarding asthma before participating in the entire study, candidates will be identified from the Raqeem database of the Makkah Health Sector, Primary Health Department. After being identified, potential participants will be asked to complete a Caregiver Knowledge and Practice Questionnaire regarding their understanding and management of asthma. The Childhood Asthma Control Test (C-ACT) will be used to assess how well children are managing their asthma before participating in the study. Both of these measurements will help establish the typical level of asthma control prior to study participation.

The intervention will consist of educational sessions designed to provide caregivers with the knowledge and skills to manage their child's asthma. Educated caregivers will become knowledgeable about asthma, recognize and avoid triggers, use medications properly, monitor symptoms (with family members' cooperation), and provide culturally sensitive education.

Caregivers will complete the Caregiver Knowledge and Practice Questionnaire and the C-ACT after completing the caregiver-led asthma management intervention. This study aims to determine whether a caregiver-oriented intervention has improved knowledge and practice in asthma management among caregivers of children with asthma.

The control group will utilize a traditional approach to asthma management through their primary health care provider. This involves a typical medical consultation, general education, and general advice on asthma management from a health care professional, delivering the regular asthma services as per usual, without participation in the caregiver-oriented asthma management program.
The control group will undergo a traditional approach to asthma management with their primary health care provider. This involves a typical medical consultation, general education, and general advice from a health care professional on asthma management - delivering the usual asthma services as per normal, without attending an organized caregiver-oriented asthma management program.

A pre-/post-test method will be used for data collection. At the beginning of the study, caregivers will complete the "Caregiver Knowledge & Practice Questionnaire," and the "Child Asthma Control Test" (C-ACT) will be administered to determine the level of asthma control for the children. Data will be collected at the end of the intervention using the same tools as at the start. The objective is to compare the level of improvement in knowledge and practices resulting from a caregiver-led asthma management program with the usual practice of asthma management through their primary health care provider. Data will be collected, labeled, and maintained safely and confidentially.

Pursued in an orderly manner, implementing an established systematic approach can ensure that the data are reliable, complete, and suitable for the quantitative statistical analysis required to meet research objectives and test the hypotheses developed by the investigator in this study.

Analysis

The data analysis for this study will be based on both descriptive and inferential statistics, as modified for use with the quasi-experimental pre-test–post-test control-group design. Descriptive statistics (mean, standard deviation, frequency, and percentage) will be used to summarize the pre-test and post-test asthma symptom control scores of participating children in the intervention and the control groups. The pre-test and post-test scores can then be used to compare asthma control levels across groups and to provide objective documentation of each group's demographic and baseline characteristics and post-intervention outcomes.

To assess whether a statistically significant difference exists in asthma symptom control between the intervention and control groups from pre-test to post-test, inferential statistics will be employed. For this study, gain scores (post-test score minus pre-test score) will be evaluated using independent-samples t-tests. If the homogeneity-of-variance and normality assumptions are violated, the Mann-Whitney U test will be used as a nonparametric alternative to the independent-samples t-test.

Effect size analysis will be conducted on the mean change gain scores of the two groups (i.e., the intervention group versus the control group) using Cohen's d to illustrate the magnitude of change and the practical significance of the caregiver-led asthma management program. This will provide an estimate of the intervention's effect size (large, medium, or small).

Using multiple linear regression analysis, the final component of this analysis will identify the major factors in the caregiver-led asthma management program related to better asthma symptom control. The dependent variable will be the post-test asthma control score; the independent variables will be the pre-test asthma control score, group, caregiver knowledge, medication adherence, trigger avoidance, and symptom monitoring. This will enable evaluation of how much specific components of the intervention contributed to improvements in asthma symptom control, while statistically controlling for baseline differences between groups.

Findings and Discussion

Anticipated Findings

This study is expected to demonstrate that the caregiver-led asthma management program will notably improve caregiver knowledge, management practices, and asthma outcomes among preschool children with uncontrolled asthma in Makkah. Caregivers in the intervention group are estimated to show improved understanding of asthma triggers, correct medication use, symptom monitoring, and adherence to asthma management plans compared to those receiving usual care.

Children in the intervention group are likewise expected to exhibit significantly improved asthma control scores (C-ACT and TRACK) from pre-test to post-test, with a greater proportion achieving controlled asthma status than those in the control group. The findings are also expected to reveal statistically significant differences in gain scores between groups, supporting the effectiveness of the intervention program.

The intervention is anticipated to produce meaningful clinical improvement, reflected in better symptom control and reduced asthma-related healthcare utilization, including emergency visits and hospital admissions. Caregiver knowledge, medication adherence, trigger avoidance, and symptom monitoring are expected to emerge as important predictors of improved asthma outcomes.

Conclusion

This study aims to demonstrate that a caregiver-led asthma management program is effective in improving asthma control among preschool children in Makkah. The overall goal is to enhance caregivers' knowledge and facilitate better symptom management, leading to improved children's health outcomes. Based on this research, it is anticipated that identifying the caregiver's pivotal role in managing asthma in children will provide a rationale for implementing culturally relevant, family-centered programs in primary care. These culturally relevant, family-centered programs may empower caregivers, reduce asthma-related complications, and improve families' overall health. Collectively, the results will support the implementation of culturally relevant, family-centered programs in the primary care setting to improve asthma control in children. This may help improve children's asthma control, empower the caregivers, and create a healthier family. This may support the evaluation of caregiver-led asthma management programs as a key intervention to improve asthma control in preschool-aged children in Makkah.

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