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Levels of Albuterol Inhaler With and Without Spacers in Children With Asthma

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This is to certify that the doctoral study by

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has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

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Walden University
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Abstract

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MPH, National University, 2017

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AA, Southwestern College, 2013

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Public Health

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Abstract

Children with asthma remain a problem in public health because asthma drastically impacts children's daily activities, increases absenteeism in school, and causes difficulties in sleeping. Researchers have demonstrated that poor asthma management is due to a lack of education about the correct inhaler technique, and the appropriate doses are not inhaled. Researchers have yet established whether asthma symptoms improve based on the doses inhaled with or without a spacer and whether children are most likely to experience fewer asthma episodes or attacks if they receive professional instruction. The purpose of this study was to fully understand the influence of an inhalation device with or without a spacer in medication delivery and to understand if instruction given by clinicians alleviates the number of asthma episodes or attacks. The transtheoretical or stages of change was used to analyze an individual's ability to act on a new healthier behavior. This study involved children (N = 416) aged 7 through 12 years old who participated in the 2015 Asthma Call-Back Survey. Quantitative cross-sectional study design was used to encompass information, including an interview questionnaire, a survey, and existing literature. A chi-square, Phi, and Cramer's V test were used to address the research questions. The results of this study indicated that managing asthma symptoms does not depend on the number of doses inhaled with or without a spacer. Children are less likely to experience asthma episodes or attacks with proper professional education. Further exploration is needed to investigate the effectiveness of the method of teaching by pharmacists and other clinicians. The parents of children and clinicians may benefit from the results of this study by taking immediate health improvement action.

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Dedication

I dedicate my doctoral study to my family. My family has been my inspiration to obtain higher education and do great things in life. I am grateful for my family for their endless support in my studies and professional goals. I could not have reached another milestone without them by my side.

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I would like to thank my committee members, Dr. Mountasser Kadrie and Dr. W Summer Davis, for their full support and endless commitment to review and provide feedback on my doctoral study. I thank you for encouraging me to do better academically and professionally. I also would like to thank my URR, Dr. Stacy-Ann Christian, for providing important insights and feedback on my doctoral study.

Table of Contents

List of Tables

List of Figures

Section 1: Foundation of the Study and Literature Review

Introduction

Children with asthma may encounter serious health complications that may affect their health status, which has become a significant concern in public health. Asthma causes inflammation in the airways, resulting in difficulty breathing, wheezing, and shortness of breath. Asthma is frequently associated with respiratory infections, chest pressure, anxiety, rapid heart rate, and throat irritation (Denholm, Van Der Werf, & Hay, 2020; Ehrlich et al., 2019). In the United States, more than 497,000 people are hospitalized annually due to asthma (Shaw et al., 2016), and according to the Centers for Disease Control and Prevention (CDC; 2018), there are over 6 million children under the age of 18 with asthma. The use of inhaled treatments has become one standard protocol for asthma and children (Bush, Fleming, & Saglani, 2017); however, this remains a concern as proper usage and effectiveness of this form of treatment may not always be performed correctly.

While the inhalation of medication remains a standard treatment, the inclusion of a spacer helps prevent medication loss, ensuring more of the treatment is inhaled to the lungs (Gillette, Rockich-Winston, Kuhn, Flesher, and Shepherd, 2016). A spacer is a tube that improves the inhalation of medication into the lungs (Kofman & Teper, 2018). Moreover, children who lack training in the proper use of the inhaler may not receive sufficient treatment, resulting in significantly limited asthma symptom control. The technique used in the inhalation of medication determines the amount of medication delivered to the lungs; operating the inhaler device correctly increases the likelihood of

receiving the proper therapeutic dose. Therefore, further study is needed to investigate the association between (a) the amount of the Albuterol (+ A. Sulfate or Salbutamol) inhaled (with or without spacers) among children in the sample population, (b) the association between education on the proper delivery of Albuterol (+ A. Sulfate or Salbutamol), and (c) the severity of asthma attacks in children.

This study can promote positive social change because the results help inform the foundational knowledge by informing parents about the proper use of inhalation and making appropriate health decisions to reduce asthma incidents in children. Public health professionals and other clinical providers could use the research findings to educate the parents to increase awareness of this health issue. Positive social change may be accomplished through health care providers demonstrating the proper use of the inhalation technique while administering the medication on their patients in the healthcare setting. Effectively using the inhalation devices properly with a spacer may significantly alleviate the duration of asthma episodes and reduce emergency department (ED) visits.

Problem Statement

Asthma remains a significant concern in the field of public health because it drastically impacts children's daily activities, increases absenteeism in school, and causes difficulties in sleeping (Shaikh & Byrd, 2016). In the United States, an estimated 10% of children have asthma (Shaikh & Byrd, 2016); if left untreated, asthma symptoms can be worsened through poor symptom management, leading to severe health conditions. An

inhaler remains the standard method for delivering asthma medication into the lungs (Gillette et al., 2016).

Research has shown that some children's inhaler techniques might be ineffectual, and the type of device used might affect asthma outcomes (Gillette et al., 2016). Incorrect inhalation technique is a significant factor for inadequate medication delivery, resulting in poor control of asthma symptoms (Ravikumar, Raghavendra, & Priyadarshini, 2018). Therefore, establishing an efficient method is crucial in selecting asthma control medication delivery (Gillette et al., 2016). According to Kofman and Teper (2018), improving the inhalation technique, such as using a spacer with inhalation delivery devices, increases asthma control in children. As researchers have yet to investigate if a certain amount of Albuterol (+ A. Sulfate or Salbutamol) inhaled with or without a spacer affects the likelihood of asthma episodes or attacks in children between the ages of 7 and 12, there currently exists a gap in the knowledge.

Inhalation of medications has several positive effects in treating diseases of the respiratory tract (Kofman & Teper, 2018). When using the inhalation devices, patients need to follow several chronological steps to deliver the drugs successfully to the lungs (Al Ammari, Yunus, Al Ghobain, & Al Halwan, 2016). Many children with asthma misuse their inhaler devices, resulting in unreliable drug delivery, even after proper inhalation instruction (Jat, Singhal, & Guglani, 2016). Many children still misuse their inhaler device, even after being taught how to operate the device correctly (Shaw et al., 2016). Özkars and Kirik (2019) added that an improper medication use technique could prevent the medication from reaching airways, resulting in at least limited effectiveness

in treating symptoms. Children's inhalation techniques may be too imprecise to result in reliable drug delivery (Shaw et al., 2016). Consequently, in this study, I focused on investigating the association between the amounts of inhalation of Albuterol (+ A. Sulfate or Salbutamol) with and without spacers in children ages 7 to 12 years old with asthma.

Purpose of the Study

The primary purpose of this study was to examine the association between the amount of inhalation of Albuterol (+ A. Sulfate or Salbutamol) and the use of spacers among 7 to 12-year-old children with asthma. In this study, I sought to determine if the amount of Albuterol (+ A. Sulfate or Salbutamol) inhaled varied with the use of spacers when used by children with asthma aged 7 to 12 years old suffering an asthma attack episode. The variables were Albuterol (+ A. Sulfate or Salbutamol) and the use of spacers; the population sample was children aged 7 to 12 years with asthma. The variables were examined to address the research questions and develop new insights into the current health issue to create useful and practical approaches in designing and implementing a prevention program, potentially leading to positive social change. Additionally, the study improved the knowledge of the delivery of asthma medication, increasing children's awareness of the proper use and maintenance of inhalers.

Research Questions and Hypotheses

Research Question (RQ)1-Quantitative: What is the association between the amount of Albuterol (+ A. Sulfate or Salbutamol) inhaled with or without spacers among children 7 to 12 years old?

$H_{01:}$ There is no significant statistical association between the amount of Albuterol (+ A. Sulfate or Salbutamol) inhaled with or without spacers among children 7 to 12 years old.

$H_{1:}$ There is a significant statistical association between the amount of Albuterol (+ A. Sulfate or Salbutamol) inhaled with or without spacers among children 7 to 12 years old.

Research Question (RQ)2-Quantitative: What is the association between the number of asthma episodes or attacks with or without professional inhalation instruction on the proper delivery of Albuterol (+ A. Sulfate or Salbutamol) in children 7 to 12 years old?

H_{01}: There is no association between the number of asthma episodes or attacks with or without professional inhalation instruction on the proper delivery of Albuterol (+ A. Sulfate or Salbutamol) in children 7 to 12 years old.

H_{02}: There is an association between the number of asthma episodes or attacks with or without professional inhalation instruction on the proper delivery of Albuterol (+ A. Sulfate or Salbutamol) in children 7 to 12 years old.

Theoretical Foundation for the Study

This study's theoretical framework was the transtheoretical model or stages of change (see Keshmiri et al., 2017). This theory was appropriate to this study because it examines an individual’s ability to act on new healthier behavior and provides strategies or approaches for change to guide the individual in reaching a desired health outcome

(Keshmiri et al., 2017). According to Keshmiri et al. (2017), participants can be at any of the six constructs of stages of change:

1. Precontemplation
2. Contemplation
3. Preparation
4. Action
5. Maintenance
6. Termination

The individuals undergo each stage to increase compliance with inhaled medications. The significance is that the transtheoretical model assists individuals in adopting a new behavior, whether to use an inhaler with medicines to prevent asthma episodes or attacks among asthmatic children. The transtheoretical model guides the children with asthma to learn and comply with the proper use of inhalational techniques and interventions to achieve their desired health outcomes. The transtheoretical model is a valuable tool to guide and counsel participants to reach their desired health outcomes using the interventions published in a health program (Daniels et al., 2014). This particular framework comprehensively assesses behavior change and the design of effective interventions (Gold et al., 2016). Berhane, Biadgilign, Berhance, and Memiah (2015) stated that the six constructs of the model act as the model of behavior change to articulate how and why people alter their behaviors.

Nature of the Study

The nature of this study was a cross-sectional research design data analysis that has been conducted using Statistical Package for the Social Sciences (v.25) Software. The dependent variable was the number of canisters Albuterol (+ A. Sulfate or Salbutamol). The independent variable was Albuterol (+ A. Sulfate or Salbutamol) with or without a spacer. For the second research question, the dependent variable was the duration of asthma episodes or attacks in children, and the independent variable was with or without an inhalation technique instruction given by a professional. Using quantitative research for this study can develop numerical data that provides meaningful new insights that support generalizations related to the phenomenon under study. The quantitative research was performed to provide statistical analysis that validated the association between two or more variables and measured trends or the incidence of various views.

The quantitative research design addresses cause and effect relationships and, therefore, can be relied on to create predictions. Quantitative research can report credible statistics results to help answer the research questions. The quantitative research design establishes statistical numbers and associations between variables that can be described using figures, graphs, and inferential statistics. Further, my investigation addressed asthmatic children in that I was interested in understanding asthma episodes or attacks determined by the amount of medication inhaled with and without a spacer. In this research study, I focused on investigating the association of the number of canisters of Albuterol (+ A. Sulfate or Salbutamol) with or without a spacer used in children with asthma in the age group of 7 to 12 years old. Additionally, I investigated the association

of the duration of asthma attacks and episodes on children with asthma and whether they received professional instruction on how to operate an inhalation device correctly.

Literature Search Strategy

The literature review provided an overview of an Albuterol (+ A. Sulfate or Salbutamol) inhaler with and without a spacer in children ages 7 to 12 years with asthma. The keywords searched were *spacers, inhalers, inhalation technique, medications, asthma, children, public health, doses, education, quality of life, respiratory disease, medication adherence, asthma control, asthma symptom control, asthma knowledge, medication nonadherence, asthma outcome,* and *pediatric* in the databases Google Scholar, PubMed, and EBSCO. The keywords listed above were tailored to the scope of the study using the appropriate databases with peer-reviewed scholarly articles reviewed that were published from 2015 and 2019.

Literature Review Related to Key Variables and/or Concepts

Health Issue: Asthma

Asthma is one of the concerns in public health because it develops adverse health effects in children. Asthma is a chronic disease, is heterogeneous, and is an inflammatory disease of the respiratory system (Ibrahim et al., 2019). Coughing, wheezing, chest tightness at night, and breathing difficulties are indicators of asthma in children (Furtado et al., 2019). This health issue needs to be addressed to improve and obtain the desired positive health outcome in the population. According to Gillette et al. (2016), about 7 million in pediatric populations in the United States are affected by asthma.

Asthma leads to chronic disease in children, and it increases the number of hospital visits (Ahmad et al., 2018; Jat et al., 2016; Tattersall et al., 2018). Asthmatic children left untreated are most likely to experience several challenges in their life mentally and impaired quality of life (Greenlee, Winter, Fiese, & Everhart, 2019). The impairment to quality of life limits children's daily activities such as in sports and games, and they may experience difficulties interacting with family members, anxiety, and disrupt functionality because of the disease (Kocaaslan & Akgun Kostak, 2019). Understanding the factors associated with the adverse outcomes for children with asthma is crucial to identifying interventions and preventions to alleviate the condition's symptoms more effectively.

Quality of Life for Children With Asthma

There are several effective treatments and interventions available to treat asthma; however, asthma continues to negatively impact children's quality of life when these treatments and interventions are not always implemented correctly. Quality of life plays a vital role in monitoring asthma control (Melgarejo González-Conde, Pérez-Fernández, Ruiz-Esteban, & Valverde-Molina, 2019). Quality of life is used as an indicator for children who have asthma as the condition negatively impacts their physiological development, drastically affecting physical, mental, and emotional health (Kocaaslan & Kostak, 2019). Asthmatic children may experience a lower tolerance for physical activity and are more likely to stay indoors than other children without asthma (Furtado et al., 2019). Self-efficacy refers to an individual who can perform behaviors necessary to manage asthma symptoms and maintain a positive health outcome (Melgarejo González-

Conde et al., 2019). Children with proper asthma education can provide care for themselves with minimal supervision. Professionals providing care to children with asthma need to comply with and understand the national guidelines to effectively implement an asthma management plan (McCabe, McDonald, & Lipman, 2019). Children with asthma tend to eliminate their extracurricular activities and be bullied because of their symptoms (Carey, Edds-McAfee, Martinez, Gutierrez de Blume, and Thornton, 2019; Kalyva, Eiser, & Papathanasiou, 2016). Poor asthma control affects the quality of life. For example, children may be discouraged from attending school or academic performance may be impacted; the parents may also need to miss work to provide care for their child (Carey et al., 2019; Ellis et al., 2019).

Poor asthma control increases the rate of morbidity, limits daily activities, and negatively impacts children's overall health status (Quirt, Hildebrand, Mazza, Nova, and Kim, 2018). Children with asthma are often unable to attend school for at least two consecutive days more than children without asthma (Carpenter et al., 2016). Individuals who care for children need to provide continuous guidance to manage their asthma and support related decision-making. Asthma impacts the quality of life of children in several ways. Therefore, it is critical for health care providers to form a concept for medical treatment and education for asthmatic populations to manage children's asthma symptoms.

Emergency Department Visit

Children with asthma who do not effectively use an inhaler during asthma attacks or episodes may encounter difficulties controlling asthma and may need to seek

emergency treatment more frequently. Patients may be required to visit the ED more frequently due to poor asthma management and control (Storms, Tringale, & Ferro, 2015). Effective interventions help address asthma symptoms; however, there are more asthma-related ED visits than primary care visits in children with asthma (Celik, Araz, Bastani, & Saenz, 2017). In the United States, asthmatic children are more likely to visit the ED and require hospitalization than older adults (Al-Muhsen et al., 2015). Patients need a higher level of asthma management if they have been hospitalized because of asthma exacerbations (Basheti, Obeidat, & Reddel, 2018). When a high-risk population of asthma patients visits the hospital because of asthma episodes or attacks, they will be educated and provided with self-management skills to control asthma symptoms (Basheti et al., 2018). Educating the patients at every hospital visit, particularly on inhaler technique skills, is vital as incorrectly operating an inhaler device leads to more ED visits in children (Carpenter et al., 2016). Effective asthma education is critical for asthmatic children because it reduces hospital admissions, improves functionality, and achieves more positive health status (Grover et al., 2016). In a previous study, Ali et al. (2019) showed that providing asthma education with patients one at a time is associated with asthma control, fewer ED visits, and fewer hospital admissions. Administering prophylactic inhaled corticosteroids has been shown to reduce the severity of the problem, but without appropriate guidelines on how to use the medication effectively, it can cause a relapse of symptoms (Ali et al., 2019). It is still unclear whether a lack of knowledge impacts the delivery of medication and the occurrence of exacerbations and ED visits. In the previous study, researchers did not have sufficient information about

whether a child's age can be a factor during inhalation regardless of if a child was instructed by a healthcare professional (Ali et al., 2019). Several research findings revealed that not providing credible asthma education to the asthmatic population may lead to poor asthma control, and symptoms may prolong (Ali et al., 2019). The insufficient information to explain the association between asthma education and drug delivery may make it difficult to manage asthma attacks or episodes, and the asthma patient might continue to develop severe medical complications.

Inhaler Device

An inhaler is the method of medication delivery in the lungs for asthmatic children. The goals of the inhaler devices are to control asthma symptoms and alleviate risks. Inhaler devices are the primary route to administer adequate drugs in the airways to treat asthma (Pessôa et al., 2018). According to Gillette et al. (2016), inhaler devices are the preferred medication delivery method in asthma straight to the lungs. However, if the appropriate number of doses is not inhaled, there is a likelihood that a child may experience asthma episodes or attacks, especially when it is inadequate for breathing during the inhalation (Zoltan, 2015). The inhaled treatment has many positive impacts on treating asthma because of the high delivery concentration of the drug straight to the airways with a few side effects, but demonstrating incorrect technique turns to the inefficacy of treatment (Türkeli, Yılmaz, & Yüksel, 216). The inhaler devices continue to affect asthma outcomes, and an inhaler device is becoming an essential choice for asthma control medication (Gillette et al., 2016). Asthma can be controlled more effectively when the children use an inhalation technique correctly (Gillette et al., 2016). Inhalers are

crucial tools to immediately treat asthma exacerbation and control for patients with persistent asthma (Ali et al., 2019). A child is expected to have the ability to correctly use the inhaler device as it is known to be an essential factor for successful asthma treatment (Juntunen-Backman et al., 2015). However, patients continue to misuse an inhaler device even though they were trained on the correct technique (Aydemir, 2015). Adherence to the proper procedures may reduce asthma attacks or episodes. Operating the inhalation techniques properly could also reduce visiting the emergency room. For long-term treatment, the inhalation devices might be an appropriate tool to use for asthma management; however, the device's effectiveness depends on how the inhalation technique is performed (Mebrahtom, Mesfin, Gebreyesus, & Teweldenmedhin, 2019). Incorrectly using an inhalation technique can substantially reduce treatment effectiveness (Mebrahtom et al., 2019). Some evidence has indicated that misusing an inhaler can cause only a small amount of medication to be delivered to the lungs (Mebrahtom et al., 2019). However, it is not clear if this is also due to the absence of a spacer attached in an inhaler. Misusing an inhaler device decreases drug delivery, and the patients may encounter consequences with asthma health complications (Almomani, Mokhemer, Al-Sawalha, & Momany, 2018). Inadequate drug delivery to the lungs can be the result when patients do not operate an inhalation device correctly, causing the prevalence rate of asthma to rise consistently (Kovačević et al., 2018). Patients may still perform the inhalation techniques poorly, even after instructions (Kilgore, Al Katranji, Woodall, Shepherd, and Flesher, 2016; Jat et al., 2016). Previous studies have indicated that a lack of controlling asthma might be in part due to the improper usage of the inhaler devices

(Kilgore et al., 2016). Nevertheless, previous researchers did not state if using spacers would improve the drug delivery regardless if the patients incorrectly operated the inhaler devices or missed a few steps in sequence.

Asthma Education

Researchers have suggested that 67% of health care providers are unable to demonstrate the correct inhaler technique to their patients (Kilgore et al., 2016; Root & Small, 2019). An inhalation device is a standard route to administer asthma drugs, but few health care professionals have the competence to teach the technique to their patients (Velasco et al., 2015). When a pharmacist provides education regarding the proper use of an inhaler in children, it improves the symptoms and inhaler technique and decreases the number of ED visits and hospitalizations (Zarmouh, 2019). When health care professionals deliver the instructions to patients, the adherence and inhaler technique improve in children, but the ED visits, hospitalizations, and symptoms remain the concern (Zarmouh, 2019). This indicates that a patient's use of an inhalation technique depends on how it was taught, and, therefore, poorly controlling asthma is not solely because of how it was performed or the absence of a spacer with an inhaler. The practical education or instruction on how to operate an inhaler seems to depend on who provides the materials. It is unclear whether the pharmacists or other healthcare professionals should disseminate information on effectively performing the inhalation technique to better control asthma in children. Although a correct inhaler technique seems understandable and easy to follow, many patients tend to forget the inhaler vocal training they have received (Al Ammari et al., 2017).

The factors to unsuccessfully control asthma are a lack of education about the correct inhaler technique, and the learning process is complex to adhere to several asthmatic children (Ali et al., 2019). The lack of knowledge about asthma, inadequate inhaler training, and low level of health literacy impacts a patient's ability to operate an inhaler accurately (Axtell, Haines, & Fairclough, 2017). Many inhaler devices users may experience discouragement because of a lack of benefit from treatment (Jat et al., 2016).

The patients or parents might have received training about the correct use of inhalers by a professional. However, if these audiences do not understand the information provided, it may be a factor to incorrectly operating an inhaler with or without a spacer. The patients or parents of patients who do not understand the health information provided for the proper use of the medication may improperly administer the drug resulting in the worsening of asthma symptoms severity and increase the rate of hospitalizations (Yin et al., 2019). Health care providers often identify the appropriate inhaler device for their patients and are knowledgeable enough to teach their patients the correct inhaler technique; however, they may overlook assessing the level of proficiency (Kshatriya, Khara, Paliwal, & Patel, 2016). In the event of an asthma attack or episode, the first selection of the method to treat it is the metered-dose inhaler (Ozkars & Kirik, 2019). There are some cases that it may prove difficult to learn the proper technique of medication use (Ozkars & Kirik, 2019). The medication will not reach the airways and may prove ineffectual if children do not use the inhaler incorrectly (Ozkars & Kirik, 2019). Aside from using an inhaler correctly, a tool called the "spacer" attached to an inhaler could prevent the medication from escaping and more of the medicine deposited

in the lungs. When children encounter difficulties in using inhaler devices, the result may decrease adherence, resulting in ineffective drug delivery. The researchers in the previous study discussed several effective inhalers to use to treat asthma with the proper inhalation technique instructions to treat asthma. However, it is unclear whether this method has reduced the symptoms and prevalence of asthma in the children population, specifically ages seven to 12 years old.

Spacers

Using spacers with an inhaler may be beneficial to improving drug delivery in the lungs. The spacers might have the features that allow most of the medications to be inhaled through the lungs by requiring the patient to coordinate the actuation and breathing sequence. A spacer attached to an inhaler device may increase the deposition of drugs in the lungs if the patients provide adequate coordination of inspiration (Guilbert et al., 2017). The inspiratory flow rates are a critical factor in inhaling the appropriate amount of drug delivery (Haidi et al., 2016). Failure to perform hand-breath coordination can fail to deliver an adequate amount of medication into the lung with in-breath (Sanders & Bruin, 2015). Young asthmatic children should utilize an inhaler with a spacer to prevent insufficient coordination compared to older asthmatic children should use a dry powder inhaler device with a proper breathing sequence (Pinto, Jeri, & Barbosa, 2018). Insufficient hand-breath coordination or inspiratory flow rate may influence during the inhalation procedures, and fewer drugs deliver through the lungs (Vandewalker, Hickey, & Small, 2017). Schoessler and Winders (2016) also stated that a spacer does not suspend the medication in the air, but it holds the drug in the chamber. Schor et al. (2017) further

stated that spacers could reduce the requirement for hand-breath coordination and enhance lower airways by improving the efficacy of dose inhalers in delivering medications.

An inhaler without a spacer provides a smaller number dose of the treatment to the airway; some medications stay on the tongue, and the rest may be wasted into the air (Babaei, Najafi, Khosh Boo, & Ghesmati, 2018). Using a spacer with an inhaler prevents drugs from escaping in the air and improves drug penetration into peripheral airways (Schor et al., 2017). Some studies have shown that using spacers with different inhalers such as pressurized metered-dose inhalers (pMDIs) may result from increasing the total amount of drug available for inhalation (Guilbert et al., 2017).

Childhood asthma is most likely to occur in the preschool years, and for this age group, the MDI treatment will principally be to administer with a spacer (Topal et al., 2018). The previous study has shown that MDI treatment with a spacer will be the appropriate treatment for asthmatic children. However, it is unclear whether the particular children's population received formal instruction or help from their parents during the inhalation and whether asthma episodes or attacks have occurred after the treatment. A health care provider might need to reinforce asthmatic children to use spacers with an inhaler to administer medications regardless of the type of drugs being inhaled. Kilgore et al. (2016) added that using a spacer is beneficial because it increases the likelihood of health improvement and reduces symptoms. Asthma treatments should be administered throughout periods of well-being to avoid attacks or episodes in children (Aslam, Shakir, & Murray, 2016). The desired health outcome is not feasible to achieve if the children

continue to administer medication incorrectly. Children that failed to comply with the asthma management plan resulted in poor asthma control and risk developing severe chronic health conditions.

Children not using a spacer on an inhaler significantly decrease the effectiveness of aerosol therapy of children, increasing the risk of complications (Newhouse & Amirav, 2019). Several factors lead to poor asthma control, including a poor understanding of multiple inhalers use, a lack of spacer availability, and social stigmatization (Ammari et al., 2017). Based on the previous studies, the medications administered by a health care professional indicated some improvement in controlling asthma and reduced ED visits as well as hospitalizations (Ellis et al., 2019). There are several critical steps to follow when delivering asthma drugs using an inhaler that cannot be missed because it impacts the number of medications inhaled into the lungs, and asthma symptoms may be challenging to treat as a result. When the misuse of an inhaler occurs, it may significantly increase the incidence and prevalence rate of asthma in children. Misusing an inhaler might also lead to the severity of the health problem. The researchers did not provide sufficient information about medication delivery, whether the amount of an inhaler with the appropriate medical care can obtain asthma control. There are several inhalers to administer medications to treat asthma and have been accepted widely. Unfortunately, the researchers on the previous studies do not further discuss the rationale as to why children continue to control asthma very poorly and develop symptoms even if this population received the appropriate professional instructions on how to deliver drugs using an inhaler, whether using a spacer.

The researchers did not investigate whether using a spacer with an inhaler would improve the delivery of Albuterol (+ A. Sulfate or Salbutamol) to the lungs and improving control of asthma symptoms in all children. Although a spacer prevents the treatment from evaporating, it is unclear whether the rate of inspiratory influences the drug delivery in the lungs; without new approaches or directions to address the health problem, asthma may develop severe health complications in children and remains an important concern in the field of public health.

Definitions

The amount of Albuterol (+ A. Sulfate or Salbutamol) inhaled whether using an inhaler is the dependent variable, and age and asthmatic children are the independent variables for the first research question. The asthma severity is the dependent variable, and inhalation technique instruction during asthma episode or attack, age, and asthmatic children are the independent variables for the second research question.

Albuterol (+ A. Sulfate or Salbutamol): A medication to treat asthma. Albuterol (+ A. Sulfate or Salbutamol) is a glucocorticoid used to treat allergies, inflammation, and prevent worsening of asthma through inhaled or injection (Reggie, Neimkin, & Holds, 2018).

Asthma control: Published guidance provided by a physician for patients to adhere to asthma attacks or episodes occurs. The use of asthma treatment reduces the symptoms and lessens the duration of an asthma attack or episodes (Akiki et al., 2019).

Asthma knowledge: Patients received asthma education provided by a professional about the steps need to execute in case of asthma attacks. According to Luckie et al. (2018), asthma education is a verbal or written instruction by a medical practitioner.

Asthma symptom control: Inhaling medications to control asthma symptoms and treat airway inflammation. A respiratory disease increasing the risk of developing asthma, or the asthmatic condition becomes progressively worse (Grosso et al., 2019).

Asthmatic children: A population of children (seven-12) years old with asthma. A group of asthmatic children may represent an allergic airway inflammation (Licari, Fuchs, Marseglia, & Ciprandi, 2019).

Chronic obstructive pulmonary disease (COPD): A lung disease that prevents airflow and causes shortness of breath. COPD is an inflammation, persistent airflow limitation, and mucous obstruction (Atanasova & Reznikov, 2018).

Current asthma: An individual diagnosed with asthma by a primary care physician and shows symptoms such as wheezing, nocturnal chest tightness, attack of shortness of breath, or medication use for breathing problems (Akiki et al., 2019).

Healthcare professional: Multidisciplinary team involved in direct patient care of asthmatic children. Healthcare professionals include nurses, primary care physicians, respiratory therapists, pharmacists, pediatricians, pharmacy technicians, and other clinic personnel licensed to provide care and treatment to asthmatic patients (Plaza et al., 2018).

Inhalation technique: A tool that is designed to deliver asthma medications in the human body. Sufficient amounts of drugs are distributed in the lungs when performing an inhalation technique correctly (Gregoriano et al., 2018).

Inhaler: Is a controller medication, which is the mainstay of the management of persistent asthma (Ferro et al., 2019).

Instructional mode (education): A published instruction provided by a health provider that guides the usage of an inhaler when administering medications. Instructional materials guide asthmatic patients to manage asthma and enhance learning performance (Moussa-Inaty, Atallah, & Causapin, 2019

Spacers: A tube that attaches to the inhaler and holds medication that assists get the medications into the lungs. A spacer is a tool attached to an inhaler to prevent drugs from escaping in the air to deliver adequate drugs (Ming et al., 2019).

Quality of life: Changes the health status of children negatively due to asthma symptoms, attacks, or episodes. Asthma symptoms can lead to an asthma attack that impairs the population's quality of life (Crossman-Barnes, Sach, Wilson, & Barton, 2019).

Assumptions

The participants provided appropriate and sufficient information in response to the survey questionnaires of the secondary data. Thus, the inclusion criteria are relevant and assure that the participants have all encountered the symmetrical phenomenon of the study. These assumptions were necessary for the context of the study because it is imperative to develop meaningful results that answer the research questions leading to developing the appropriate recommendation for future research of the phenomenon and social change.

Scope and Delimitations

Scope of the Study

Asthma remains to be the primary concern in public health that disrupts the health of children. An insufficient amount of medication delivered into the lungs due to improper usage of an inhaler with or without spacers results in difficulties controlling asthma outcomes. Therefore, the prevalence and incidence rate of asthma in children is continuously stationary. Focusing on these aspects to provide solutions and identify effective interventions to a health issue is imperative. Following an intervention effectively mitigates the factors that cause a long period of asthma attacks or episodes, and the children may achieve their desired positive health outcome as a result.

Delimitations

The study consisted of asthmatic children, ages seven to 12 years old. It included children who have been administered with various asthma medications such as Albuterol (+ A. Sulfate or Salbutamol) with an inhaler technique, whether using spacers. The study excluded older adults as well as children ages 1 to 6 and thirteen and up. The population that does not have a history of an asthma attack was excluded from the investigation.

Significance

The results of this study provided new insights and filled in the gaps in the literature that address the problem and health issue of children with asthma. This study also addressed the gaps by articulating the effect of inhalation of Albuterol (+ A. Sulfate or Salbutamol) using with or without spacers in children with asthma to improve the outcome of asthma and quality of life for children. Further, the findings may contribute to

the evidence-based practice to reevaluate and modify the health policy to ensure that decisions, plans, and actions that occur achieve the goals in health care within a society. My research findings provided essential insights, thus, identifying the practical approaches to help alleviate the risk factors and prevent the development of the health issue. The results may trigger an increased awareness of the health issue in public health that will change individuals' behavior leading to developing effective decisions to achieve their desired health outcome. The results allow creating an intervention that will reduce the new incidence rate of the health issue and reduce the burden about the health issue in the field of public health. The comprehensive new insights from this study will benefit social change, such as maintaining and promoting a positive health outcome in the children population.

Summary

Asthma is a chronic disease that constricts the lungs' airways and develops health complications such as shortness of breath, chest tightness, and coughing. Asthma remains the health issue in the field of public health that practitioners need to mitigate. There are a considerable amount of studies pertaining to asthmatic children. The previous studies have provided a piece of in-depth information on the risk factors, causes, symptoms, prevention, and asthma medications. However, there is insufficient evidence as to what, if there is a relationship between the amount of Albuterol (+ A. Sulfate or Salbutamol) whether using a spacer delivered in the lungs. At the same time, a healthcare provider provides users with proper instructions. Using an inhaler with or without a spacer, improperly affects the amount of asthma medication delivered in the lungs. Therefore,

asthmatic children will not be treated medically and encounter difficulties in obtaining the desired health outcome. This study focused on investigating the association of Albuterol (+ A. Sulfate or Salbutamol) with or without a spacer in children with asthma. Also, it investigated if the severity of asthma among children depends on the improper usage of the inhalation technique during administering medications. It was imperative to conduct this study to fill the literature gaps and develop a new conceptual framework to address asthma in the population. The findings of the study promote social change in the population and enhance the knowledge of healthcare providers leading to improving the medication delivery method to improve health and reduce the new incidence rate of the children.

Conclusion

Asthma, regardless of cause, is an often-chronic disease, and one that remains a significant concern to public health. Asthma is associated with adverse effects on children's health, and it is critical to investigate and identify solutions that reduce these adverse health effects. It remains imperative to investigate the complexity of these associated problems to determine effective solutions. Doing so will improve children's health and reduce the severity of the development of asthma in the population. The result of the study added information in the literature and provided additional knowledge on how to manage or control asthmatic children. The findings of this study have shown effective strategies exist for the target population, and health care providers and adherence to these strategies are critical in reducing the effects of asthma attacks, by extension, reducing the frequency of visits to ED. The results of this study provided new

insights that have promoted positive social change, providing a more in-depth understanding of asthma that children, parents, and health professionals can add to best practices in maintaining positive health status.

Section 2: Research Design and Data Collection

Introduction

The purpose of this study was to investigate the association of an Albuterol (+ A. Sulfate or Salbutamol) inhaler with and without spacers in children with asthma. In Section 1, I discussed the various effects of asthma in the target population and worldwide. This study was important to identify if the amount of medication delivered in the lungs with or without a spacer precipitates an asthma attack or episode. Through this research, I explored if the severity of asthma in children has a relationship with the instructions provided by a professional when administering drugs using an inhaler device. Overall, the results of this study can be used to develop innovative approaches to improve the delivery of medication and how to effectively use an inhaler, whether used with or without a spacer.

Research Design and Rationale

For the first research question, the dependent variable was the number of canisters of Albuterol (+ A. Sulfate or Salbutamol). The independent variable was Albuterol (+ A. Sulfate or Salbutamol) with or without a spacer. For the second research question, the dependent variable was the duration of asthma episodes or attacks in children, and the independent variable was with or without an inhalation technique instruction given by a professional.

In this quantitative research study, I used a cross-sectional design. The research design allowed me to further investigate the association of the amount of medication delivery with or without a spacer in the children population. I also identified the

association between the duration of asthma episodes or attacks and children with and without an inhalation instruction provided by a health care professional in the age group 7 to 12.

Methodology

Population

This study involved asthmatic children ages 7 to 12 years old. The Behavioral Risk Factor Surveillance System (BRFSS) Asthma Call-Back Survey (ACBS) collected data in all 50 states, including the District of Columbia and the U.S. territories (Centers for Disease Control and Prevention [CDC], 2015). In the 2015 child landline-cell phone combined data file, there were 1,146 records from nine states and Puerto Rico.

Sampling and Sampling Procedures

The BRFSS performed data collection in each state in the United States using a telephone survey system tailored to the individual's health risk factors, chronic diseases, and available preventative services (CDC, 2015). The BRFSS is partnered with the CDC to receive assistance in technical and methodological aspects by having interviewers and contractors with telephone call centers or universities in the state health department to conduct the BRFSS surveys throughout the year (CDC, 2015).

As far as the BRFSS ACBS questionnaire components, each state in the United States was mandated to use the published standard core questionnaires, modules, and stated questions. Random digit dialing techniques on both landlines and cell phones execute surveys during the data collection (CDC, 2015). The questionnaires in the surveys and any modifications to the questionnaires needed approval from the BRFSS

state coordinators and the CDC before it could be published. A proposal needed to be submitted if the BRFSS desired to add new questions in the questionnaires (CDC, 2015). Each state coordinator who submits a proposal requires presenting a rationale that supports the questions. The CDC (2015) requires each state coordinator to provide an explanation that supports the questions in the proposal, which are the (a) original question, (b) history of prior cognitive, (c) validity testing, (d) history of prior use, and (e) analytical plan. Most importantly, the proposed questions need to comply with the primary and secondary criteria related to a Healthy People 2020 objective or concern health issue and the needs of the stated department (CDC, 2015). There are different stages that the BRFSS states coordinators will undergo before approving the new questions in the questionnaires, which are (a) a technical review, (b) cognitive testing, and (c) field testing (CDC, 2015).

The BRFSS used poststratification as the statistical weighting method because the number of interviews within each state might differ according to the funding and size of regions – health districts. The age, sex, ethnicity, states, marital status, education level, homeownership, and type of phone ownership were the variables used to weight BRFSS data.

The data produced by federal agencies are accessible in public and may be reproduced without prior permission. However, it is necessary to ensure and critical to acknowledge that the CDC's BRFSS is the original source for the materials or data published in public. The Annual Survey Data section, comprehensive materials, data files, codebooks, design documents, and methodology are on the BRFSS's website.

Data Collection

Data collection for the ACBS included the use of both landline and cellphone (LLCP) samples, which were the required protocols in each state. Each state possesses a BRFSS interview schedule and expects to administer all calls for a given survey month within a similar sample month. It is possible to make up to 15 calling attempts for each phone number in the sample; however, state regulations must adhere to calling. The BRFSS (2019) protocols claimed that the five calling occasions to consider when conducting surveys are (a) to perform 20% of the interviews on weekdays, (b) to hold 80% on weeknights and weekends, (c) to note that schedules may be modified in observance to holidays and special events, (d) to make weekday calls just after the dinner hour, and (e) to make appointment call-backs during hours that are not scheduled for other interviews. ACBS collected data for the child from 26 states/territories. The child LLCP, who met data quality standards from the states/territories that performed both LLCP samples from 10 states/territories for the child data are available in public. The ACBS questionnaires were published in English and are available in Spanish. An adult aged 18 must be present to take a survey and is a proxy to the child.

Inclusion Criteria

The states that participated in the child LLCP ACBS in the year of 2015 and are included in the data and released in public are Connecticut, Kansas, Michigan, Minnesota, New Jersey, Ohio, Utah, and Puerto Rico.

Exclusion Criteria

The data that were gathered through LLCP samples from California, Georgia, Hawaii, Indiana, Maine, Massachusetts, Mississippi, Missouri, Montana, New Hampshire, New Mexico, New York, Oklahoma, Oregon, Pennsylvania, Rhode Island, Vermont, and Wisconsin were excluded because these states accumulated less than 75 records and thus were ineligible to produce reliable weights. Also, Florida, Illinois, Iowa, and Nevada did not collect child ACBS data. Florida did not collect cellphone data in January, February, March, and April 2015. The among weighted states with no record of ACBS participation in the LLCP data for children, including Minnesota, Nebraska, New Jersey, Texas, Utah, more than 10% were not included in the data. The modified adjustment factor method was used for these states for weighting purposes.

Power Analysis

To identify the required sample size for my study, I used the G*Power3 software. The G*Power3 software is used to determine the appropriate sample size for statistical analyses (Gignac & Szodorai, 2016). Using the G*Power3 analysis, the sample *t* tests, with effect size 0.5, alpha level 0.05, and power 0.95, a sample size of 176 was necessary. The power analysis occurs in the research process as well as during data analyses (Pek & Park, 2019). The power analyses are responsible for identifying the smallest sample size that is appropriate to detect the effect of the test statistics (Pek & Park, 2019). The study results relied on statistical power, and having a low sample size may cause a higher number of false negatives, false positives, or inability to show association (see Gjerdevik et al., 2019). Incorporating the Power*G3 software to identify

the sample size in my research study was an essential component in the data analysis in order to answer the research questions.

Instrumentation and Operationalization of Constructs

The secondary data were accessed from the CDC – ACBS that was conducted from 2006 to 2015 as part of the BRFSS. The BRFSS-ACBS data published in 2015 were used as the secondary data, which were accessed in the public database. However, permission to use the data was submitted to the CDC before accessing the codebook. The ACBS used the appropriate instruments for the current study as it collected information about chronic diseases, medications, socioeconomic status, behavioral, and environmental predictors that relate to better control of asthma.

Operationalization

There were two dependent variables in this research study: the amount of Albuterol (+ A. Sulfate or Salbutamol) inhaled and asthma duration (Table 1). There were three independent variables: age-group, Albuterol (+ A. Sulfate or Salbutamol) with or without a spacer, and professional inhalation instruction (Table 2). The independent variables were analyzed to identify the association with the dependent variables.

Table 1

Dependent Variables

Variables	Measurement	Survey question	Data values or units
Number of canisters Albuterol (+ A. Sulfate or Salbutamol)	Ratio	How many canisters of [medication's name] has [child's name] used in the past 3 months?	____canisters, don't know, none, refused
Asthma duration	Ratio	During the past three months, how many asthma episodes or attacks has [he/she] had?	None, don't know, refused

Table 2

Independent Variables

Variables	Measurement	Survey question	Data values or units
Age-group	Ordinal	Child asthma call-back age group questionnaire	Age 0-6, age 7-12, age 13-17
Albuterol (+ A. Sulfate or Salbutamol) with or without a spacer	Nominal	Does [he/she] use a spacer with [medication's name]?	Yes, no
Professional inhaler instruction	Nominal	Did a health professional show [him/her] how to use the inhaler?	Yes, no, never took asthma medication, never used

Data Analysis Plan

Statistical Package for Social Sciences (v 25) by IBM was used to perform data analyses for the asthma call-back survey 2015 data. Before performing data analyses, it is necessary to execute data cleaning and implementing screening procedures by examining the data thoroughly for entry error, to ensure that the data correctly reflects the responses provided by the participants, identify missing data and ensure that the variables needed to answer the research questions are included in the data. Since this was quantitative research, cleaning the data entailed identifying missing data from the data entry, which can be detected from the frequencies of the variable. During the data screening, it was vital to identify a pattern to the missing data, if any, double entries, outliers, and unreported results. Missing values were detected in the data, and therefore, a transformation feature was utilized to address them; likewise, the sample was sufficient for my study.

The data analysis was intended to answer the following research questions below and accept or reject hypotheses:

Research Question (RQ)1-Quantitative: What is the association between the amount of Albuterol (+ A. Sulfate or Salbutamol) inhaled with or without spacers among children 7 to 12 years old?

$H_{01:}$ There is no significant statistical association between the amount of Albuterol (+ A. Sulfate or Salbutamol) inhaled with or without spacers among children 7 to 12 years old.

$H_{1:}$ There is a significant statistical association between the amount of Albuterol (+ A. Sulfate or Salbutamol) inhaled with or without spacers among children 7 to 12 years old.

Research Question (RQ)2-Quantitative: What is the association between the number of asthma episodes or attacks with or without professional inhalation instruction on the proper delivery of Albuterol (+ A. Sulfate or Salbutamol) in children 7 to 12 years old?

H_{01}: There is no association between the number of asthma episodes or attacks with or without professional inhalation instruction on the proper delivery of Albuterol (+ A. Sulfate or Salbutamol) in children 7 to 12 years old.

H_{02}: There is an association between the number of asthma episodes or attacks with or without professional inhalation instruction on the proper delivery of Albuterol (+ A. Sulfate or Salbutamol) in children 7 to 12 years old.

Statistical Analysis

The statistical analysis was quantitative research involved descriptive statistics that demonstrated the frequency counts, ranges (high and low values), means, modes, median, and standard deviation. This particular test provided a summation of the sample and measures (Ho & Yu, 2015). The quantitative data are typically demonstrated as frequency distribution or relative frequency rather than percentage; the upper and lower limits will depend upon the size of the data (Kulkarni, 2016).

The first research question consisted of a dependent variable, the amount of Albuterol (+ A. Sulfate or Salbutamol) inhaled. The independent variable was with or

without a spacer. The second research question included a dependent variable, the number of asthma episodes or attacks. The independent variables included with or without a professional inhalation instruction on proper delivery of Albuterol (+ A. Sulfate or Salbutamol) and age-group (7-12). A sample *t* test was used to test the hypotheses and identify the association of the two variables. A sample *t* test was appropriate as it compared two groups and performed a comparison of characteristics of two variable groups (Plonsky, 2015). The sample size for the experimental and control groups is essential when using *t* tests in a study (Kim & Park, 2019). Using this particular test was imperative to identify the association by comparing the dependent and independent variables.

Threats to Validity

The BRFSS-ACBS within the CDC collects data for samples by administering the survey in the population as well as intending to be generalizable. Westreich, Edwards, Lesko, Cole, & Stuart (2018) stated that an external validity revolves around the generalizability of findings beyond the experimental context. External validity may arise as a problem if a study sample is not tailored to the target population or cannot assume the actual association in a study sample will be the exact effect in the population (Westreich et al., 2018). The confounding factors, nonexchangeability for generalizability, and nonrepresentative of a target population are the potential threats to this particular validity (Westreich et al., 2018). Confounding or covariate factors are the potential threats to external validity in my research study, including gender, proficiency level, and ethnicity of the child.

Internal validity determines whether causation can be inferred from the statistical conclusions (Richardson, Dalton, Shafer, and Patterson, 2016). This form of validity can be threatened by those similar threats to statistical conclusion validity and other assessment factors, including altering the instrument over time or test exposure (Richardson et al., 2016). Confounding factors and selection biases can threaten internal validity (Westreich et al., 2018). The study employs a cross-sectional design, which does not apply to internal validity because the causal relationships cannot be certainly proven.

Statistical conclusion validity determines the accuracy of inference about the presence and strength of the relationship between two variables (Richardson et al., 2016). Additionally, it can be threatened by measurement limits (e.g., restricted range), measurement error (e.g., unreliability), incorrectly applied statistics, unreliable treatment implementation, and other sources of variance introduced into the experimental setting as well as by low statistical power (Richardson et al., 2016). These threats can increase the chance of Type 1 or Type II error or the additional error called Type III error by some concluding significance or non-significance when in fact, the assessments or the treatments were not correctly implemented (Richardson et al., 2016).

Ethical Procedures

The ethical concern with the BRFSS with ACBS data was that the Institutional Review Board (IRB) required that asthma should be discussed with the participants during an interview process in some states, and other states do not require asthma to be disclosed. The interviewers must be attentive with the consent informed or a code number on file before a survey can be administered. A code one (1) is indicated on the file, in

which the state does require action to link the responses from the two interviews. Otherwise, ACBS cannot be performed, and there will be no record on file if consent was denied.

Permission request was submitted to the CDC to utilize the ACBS data conducted in 2015 within the BRFSS. The CDC provided instructions on obtaining a public data file tailored to asthma data in children. The Walden University Institutional Review Board (IRB number: 07-16-20-0741112) has approved my doctoral study to use the ACBS data conducted in 2015 in the CDC to perform data analyses. My research data and the ACBS data focused on the children's population. According to Joshua, Zwi, Moran, & White (2015), vulnerable children group experience several obstacles to health care, which include sub-optimal access compounded by social disadvantage and culture or linguistic barriers, were not aware of care services are being offered, and capacity to use them, insufficient awareness by health providers of their complex health needs. However, an 18-year or older adult is required to take the questionnaires of the survey for the child. Therefore, it does not fall onto the vulnerable children group.

Summary

In section 2, I discussed the cross-sectional research design in the study to investigate further the statistically significant association between the variables at the 0.05 significance level. This study tailored to asthmatic children ages 7 to 12, and data was extracted from the BRFSS – ACBS within the CDC published in 2015. The survey dataset was analyzed using SPSS (v.25) and performed descriptive analysis, frequencies, and sample *t* tests.

Section 3: Presentation of the Results and Findings

Introduction

The primary purpose of the research study was to thoroughly investigate the association between the amount of inhalation of Albuterol (+ A. Sulfate or Salbutamol) and the use of spacers among 7 to 12-year-old children with asthma. In Section 3, I provide the results of the statistical analyses and the presentation of findings in tables and figures. Additionally, I demonstrate the different components of the data collection for the BRFSS ACBS dataset that was conducted in 2015. This section involves the answers to the research questions as follows:

Research Question (RQ)1-Quantitative: What is the association between the amount of Albuterol (+ A. Sulfate or Salbutamol) inhaled with or without spacers among children 7 to 12 years old?

$H_{01:}$ There is no significant statistical association between the amount of Albuterol (+ A. Sulfate or Salbutamol) inhaled with or without spacers among children 7 to 12 years old.

$H_{1:}$ There is a significant statistical association between the amount of Albuterol (+ A. Sulfate or Salbutamol) inhaled with or without spacers among children 7 to 12 years old.

Research Question (RQ)2-Quantitative: What is the association between the number of asthma episodes or attacks with or without professional inhalation instruction on the proper delivery of Albuterol (+ A. Sulfate or Salbutamol) in children 7 to 12 years old?

H_{01}: There is no association between the number of asthma episodes or attacks with or without professional inhalation instruction on the proper delivery of Albuterol (+ A. Sulfate or Salbutamol) in children 7 to 12 years old.

H_{02}: There is an association between the number of asthma episodes or attacks with or without professional inhalation instruction on the proper delivery of Albuterol (+ A. Sulfate or Salbutamol) in children 7 to 12 years old.

Data Collection of Secondary Data Set

Data collection for the ACBS and the use of both LLCP samples were the required protocols in each state. ACBS collected data for children from 26 states/territories. The child LLCP who met data quality standards from the states/territories using both LLCP samples from 10 states/territories for the child data were available in public. The ACBS questionnaires were published in English and were available in Spanish. An adult aged 18 or above had to be present to take a survey and was a proxy to the child.

Timeframe for Data Collection

The ACBS undergoes a pilot study each year, which is a comprehensive asthma survey administered in 50 states, the District of Columbia, and participating territories with BRFSS using both landlines and cellphones. The BRFSS has discovered a new approach to identify respondents with asthma to expand interviewing on a call-back basis. Thus, it included a larger sample size in each area. States typically follow a suggested BRFSS interviewing schedule and complete all calls for a given survey month within a similar sample month. There are up to 15 calling attempts that may be made for

each phone number in the sample, but it depends on state regulations for calling and outcomes of previous calling attempts. The data are available within 6 months from the end of the calendar year of data collection.

Response Rate

The BRFSS respondents who reported ever being diagnosed with asthma were eligible for the asthma call-back. The weighting methodology for the BRFSS was changed significantly, and cell phone samples were added to the traditional landline phone samples. The number of states or territories that respond in the ACBS has increased each year. However, ACBS follows a rule of not reporting or interpreting point estimates based on fewer than 50 unweighted respondents.

Demographic Characteristics of the Sample

Tables 3, 4, and 5 display the demographic information of the sample in the study. The study involved $N = 416$ participants aged 7 to 12 years with a diagnosis of asthma. Boys ($n = 243$) represented 58.4% and girls ($n = 172$) represented 41.3%. These individuals lived in Connecticut (10.3%), Kansas (15.4%), Michigan (9.1%), Minnesota (11.3%), Nebraska (9.4%), New Jersey (13.5%), Ohio (4.6%), Texas (7.5%), Utah (11.1%), and Puerto Rico (7.9%). As part of the screening process, these children's parents were interviewed to determine if their child would be eligible for the study. Because this is a vulnerable population, an 18-year-old or older must be present at the interview time for completion. This study involved children 7 to 12 years old who were diagnosed with asthma.

Table 3

State of Child

State	Frequency	Percent	Valid percent	Cumulative percent
Connecticut	43	10.3	10.3	10.3
Kansas	64	15.4	15.4	25.7
Michigan	38	9.1	9.1	34.9
Minnesota	47	11.3	11.3	46.2
Nebraska	39	9.4	9.4	55.5
New Jersey	56	13.5	13.5	69.0
Ohio	19	4.6	4.6	73.6
Texas	31	7.5	7.5	81.0
Utah	46	11.1	11.1	92.1
Puerto Rico	33	7.9	7.9	100.0
Total	416	100.0	100.0	

Table 4

Child Age Age-Group Call-Back

Age	Frequency	Percent	Valid percent	Cumulative percent
Age 7 - 12	416	100.0	100.0	100.0

Table 5

Gender of Child

Gender	Frequency	Percent	Valid percent	Cumulative percent
Boy	243	58.4	58.4	58.4
Girl	172	41.3	41.3	99.8
Refused	1	.2	.2	100.0
Total	416	100.0	100.0	

Results of the Study

The chi-square test was applied to test the association between two variables. If the chi-square test rejects the null hypothesis, then there is an association between the two variables, which means that there is a statistical association between the two variables (Zhu & Fang, 2016). Testing for association between two variables is routinely performed in statistical applications, and Pearson's Ch-Sq statistic is widely applied to the test if both variables of interest are ordinal or continuous to measure the association (Shih & Fay, 2017). I used Cramer's V test to evaluate and measure the strength of the association between the amount of Albuterol (+ A. Sulfate or Salbutamol) inhaled with or without spacers among children for the first research question as well as the association between the number of asthma episodes or attacks and with or without a professional inhalation instruction on the proper delivery of Albuterol (+ A. Sulfate or Salbutamol) in children ages 7 to 12. Cramer's V test and Phi solely confirmed an association between the two variables, the direction of an association, the strength of an association, and the statistical significance of the association between the independent and dependent variables found in this study. Amran, Zaaba, Singh, and Marashih (2017) stated that the independent variable could be classified as the variable that cannot be changed for the result. In contrast, the dependent variable can be classified as the variable that can be changed for the result.

Statistical Assumptions

The chi-square assumptions, including the data in the cells, have frequencies or counts of cases rather than percentages or some other transformation of the data. The

levels of the variables are mutually exclusive, and thus, a particular subject fits into one and only one level of each of the variables. There are two variables both measured at the nominal and ordinal levels.

Research Question (RQ)1-Quantitative: What is the association between the amount of Albuterol (+ A. Sulfate or Salbutamol) inhaled with or without spacers among children 7 to 12 years old?

The expected count is what I would expect to observe if there was no association. In table 6 and figure 1, I would expect 20 participants have used a spacer, 11 participants did not use a spacer, and 0.4 participants indicated that medication has a built-in spacer or does not need a spacer with zero number of canisters inhaled. I would expect 49 participants have used a spacer, 37 did not use a spacer, and one has indicated that medication has a built-in spacer or does not need a spacer with one number of canisters inhaled. I would expect 11 children have used a spacer, 32 did not use a spacer, and one has stated that medication has a built-in spacer or does not need a spacer with the amount of two canisters inhaled. I would expect ten children used a spacer, six did not use a spacer, and 0.2 indicated that medication has a built-in spacer or does not need a spacer with the amount of three canisters inhaled. I would expect 0.6 children used a spacer, 0.4 did not use a spacer, and zero of the participants indicated that medication has a built-in spacer or does not need a spacer with the amount of 4 canisters inhaled I would expect 0.6 children used a spacer, 0.4 did not use a spacer, and zero of the participants indicated that medication has a built-in spacer or does not need a spacer with the amount of five canisters inhaled. I would expect 0.6 children used a spacer, 0.4 did not use a spacer, and

zero of the participants indicated that medication has a built-in spacer or does not need a spacer with the amount of eight. I would expect two children used a spacer, one child did not use a spacer, and zero of the participants indicated that medication has a built-in spacer or does not need a spacer with the amount of 12 canisters inhaled canisters inhaled.

Table 6

Albuterol (+ A. Sulfate or Salbutamol) Medication With or Without a Spacer

			Albuterol (+ A. sulfate or salbutamol: if spacer used			
			Yes	No	Medication has a built-in spacer/does not need a spacer	Total
Albuterol (+ A. sulfate or salbutamol): Number of canisters	0	Count	23	11	0	34
		Expected Count	20.4	13.2	.4	34.0
	1	Count	43	37	2	82
		Expected Count	49.1	31.9	1.0	82.0
	2	Count	12	7	0	19
		Expected Count	11.4	7.4	.2	19.0
	3	Count	11	5	0	16
		Expected Count	9.6	6.2	.2	16.0
	4	Count	1	0	0	1
		Expected Count	.6	.4	.0	1.0
	5	Count	1	0	0	1
		Expected Count	.6	.4	.0	1.0
	8	Count	0	1	0	1
		Expected Count	.6	.4	.0	1.0
	12	Count	3	0	0	3
		Expected Count	1.8	1.2	.0	3.0
Total		Count	94	61	2	157
		Expected Count	94.0	61.0	2.0	157.0

Figure 1 shows the number of canisters inhaled whether a spacer is used among children aged 7 to 12 years.

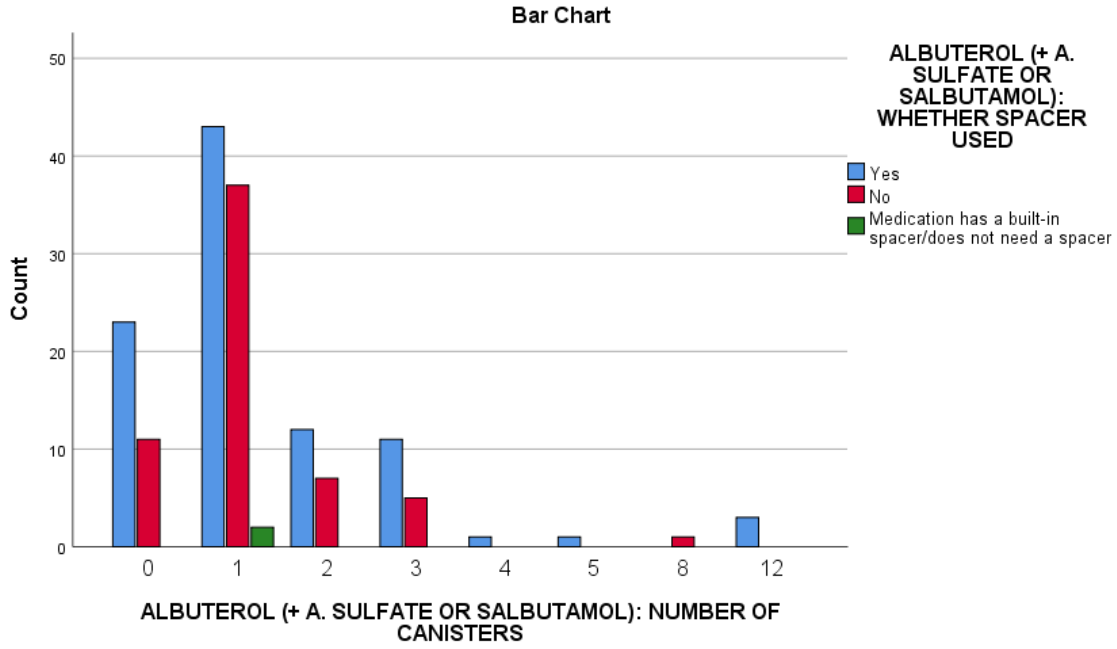

Figure 1. The number of canisters inhaled whether a spacer is used among children aged 7 to 12 years.

In table 7, the chi-square test, $X^2 = 9.479$, $p = .799$. The statistical test tells us that there is no significant statistical association between the amount of the Albuterol (+ A. Sulfate or Salbutamol) inhaled with or without spacers among children ages seven to 12 years old. We accept the null hypothesis and reject the alternative hypothesis.

Table 7

Chi-Square Tests

	Value	*df*	Asymptotic significance (2-sided)
Pearson Chi-Square	9.479[a]	14	.799
Likelihood ratio	12.275	14	.584
Linear-by-linear association	1.201	1	.273
N of valid cases	157		

a. 16 cells (66.7%) have expected count less than 5. The minimum expected count is .01.

Table 8 shows the strength of the association between the amount of the Albuterol (+ A. Sulfate or Salbutamol) inhaled with or without spacers among children ages seven to 12 years old variables is weak by examining the phi and Cramer's V test.

Table 8

Symmetric Measures

		Value	Approximate significance
Nominal by nominal	Phi	.246	.799
	Cramer's V	.174	.799
N of valid cases		157	

Research Question (RQ)2-Quantitative: What is the association between the number of asthma episodes or attacks with or without professional inhalation instruction on the proper delivery of Albuterol (+ A. Sulfate or Salbutamol) in children 7 to 12 years old?

The expected count is what I would expect to observe if there was no association. In table 9 and figure 2, I would expect 340 children received professional inhaler instruction, 11 did not receive professional inhaler instruction, and two children who did not know if they received professional inhaler instruction with zero asthma episodes or attacks. I would expect 100 children received professional inhaler instruction, three children did not receive professional inhaler instruction, and 0.7 did not know if they have received professional inhaler instruction with 1 number of asthma episodes or attacks. I would expect 63 children received professional inhaler instruction, two did not receive professional inhaler instruction, and 0.4 did not know if they have received professional inhaler instruction with two asthma episodes or attacks. I would expect 28 children received professional inhaler instruction, 0.9 did not receive professional inhaler instruction, and 0.2 did not know if they have received professional inhaler instruction with three asthma episodes or attacks. I would expect 13 children received professional inhaler instruction, 0.4 did not receive professional inhaler instruction, and 0.1 did not know if they have received professional inhaler instructions who had four asthma episodes or attacks. I would expect 14 children received professional inhaler instruction, 0.4 did not receive professional inhaler instruction, and 0.4 did not know if they have received professional inhaler instruction, which had five asthma episodes or attacks. I

would expect 12 children received professional inhaler instruction, 0.4 did not receive professional inhaler instruction, and 0.1 did not know if they have received professional inhaler instruction, which had six asthma episodes or attacks. I would expect five children received professional inhaler instruction, 0.2 did not receive professional inhaler instruction, and zero of the participants indicated that they do not know if they have received professional inhaler instructions who had seven asthma episodes or attacks. I would expect two children received professional inhaler instruction, 0.1 did not receive professional inhaler instruction, and zero of the participants indicated that they do not know if they have received a professional inhaler, which had eight asthma episodes or attacks. I would expect one child received professional inhaler instruction, zero children did not receive professional inhaler instruction, and zero of the participants indicated that they do not know if they have received a professional inhaler, which had nine asthma episodes or attacks. I would expect six children received professional inhaler instruction, 0.2 did not receive professional inhaler instruction, and zero of the participants indicated that they do not know if they have received a professional inhaler, which had ten asthma episodes or attacks. I would expect one child received professional inhaler instruction, zero children did not receive professional inhaler instruction, and zero of the participants indicated that they do not know if they have received professional inhaler instruction, which had fifteen asthma episodes or attacks. I would expect three children received professional inhaler instruction, 0.1 did not receive professional instruction, and zero of the participants indicated that they do not know if they have received professional inhaler instruction, which had twenty asthma episodes or attacks. I would expect two children

received professional inhaler instruction, 0.1 did not receive professional inhaler instruction, and zero of the participants indicated that they do not know if they have received a professional inhaler instruction that had thirty asthma episodes or attacks. I would expect one child received professional inhaler instruction; zero of the participants did not receive professional instruction, and zero of the participants indicated that they do not know if they have received professional inhaler instruction, which had forty asthma episodes or attacks. I would expect one child received professional inhaler instruction; zero of the participants did not receive professional instruction, and zero of the participants indicated that they do not know if they have received professional inhaler instruction, which had sixty asthma episodes or attacks. I would expect two children received professional inhaler instruction, 0.1 did not receive professional inhaler instruction, and zero of the participants indicated that they do not know if they have received professional inhaler instruction, which had ninety asthma episodes or attacks.

Table 9

The Number of Episodes or Attacks and Professional Inhaler Instruction

			Professional inhaler instruction			
			Yes	No	Don't know	Total
Number of episodes/attacks	0	Count	340	11	2	353
		Expected Count	339.8	10.9	2.3	353.0
	1	Count	104	0	0	104
		Expected Count	100.1	3.2	.7	104.0
	2	Count	62	3	0	65
		Expected Count	62.6	2.0	.4	65.0
	3	Count	25	3	1	29
		Expected Count	27.9	.9	.2	29.0
	4	Count	13	0	0	13
		Expected Count	12.5	.4	.1	13.0
	5	Count	14	0	0	14
		Expected Count	13.5	.4	.1	14.0
	6	Count	11	1	0	12
		Expected Count	11.6	.4	.1	12.0
	7	Count	5	0	0	5
		Expected Count	4.8	.2	.0	5.0
	8	Count	2	0	0	2
		Expected Count	1.9	.1	.0	2.0
	9	Count	1	0	0	1
		Expected Count	1.0	.0	.0	1.0

(table continues)

			Professional inhaler instruction			
			Yes	No	Don't know	Total
Number of episodes/attacks	10	Count	5	1	0	6
		Expected Count	5.8	.2	.0	6.0
	15	Count	1	0	0	1
		Expected Count	1.0	.0	.0	1.0
	20	Count	3	0	0	3
		Expected Count	2.9	.1	.0	3.0
	30	Count	2	0	0	2
		Expected Count	1.9	.1	.0	2.0
	40	Count	1	0	0	1
		Expected Count	1.0	.0	.0	1.0
	60	Count	1	0	0	1
		Expected Count	1.0	.0	.0	1.0
	90	Count	1	0	1	2
		Expected Count	1.9	.1	.0	2.0
Total		Count	591	19	4	614
		Expected Count	591.0	19.0	4.0	614.0

Figure 2 shows a bar chart of the number of episodes or attacks and whether the children received professional inhaler instruction.

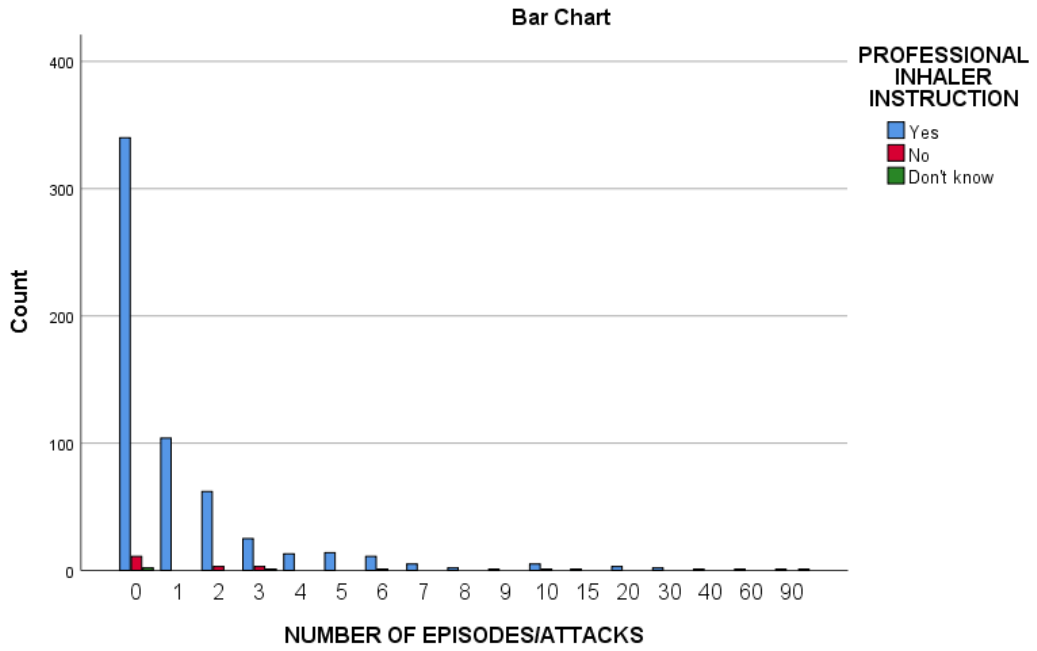

Figure 2. The number of asthma episodes or attacks if a professional inhaler instruction was provided.

In table 10, the chi-square test, $X^2 = 95.541$, $p = .000$. The statistical test tells us that there is an association between the number of asthma episodes or attacks and with or without a professional inhalation instruction on proper delivery of Albuterol (+ A. Sulfate or Salbutamol) in children ages seven to 12 years old. We reject the null hypothesis and accept the alternative hypothesis.

Table 10

Chi-Square Tests

	Value	*df*	Asymptotic significance (2-sided)
Pearson Chi-Square	95.541[a]	32	.000
Likelihood ratio	27.806	32	.679
Linear-by-linear Association	39.926	1	.000
N of valid cases	614		

a. 42 cells (82.4%) have expected count less than 5. The minimum expected count is .01.

In table 11, we can see that the strength of the association between the number of asthma episodes or attacks and with or without a professional inhalation instruction on proper delivery of Albuterol (+ A. Sulfate or Salbutamol) in children ages 7 to 12 years old is strong by examining the phi and Cramer's V test.

Table 11

Symmetric Measures

		Value	Approximate significance
Nominal by nominal	Phi	.394	.000
	Cramer's V	.279	.000
N of valid cases		614	

Summary

The first research question intends to investigate the association between the amount of the Albuterol (+ A. Sulfate or Salbutamol) inhaled with or without spacers among children ages seven to 12 years old. It was found that there is no significant statistical association between the amount of the Albuterol (+ A. Sulfate or Salbutamol) inhaled with or without spacers among children ages seven to 12 years old. Therefore, we fail to reject the null hypothesis and reject the alternative hypothesis. The phi and Cramer's V test indicated that the association between the variables is weak. The second question intends to investigate the association between the number of asthma episodes or attacks with or without a professional inhalation instruction on proper delivery of Albuterol (+ A. Sulfate or Salbutamol) in children ages seven to 12 years old. The result of this study showed that there is an association between the number of asthma episodes or attacks and with or without a professional inhalation instruction on proper delivery of Albuterol (+ A. Sulfate or Salbutamol) in children ages seven to 12 years old. Therefore, we reject the null hypothesis and accept the alternative hypothesis. The phi and Cramer's V test indicated that the association between the variables is strong. While section 3 has demonstrated the statistical analysis findings, section 4 discussed the interpretation of the findings in-depth, limitations of the study, and recommendations.

Section 4: Application to Professional Practice and Implications for Social Change

Introduction

The primary purpose of this research study was to thoroughly investigate the association between the amount of inhalation of Albuterol (+ A. Sulfate or Salbutamol), whether or not using a spacer. I also examined the association between the number of asthma episodes or attacks with or without professional inhalation instruction on the proper delivery of Albuterol (+ A. Sulfate or Salbutamol) in children 7 to 12 years old. The nature of this study was a cross-sectional research design data analysis that was conducted using Statistical Package for the Social Sciences (v.25) Software. Using quantitative research for this study allowed me to develop numerical data that provided in-depth information that supports generalizations related to the phenomenon under study. I found that there is no significant statistical association between the amount of Albuterol (+ A. Sulfate or Salbutamol) inhaled with or without spacers among children ages 7 to 12. Additionally, I found that there is an association between the number of asthma episodes or attacks with or without professional inhalation instruction on the proper delivery of Albuterol (+ A. Sulfate or Salbutamol) in children ages 7 to 12.

Interpretation of the Findings

The first research question tested the association between the amount of inhalation of Albuterol (+ A. Sulfate or Salbutamol), whether using a spacer, in children ages 7 to 12. The association between the amount of Albuterol (+ A. Sulfate or Salbutamol) inhaled with or without spacers among children ages 7 to 12 was not statistically significant ($p > 0.05$). The strength of association between the amount of

Albuterol (+ A. Sulfate or Salbutamol) inhaled with or without spacers was weak based on the phi and Cramer's V test. Therefore, the number of doses inhaled in the lungs does not depend on with or without a spacer. Previous studies have shown that using spacers with an inhaler device is beneficial to improve drug delivery in the lungs as well as prevent the medication from escaping in the air (Pessôa et al., 2018). A spacer is intended to help the lungs absorb the appropriate amount of dose for effective treatment (Farahbakhsh, 2020). However, the findings in this study do not align with the previous studies. The findings of this study do not confirm whether using a spacer increases the chance for the medication to be inhaled in the lungs.

The second research question tested the association between the number of asthma episodes or attacks with or without professional inhalation instruction on the proper delivery of Albuterol (+ A. Sulfate or Salbutamol) in children ages 7 to 12. The association between the number of asthma episodes or attacks with or without professional inhalation instruction on the proper delivery of Albuterol (+ A. Sulfate or Salbutamol) in children ages 7 to 12 was statistically significant ($p < 0.05$). Phi and Cramer's test indicated that the strength of association between the number of asthma episodes or attacks with or without professional inhalation instruction on the proper delivery of Albuterol (+ A. Sulfate or Salbutamol) was strong. When children between the ages of 7 and 12 receive professional inhaler instructions, they are more likely not to have asthma episodes or attacks. The children may have fewer visits to the ED as a result of this observation.

On the other hand, if children do not receive professional inhaler instruction, they may not know what to do during asthma episodes or attacks, and there is a higher likelihood that they visit the ED for clinical evaluation and treatment. This result shows the importance of receiving professional inhaler instruction to effectively manage asthma to decrease the number of asthma episodes or attacks. The results imply a critical need for children to learn the proper way to use an inhaler device to control their asthma symptoms from a professional to reduce asthma episodes or attacks and ED visits. In Table 9, (N = 340), children received professional inhaler instruction, which had 0 asthma episodes or attacks. N = 1 indicated "yes" received professional inhaler instruction, N = 0.1 indicated "no" did not receive professional inhaler instruction, and N = 0.0 indicated that children who "do not know" if they received professional inhaler instruction; they had 90 asthma episodes or attacks.

The statistical test in Table 9 revealed that the more professional inhaler instruction children received, the less they experienced asthma episodes or attacks. In contrast, the children who did not receive professional inhaler instruction were more likely to experience several asthma episodes or attacks. Previous studies revealed that the effectiveness requires that patients use an inhalation device with a proper technique, and health care providers must have firm skills to use inhalation devices in order to teach their patients effectively (Kellman, Iserson, Levy, McIntosh, & Maxwell, 2020). Most patients who visit the ED with asthma do not have adequate exposure to asthma education (Losappio et al., 2019). However, the findings of my analysis in this study are aligned with the literature in finding that the leading cause for children to visit the ED

may occur due to not being able to operate an inhaler device properly when asthma episodes or attacks happen.

Application of Transtheoretical Change or Stages of Change

The theoretical framework that was applied in this study was transtheoretical change or stages of change. The transtheoretical change model was used to examine an individual's readiness to take action on a new behavior to improve their health. The process of behavioral change involves five stages of change, including precontemplation, contemplation, preparation, action, and termination (Keshmiri et al., 2017). Children must be provided with relevant information by their parents or health care providers about asthma and to recognize the symptoms of asthma to take actions to manage asthma immediately effectively. Children must be educated and provided with guidance on the proper use of an inhaler device for the sufficient amount of medication inhaled into the lungs to reduce asthma episodes or attacks and ED visits. Based on the results of this study, the transtheoretical model or stages of change imply that the children need to understand the medical complications of asthma, and they must take the appropriate actions. Changing their behavior may be essential to manage asthma effectively by firmly adhering to the instructions on how to use inhaler devices to maximize the appropriate amount of medication inhaled in the lungs to decrease the number of asthma episodes or attacks.

Limitations of the Study

The limitations identified in this study included that the primary variables to test for an association did not have values, and the variables associated in this study presented

a large number of missing values as a sample of 176 was necessary. This factor may have significantly affected the results as to whether there is an association between the amount of the Albuterol (+ A. Sulfate or Salbutamol) inhaled with or without spacers among children ages 7 to 12.

Recommendations

Further study is needed to conduct an in-depth exploration of how the age of a child may influence the way they use an inhaler device properly, with or without a spacer. There is a need for further research to identify a recommendable treatment plan for a patient with asthma who has coronavirus disease 2019 (COVID-19). Researchers need to further examine the efficacy of the interventions on managing asthma to help reach the desired health outcome. There is a need for further investigation on whether children are more likely to adhere to instructions provided by pharmacists and other clinicians. For children who inhaled the appropriate amount of medication but do not show improvement, it may be necessary to look at other factors, such as a history of asthma or an underlying medical complication. It may also be necessary to research if children are receiving information in their preferred learning style on how to use an inhaler properly. Future researchers could also look at if children with a high number of asthma attacks or episodes receive educational materials from their health care providers. Researchers could also examine if the amount of medication inhaled in the lungs depends on a spacer or medication with a built-in spacer without professional instruction. Another future research question may be if it is more effective when a pharmacist provides education on asthma management and the proper use of inhaler devices to a child rather

than other clinicians. It may also be necessary to evaluate and focus on the asthma treatment guidelines to align patient care at the policy level. There is a significant impact when a pharmacist includes training on asthma control to children as they focus on the asthma action plan and equip them with additional resources to better provide care for children with asthma (Kovačević et al., 2018). Improperly using an inhaler medication can lead to poor asthma management, leading to adverse outcomes. Deeks et al. (2018) stated that pharmacists have demonstrated that they can improve asthma control by increasing the appropriate use of medication.

Implications for Professional Practice and Social Change

Professional Practice

Clinics, hospitals, and pharmacies need to have current guidelines for managing asthma. Professional clinicians should be competent and have broad knowledge about asthma and the use of inhaler devices. Providers must commit to continuing education on asthma to enhance their skills and expertise to implement the interventions for managing asthma effectively. With minimal training, pharmacists would be able to perform a device training educational session to all patients with asthma with the outcome of improvements in asthma management (Basheti A., Salhi, Basheti M., Hamadi, & Al-Oerem, 2019). There is a confirmatory that poor inhaler technique contributes to poor management and loss of asthma control with children requiring to take reliever medications (Goodwin & Heraghty, 2015). There are at least 25% of children with asthma who do not receive any verbal instructions on how to use their inhaler devices sufficiently (Goodwin & Heraghty, 2015). For those who do, the quality and duration of

instructions are often insufficient (Goodwin & Heraghty, 2015). All types of care providers need to provide the highest quality care service to their inpatient and outpatient children to ensure that expectations are met (Park, G., Park, K., & Agarwal, 2016). It may be essential for clinical facilities to develop and implement some other ways to deliver instructions on how to use inhaler devices correctly in children. The methods of teaching aligned with children's learning styles may increase their adherence to the guidelines because they may have a better understanding of the whole sequence steps.

Social Change

The results of this study serve to develop a positive social change at an individual, family, community, organization, and policy levels. The results transform into a positive social change in human interactions as they become more aware of asthma and attain the critical interventions to adhere to control asthma effectively. The parents and relatives may become more aware of the problems that will increase their commitment to guiding their children throughout the asthma treatment to improve symptoms. Additionally, the parents and relatives will provide social support and commit to counseling their child who has asthma by following the clinicians' guidelines to improve poor asthma outcomes. The parents of children with asthma may also become a representative member of a community to offer a forum to discuss the new insights found within the individuals at large to encourage them to take action for the health improvement of their children with asthma.

The results of this study signify the need for health policymakers to reevaluate the guidelines of clinics to ensure that they stay current with the instructions for asthma

management. Also, the clinics must ensure to be equipped with educational materials about asthma that align with the needs of patients with asthma to maximize the efforts to reach their desired health outcome. Ultimately, healthcare providers must take immediate action after learning new insights about the importance of using inhaler devices correctly to alleviate the number of children admitted to the ED or hospitalization rate.

Conclusion

Children with asthma remain to be a problem in the field of public health that needs to mitigate. Asthma contributes to adverse health outcomes that limit a child's daily activities and even increase school absenteeism. An inhaler device is a standard medication treatment for asthma with or without a spacer. A spacer is a tool that can be attached to the inhaler device to help doses from escaping in the air, if operated correctly, according to a previous study. This research found that there is no significant statistical association between the amount of the Albuterol (+ A. Sulfate or Salbutamol) inhaled with or without spacers among children ages seven to 12 years old when examining the association between the amount of the Albuterol (+ A. Sulfate or Salbutamol) inhaled with or without spacers among children ages seven to 12 years old. Additionally, this study also investigated the association between the number of asthma episodes or attacks and with or without a professional inhalation instruction on proper delivery of Albuterol (+ A. Sulfate or Salbutamol) in children ages seven to 12 years old and it has found that there is an association between the number of asthma episodes or attacks and with or without a professional inhalation instruction on proper delivery of Albuterol (+ A. Sulfate or Salbutamol) in children ages seven to 12 years old. The association between the

amount of the Albuterol (+ A. Sulfate or Salbutamol) inhaled with or without spacers among children ages seven to 12 years old was less clear. However, the statistical significance between the number of asthma episodes or attacks with or without a professional inhalation instruction on proper delivery of Albuterol (+ A. Sulfate or Salbutamol) in children ages seven to 12 years old confirmed the findings from the previous studies. When children do receive professional inhaler instructions, they are most likely not to have asthma episodes or attacks, leading to fewer visits to the ED. Subsequently, if children do not receive professional inhaler instruction, they are most likely to not know what to do during asthma episodes or attacks. As a result, there is a likelihood that they will visit the ED for treatment. This study of the phenomenon warrants further research to deeply explore the effectiveness of the interventions for controlling asthma as well as to investigate if there are other factors such as underlying medical conditions that may prohibit the patients from recovering or worsening asthma symptoms. The results of the study warrant a positive social change at an individual, community, family, policy, and organizational levels to increase awareness and conduct reevaluations of guidelines about the use of inhaler devices to improve asthma treatment and management.

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