

Asthma Education for Children Aged Three to Five Years in Two Community Settings

by

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Abstract

Asthma currently affects approximately 10% of children in Australia. The disease is associated with significant rates of morbidity and mortality. Considerable research has been conducted to identify evidence-based practices and therapeutic interventions that may prove useful in assisting the management of asthma. There has been an effort to find educational interventions that will increase the ability of young children to understand asthma. Increasing children's knowledge of the disease can improve their management practices and health status.

The original contribution of this research to knowledge is that very young children with asthma and those without asthma were able to learn about asthma and its management when provided with education in a community setting. The research involved the use of age-appropriate asthma education resources, the Children's Asthma Education Resource Package (CAERP). These resources were used independently by educators and parents in early childhood centres and homes, which led to an improvement in the asthma-related knowledge of very young children. Improvements in the asthma health of very young children were found; however, most of these improvements were not statistically significant.

When developed, the CAERP was one of the few resources specifically developed and evaluated for very young children with asthma. The CAERP consists of a picture book and three video segments designed to educate children about asthma and its management. Earlier research evaluating the CAERP components in controlled experimental settings (University, medical centres, and hospitals) found that these resources significantly improved children's knowledge and management of asthma, improved adherence to medication regimens, and consequently improved the health status of children with asthma. The current research differs from this earlier research by evaluating the effectiveness of the CAERP in community settings.

This research reports on two studies evaluating whether the independent use of the CAERP by children, educators, and parents in community settings was effective in improving

the asthma-related knowledge and asthma management and health of children. Two quasi-controlled experimental studies were conducted to evaluate the CAERP when it was used to educate children aged 3 to 5 years of age in early childhood centres and homes in Queensland, Australia. The first study, Study One involved 564 children, aged 3 to 5 years. Some of the children had an asthma diagnosis; others did not. The children attended either child care, kindergarten, or preschool. Experimental class groups were given the CAERP for three months. At the beginning of the study, all children were tested individually about their knowledge of asthma and its management. This testing was repeated two weeks after the baseline test, and again four weeks after the second test. Results showed children receiving the educational intervention had significantly increased gains in asthma-related knowledge compared to children in the control groups.

Study Two involved 92 children diagnosed with asthma who required daily medication. Upon enrolment into the Study, each child's parents were given the CAERP and requested to use these resources with their child at least once during the first two weeks of the study. Parents completed a daily diary noting information on the child's symptoms, compliance with medication, and use of medical services. Results showed children in the experimental group required fewer visits to the doctor than children in the control group. There was a small to medium positive effect on the asthma health and management of children who used the CAERP though this result was not statistically significant.

The results of this research indicate that resources developed using sound educational principles are a useful and cost-effective means of providing even the youngest children with information about asthma and its management. This research recommends possible directions for future research in the field of health education for very young children.

Acknowledgements

As an experienced early childhood educator, I am aware of the enormous challenges experienced by children with chronic medical conditions. Through my interactions with children with asthma and their families, I have gained insights into the difficulties faced by them in managing their disease and in receiving health education appropriate to their age. I believe that the lack of effective and age-appropriate health education may contribute adversely to the children's quality of life in their early childhood years.

My work is invigorated by the belief that young children deserve an optimal quality of life, regardless of their medical condition. Appropriate educational initiatives and child-friendly health care systems are vehicles for improving the lives of many young children. The challenges faced by young children inspired me to explore how health education experiences for these individuals can be improved.

Young children need improved health education in all sectors of healthcare. These children require education programs that are sensitive to their needs and unique characteristics. We must increase our understanding of how children best learn the insights, skills, and attitudes they need to manage their disease.

This research viewed asthma as just one example of a chronic disease experienced during early childhood that can have its adverse effects mitigated through quality health education. With the implementation of improved health education programs, we can enhance the health outcomes for children, families, and communities. I hope the results of this research will have widespread applicability when it comes to developing health education initiatives for young children and their caregivers. Without question, I believe this research project will stimulate further health education efforts in programs dedicated to young children.

In completing this work, many people have offered invaluable input, advice, critique, and practical assistance. Firstly, I would like to acknowledge the valuable contributions of the many children, parents, educators, and healthcare professionals who participated in and facilitated the success of this research. Secondly, I would like to thank Professor Heather Mohay and Dr Brent Masters for their significant contribution to the initial supervision of this research. Finally, I wish to express my gratitude to my current supervisors, Professor Jenni Judd, Associate Professor Gillian Busch, and Dr Wendy Boyd, who have seen the project through to completion. I am grateful for their dedication and ongoing contributions.

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Previous Submission Statement

This paper has not been submitted for an award by another research degree candidate, either at CQUniversity or elsewhere.

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Chapter One

Introduction

“One step at a time, inhaler in hand, I will fulfil my dreams and live life to the fullest” (Hotz, 2015, para. 5). This simple but powerful statement made by a 17-year-old girl reminds us of the challenges faced daily by children around the world who are living with asthma. The overarching goal of this research is to improve the quality of life of children with asthma. This research will contribute to this goal by showing that very young children can learn about asthma and the management of asthma.

Asthma is a significant health concern for many children, and its symptoms can be alleviated through effective self-management (Global Initiative for Asthma, 2020). If children are educated to understand their asthma, and taught the self-management strategies required to manage it, then health outcomes for these children can be improved. Many asthma education programs address the needs of older children, but limited attention has targeted the direct education of children aged 3 to 5 years. This research will address this gap by showing that these very young children can learn about asthma and its management in their homes and early childhood centres.

Nature of the Problem

Asthma is the most common chronic disease amongst children across the globe resulting in significant levels of morbidity and mortality (Global Initiative for Asthma, 2020). Asthma affects the airways by making them narrower, resulting in symptoms of cough, wheeze, and difficulty in breathing. Although asthma is not curable, an individual can alleviate the symptoms through effective self-management, which improves health outcomes and quality of life.

The Global Asthma Network recommends further study about the mechanisms that can influence the ‘preventable burden of asthma’ (The Global Asthma Network, 2018). The preventable aspect of the burden of asthma refers to the extent to which asthma is controlled with

proper clinical care and self-management. As there is no known cure for asthma, all attention from healthcare professionals, the individual with asthma and their family needs to concentrate on the tasks associated with monitoring and managing the disease in ways that will contribute to preventing the exacerbation of symptoms.

Although young children cannot and should not be expected to assume full responsibility for their disease management, they can be encouraged to become cooperative managers of their asthma together with family members and healthcare professionals (The Global Asthma Network, 2018). For this reason, it is necessary to provide quality asthma education appropriate to the age of children during the early childhood years. Early education is particularly important, as many children with asthma experience their first symptomatic episodes early in their lives and might continue to experience symptoms on an intermittent and variable basis throughout their childhood and adult years (Decrue et al., 2020; Guevara et al., 2003).

Without education to increase the understanding of asthma and its management at the time children first experience symptoms, inappropriate and incorrect management practices and negative disease beliefs may develop (Al-Muhsen et al., 2015). The provision of age-appropriate asthma education for very young children aims to maximise the educational benefits, and obviate the need to correct inappropriate practices and beliefs, and reduce associated healthcare costs. In this research, the phrase “very young children” is used when referring to children aged 3 to 5 years and children of this age are the focus of this research. The phrase “young children” is used when referring to children when this may include, but is not exclusive to, children aged 3 to 5 years. The term “children” is used when referring to children aged from birth to 18 years. These distinctions are required as most previous research does not specifically address very young children, but they may have been considered as part of the research population.

Although there have been numerous programs developed for the education of school-aged children and adults, there have been very few attempts to create educational programs focusing on very young children (Coffman et al., 2009; Friend & Morrison, 2015; Geryk et al., 2017; Holzheimer et al., 1998; Kakumanu & Lemanske, 2019; Mohay et al., 1993a, 1993b). Programs designed for very young children tend to educate their parents rather than the child (Ruvalcaba et al., 2019; Wilson et al., 1996). Additionally, existing programs usually rely on healthcare professionals for their implementation and are frequently delivered in clinical settings. Providing asthma education to very young children independently of clinical settings may alleviate the burden the disease places upon the families of these children. Making the education resources readily available in community settings may provide asthma education to children and families who would otherwise find access difficult due to time constraints, financial reasons, or geographical remoteness. The problem addressed by this research is the lack of age-appropriate asthma education for very young children that can be given directly to children and accessible outside the existing healthcare system.

One of the few asthma education programs developed specifically for use with very young children is the Children's Asthma Education Resource Package (CAERP) (Holzheimer, 1993; Mohay & Masters, 1991, 1992, 1993). The CAERP is a package of asthma education resources consisting of three video segments and a children's picture book. Components of the CAERP have been previously evaluated in controlled settings and shown to increase the asthma-related knowledge, management and health of very young children (Holzheimer et al., 1998; Mohay et al., 1993a, 1993b). This research seeks to determine if the CAERP is effective when used in the community and without the assistance of healthcare professionals. Early childhood centres and children's homes are the non-clinical community settings used as the venue for the delivery of asthma education in this research.

Aims and Objectives of this Research

This research aims to evaluate the effectiveness of an asthma education program designed specifically for children aged 3 to 5 years, both with and without asthma. To assess the efficacy of the package on asthma-related knowledge, Study One occurs in early childhood centres.

Research Question One is:

Does the use of the Children's Asthma Education Resource Package (CAERP) improve the asthma knowledge of children aged 3 to 5 years when used in non-clinical settings?

Study Two occurs in family homes and assesses the efficacy of the package on the asthma management practices and health outcomes of children diagnosed with asthma.

Research Question Two is:

Was the use of the Children's Asthma Education Resource Package (CAERP) associated with improvement in the asthma health and self-management of children aged 3 to 5 years with asthma when used in non-clinical settings?

Research Design

Study One was conducted in a range of early childhood centres in Queensland and assessed the effect of the CAERP on children's asthma-related knowledge. Participants in the study were allocated to either the control or experimental group based on the geographical location of the early childhood centre they attended. The educators for the experimental group were asked to use each of the three video segments and the children's picture book of the CAERP with all children participating in the study at least once in the first two weeks.

Asthma-related knowledge of all child participants was assessed on an individual basis in the early childhood centre. This testing was conducted before exposure to the CAERP, two weeks after commencement of the study, and again after an additional four

weeks. The timing of the tests allowed for the measurement of prior knowledge, short term and longer-term knowledge gains. The control group experienced the same knowledge assessment without exposure to the CAERP, and their data served as a comparison for the assessment of changes in the asthma-related knowledge of experimental group participants.

The aim of Study Two was to assess the effect of the CAERP in improving the asthma management practices and asthma health of children aged 3 to 5 years diagnosed with the disease. Children with asthma residing in South-East Queensland were enrolled in the study and allocated to either the experimental or control group. Group assignment was based on the geographical location of their residence. All parents were given a daily diary to record their children's asthma management and asthma health during the three months following their enrollment into the study.

Parents of children in the experimental group were provided with a copy of the CAERP for at-home use. Parents were instructed to view the three video segments and read the picture book with their child as often as they choose during the following three months. However, as a minimum requirement, each child and parent was to view the video segments and read the picture book at least once during the first two weeks. Participants in the control group did not receive the CAERP, and their data served as a comparative basis for assessment of changes in the asthma management and health status of experimental group participants.

The focus of the two studies was to determine the effect of the CAERP on either children's knowledge or management of asthma. Additional information was collected to inform the results of these studies. The general demographic information for participants was gathered, together with a measure of any prior knowledge of asthma held by educators and parents. Additional data was gathered in both studies to determine the perceptions of educators and parents about the effectiveness and suitability of the resource for young children.

The Significance and Contribution of this Research

In the field of asthma education, it has been established that school-aged children and adults can learn about the disease and its management (Bozkurt et al., 2013; Gillette et al., 2016; Harris et al., 2019; Mosenzadeh et al., 2019). The current research extends these previous findings by demonstrating that very young children can also benefit from asthma education. Whereas previous research with very young children was conducted in clinical settings, this research uniquely provides evidence of the effectiveness of asthma education delivered in non-clinical community settings.

The current literature shows a need for the development of educationally sound, and age-appropriate resources, for young children (Lenney et al., 2018). The CAERP fills this gap, and its components have been previously evaluated and demonstrated their effectiveness in clinical settings (Holzheimer et al., 1998; Mohay et al., 1993a, 1993b). While the data for this research was collected in 1997, it remains relevant as it shows how the resources required to fill the gap highlighted in the literature, not only exist, but have been evaluated for use in non-clinical settings. The current research also fills the gap for low-cost resources (Rodriguez-Martinez et al., 2018). Low-cost resources such as the CAERP are in demand due to the prevalence of asthma throughout the world, particularly in areas of socioeconomic disadvantage (The Global Asthma Network, 2018).

The success of asthma education conducted in non-clinical community settings will lead to a variety of benefits for children, families, communities and the healthcare system. Effective asthma education for young children in community settings can result in young children being more knowledgeable about the disease. Increased knowledge of asthma may also lead to an improvement in asthma management and health. Independent use of the asthma education resources has the potential to reduce the burden that asthma imposes on the healthcare system. This research is significant as it may indicate that the benefits of improved

knowledge and health for very young children are achievable while still reducing the burden of asthma on the healthcare system.

Asthma education for Australian children should reflect the unique culture and health delivery system of Australia. Asthma affects populations of children differently not only because of their innate differences but also because of their distinctive environmental contexts (McCallum et al., 2017). For this reason, asthma education programs that account for the uniqueness of the Australian demography, culture and health system are required. The current research uses a program tailored for the Australian context as the celebrity actors are familiar to the children in that time and place, and the themes used were distinctively Australian.

One of the two community settings used in this research is the early childhood centre. The functioning of these centres is guided by *The Early Years Learning Framework for Australia*, *The National Quality Framework*, in which are embedded the National Quality Standards, and, for the oldest children included in this research, *The Australian Curriculum* (Assessment and Reporting Authority (ACARA), n.d.; Australian Children's Education and Care Quality Authority, 2018; Department of Education and Training, 2009). The provision of asthma education in the early years' context is also supported by the principles outlined in *The Ottawa Charter for Health Promotion* and *The Alice Springs (Mparntwe) Declaration* (Council of Australian Governments. Education Council, 2019; [WHO], 1986). These documents all have components that relate to children's health and wellbeing and therefore impact on the provision of asthma education.

In summary, the current research contributes to the understanding of asthma education by demonstrating the ability of children aged 3 to 5 years to benefit from asthma education. A significant aspect of the current research is that the education took place in non-clinical

community settings without the involvement of healthcare professionals. This research has the potential to change the way that asthma education is delivered to very young children.

Structure of this Thesis

Chapter One introduces asthma as a chronic disease and makes suggestions for how the effects of asthma can be alleviated by education. Although asthma education programs for very young children are uncommon, this research fills a gap in the literature by demonstrating that asthma education may be successfully provided to children aged 3 to 5 years.

The aims, research questions and methodology used have been outlined, together with the overall structure of the thesis.

Chapter Two presents a review of the contemporary literature related to asthma and its management and how education interventions can contribute. Emphasis is placed on the effect that asthma has on children and their families and the varied education programs used to improve their knowledge and management of the disease. The review considers the particular principles and practices used in educating very young children about asthma, highlighting the lack of asthma education programs available for this age group.

Chapter Three outlines the methodology adopted for this research. Two studies will be conducted to address two specific research questions. The procedure used for each community-based study is described, and the instruments used to collect the data are also clarified. There is also a description of the educational program used, the CAERP. Full details of the video segments and picture book which comprise the CAERP are provided in the Appendices.

Chapter Four presents the results of both studies. Data analysis for Study One and Study Two are provided along with a summary of salient results. These results include data related to children's improvement in asthma-related knowledge when the CAERP was used

in early childhood centres. This chapter provides information concerning the changes in asthma management and health for children when the CAERP was used in their homes.

Chapter Five discusses the results and the implications these have for the provision of asthma education in community settings. The implications of this research on the provision of healthcare and education are also discussed. Limitations of the two studies are noted, and recommendations are made regarding the use of asthma education for very young children.

Chapter Six summarises this research, reiterating that very young children can learn about asthma and its management and that this education can be provided in community settings, independent of healthcare professionals. Suggestions for future research will be made for advancing the fields of asthma and health education for very young children. Additionally, several appendices outline the educational resources and instruments used to collect data in this research. The next chapter reviews the contemporary literature related to asthma and its management.

Chapter Two

Literature Review

Introduction

This chapter presents a review of the literature and establishes the importance of asthma as a chronic disease that has a profound impact on children around the world. While young children may experience other chronic diseases, for example, diabetes and epilepsy, this literature review will be limited to asthma (Gurhopur & Dalgic, 2018; Kyfonidis & Lennon, 2018). It is also acknowledged that education programs for other health issues such as sun-safety and healthy eating have been developed for children; however, this literature review will be limited to education programs dealing with asthma and its management (Green et al., 2020; Perez et al., 2018). Having limited the scope of this literature review to asthma, it is acknowledged that there was a paucity of Australian research regarding asthma and asthma education and therefore extensive use of relevant international studies was required. The review begins by defining asthma and highlighting the prevalence of the disease. Having addressed the widespread nature of asthma, the impact that asthma has on children, families and communities is considered together with the management strategies that reduce the preventable burden of the disease.

Asthma education is presented as a means of improving knowledge of the disease and enhancing asthma self-management and health. Education programs are explored to illustrate contemporary work in the field of asthma self-management education. These programs meet the needs of a variety of target audiences and are delivered in a range of venues by diverse individuals and groups. Programs specifically designed for children are identified, and the challenges encountered by these programs are highlighted.

The theory and research regarding very young children's ability to benefit from asthma education are also reviewed. Asthma education is considered from the perspective of

Bandura's Social Cognitive Theory with particular emphasis given to how the principles of this theory apply to the provision of health education for very young children (Bandura, 1986). Providing asthma education to very young children can occur in the earliest years of their education, and the alignment of asthma education programs with the work conducted by early childhood educators is explored. The review concludes by considering the relevance of the CAERP, a previously evaluated program that meets the unique needs of very young children.

Understanding Asthma

To fully appreciate the need for asthma education, it is necessary to gain an understanding of the disease and its management, beginning with a definition of asthma. The Global Initiative for Asthma comprises leading asthma experts from around the world. Members of this group review evidence-based literature on asthma and prepare reports and guidelines to reflect best practice in asthma management. This group has developed a consensus definition of the disease.

Asthma is a heterogeneous disease, usually characterized by chronic airway inflammation. It is defined by the history of respiratory symptoms such as wheeze, shortness of breath, chest tightness and cough that vary over time and in intensity, together with variable expiratory airflow limitation. (Global Initiative for Asthma, 2020, p. 20).

Asthma in children aged from birth to five years can be classified according to the severity and frequency of symptoms experienced (National Asthma Council Australia, 2020). Asthma can be considered as intermittent or persistent with intermittent asthma being flare ups of symptoms followed by asymptomatic periods. Persistent asthma is a mild, moderate or severe based on the frequency of both daytime and night-time symptoms (National Asthma

Council Australia, 2020). This terminology is adopted throughout this thesis to distinguish between different classifications of asthma.

The intermittent and variable nature of asthma symptoms makes it challenging to diagnose and complicates its management. The symptoms of asthma may or may not be observable when consulting a medical practitioner, causing the accurate diagnosis of asthma to be delayed. As the symptoms of asthma differ over time, a diagnosis of asthma may be difficult, and there is no one diagnostic test for the disease (de Jong & Mozun, 2019).

Asthma triggers can further complicate diagnosis and may be present, or absent at the time of consultation, and may vary from one individual to another. Asthma triggers are substances or events that are likely to lead to a worsening of symptoms which may last for several hours or even days (Vernon et al., 2012). These triggers may include pollutants, allergens, odours, foods, medications, stress, strong emotion, respiratory infection, exercise and weather. Those with asthma are encouraged to identify their triggers and take steps to avoid them (Global Initiative for Asthma, 2020; National Asthma Council Australia, 2020; Vernon et al., 2012).

The age of the individual may influence the validity of a diagnosis of asthma. Although international guidelines and many practitioners support the definition of asthma, there remains some controversy as to whether it is possible to diagnose asthma in infants and preschool-aged children (Fitzpatrick & Bacharier, 2019; Moral et al., 2019). Young children's inability to reliably complete lung function tests further complicates the diagnosis, which must then rely on only the presence of variable respiratory symptoms (National Asthma Council Australia, 2020). Children are often diagnosed with asthma based upon their medical history, performance on diagnostic tests, and clinical examination. However, a systematic literature review questioned the usefulness of a diagnosis of asthma for infants and preschool-aged children, suggesting that such a diagnosis was considered a starting point for

further investigation (Moral et al., 2019). As the symptoms of asthma are common to other diseases, it is imperative to rule out alternative diagnoses (Moral et al., 2019). The challenge of diagnosing young children's asthma is a factor to be considered in this research, which addresses the asthma education of children in this age group.

It is not always possible to achieve an accurate diagnosis of asthma for young children. Ongoing research supports the development of tools to assist practitioners in diagnosing asthma in children younger than 5 years of age (Thapa et al., 2019).

Diagnosis of asthma in children in this age group is challenging, but different approaches which focus on the reversibility of airflow obstruction and the child's response to medication show promise (Yang et al., 2019). Despite improvements in guidelines and technologies to assist with the diagnosis of asthma, a study revealed a large percentage of young children with asthma might remain undiagnosed (Zejda et al., 2020).

Although some children are diagnosed with asthma during early childhood, the trajectory of the disease throughout childhood and into adulthood is uncertain. The average age of diagnosis for asthma was 2.6 years (Radhakrishnan et al., 2014). A recent study indicates that 15% to 26% of children with mild-to-moderate persistent asthma will outgrow the disease by adulthood (Wang, Datta, Weiss, & Tantisira, 2019). A longitudinal study of children with severe asthma found that half of this population did not have severe asthma after three years (Ross et al., 2020). In an attempt to more accurately predict asthma development, researchers identified and used risk factors regarding childhood allergy and air pollution to develop the Pediatric [*sic*] Asthma Risk Score (PARS) (Biagini Myers et al., 2019). The PARS tool reliably predicted the development of severe asthma in children and encouragingly, performed better than similar tools such as the Asthma Predictive Index in predicting the development of mild-to-moderate asthma. The significance of this research is

that children with mild-to-moderate asthma are the most challenging group to predict but are more likely to respond well to intervention strategies (Biagini Myers et al., 2019).

A working definition of asthma has been established, and the challenges for medical practitioners in diagnosing asthma have been highlighted. Notably, the children in this current research are in the age group when children are first diagnosed with the disease. Asthma education interventions provided for very young children will support those already diagnosed with asthma as well as children who may receive a diagnosis of asthma later in life. As discussed above, the group who will receive a diagnosis of asthma later in life may be significant. This review will now consider the prevalence of the disease in different groups based on age, geographic location and socioeconomic status.

Prevalence of Asthma

The prevalence of asthma in both child and adult populations across the globe forms a sobering backdrop to any research involving the disease. Three hundred and thirty-nine million people are affected by asthma worldwide (The Global Asthma Network, 2018). In 2016, asthma was responsible for an estimated 420000 deaths (Vos et al., 2017). On average, more than 1000 people die from asthma every day. Interestingly, the provision of adequate patient education may have prevented the majority of these deaths (D'Amato et al., 2016).

Asthma is the most common disease of childhood (Ferrante & La Grutta, 2018). The last major international survey reporting the prevalence of asthma in children was conducted between 2000 and 2003 by the International Study of Asthma and Allergies in Childhood (ISAAC) (The Global Asthma Network, 2018). This survey of over one million children globally indicated that there was wide variability in the prevalence of asthma. Asthma prevalence in 13 to 14-year-olds ranged from 0.8% in Tibet to 32.6% in Wellington, and for 6 to 7-year-olds it ranged from 2.4% in Jodhpur to 37.6% in Costa Rica (Lai et al.,

2009). Asthma appears to be more prevalent in affluent countries, but children in less affluent countries experience more severe symptoms (Lai et al., 2009; The Global Asthma Network, 2018). Recent studies have noted that the prevalence of pediatric asthma is increasing in low to middle-income countries (Ferrante & La Grutta, 2018; Fischer et al., 2019).

In 2017-2018 in Australia, 11.2% of the total population had asthma (Australian Bureau of Statistics, 2019). The prevalence of asthma in the Australian population had increased from 9.9% to 11.2% in the last decade but has stayed relatively constant since 2014-2015 when it was 10.8% (Australian Bureau of Statistics, 2019). Those living in the major cities in Australia experienced a lower prevalence of asthma (10.6%) when compared to those living in outer regional and remote areas (12.7%). Those residing in inner-regional areas had the highest prevalence of asthma (12.9%) (Australian Bureau of Statistics, 2019). In Queensland where this research was conducted, the prevalence of asthma was 18.9% in those individuals aged 0 to 24 years (Australian Bureau of Statistics, 2019). However, the prevalence of persistent asthma in Australian children in 1997 when the data for this research was collected was 9% (Woolcock et al., 2001), and this is similar to current national statistics. The high prevalence of asthma in Australia, and in particular for children and young adults in Queensland, highlights the importance of finding ways to better support individuals living with this disease.

The prevalence of asthma differs within and between different populations and continues to be investigated. Disparities in the prevalence of asthma involve a complex interplay between environmental triggers and socioeconomic status (Kinghorn et al., 2019). A link between poor asthma health and geographic location was reported in a study conducted in Missouri (K. M. Harris, 2019). The relationship between asthma health and location was attributed to factors such as non-white and poor populations, and areas with poor access to healthcare resources. A Canadian study supported the hypothesis that for

asthma, unlike other chronic childhood diseases, there was a link between low-income children and the acquisition of the disease (Wei & Feeny, 2019). In the Australian context, the prevalence of asthma in Aboriginal and Torres Strait Islander children younger than 15 years was 15% (O’Grady et al., 2018). This statistic contrasts dramatically with the prevalence of asthma of 9.3% for non-indigenous children and is illustrative of the variability of asthma across populations (O’Grady et al., 2018).

As it is with any life-threatening disease, the mortality associated with asthma is of great concern. A study examining asthma-related deaths around the world (D’Amato et al., 2016) reported that these deaths occurred despite significant improvements in the treatment of asthma. These improvements in the medical management of asthma have not resulted in any substantial change to risk factors for children dying from asthma in the last 30 years (Herrera & Fitzgerald, 2018).

Also of concern is that the trend for reduction in global asthma mortality observed since the late 1980s may have stalled (Ebmeier et al., 2017). This global trend in asthma mortality is not reflected in some local populations as a study conducted in Brazil highlighted that the trend in asthma mortality rate decreased between 1996 and 2015 by 60% (Pitchon et al., 2019). The population up to 19 years of age was considered by Pitchon et al. (2019) with children under 5 years of age, accounting for 68% of the deaths recorded. The authors of this study suggested that the high percentage of deaths for this younger age group might be attributable to the increased vulnerability of young children in low-income countries (Pitchon et al., 2019).

Even in Australia, with its advanced healthcare system, children continue to die from asthma. Nationally, Australian deaths from asthma totalled 441 in 2017, corresponding to 1.5 per 100,000 population (Australian Institute of Health and Welfare, 2020a). Asthma mortality in New South Wales in the period 2004–2013 was 20 children up to 17-years-old

(Van Asperen, 2015). Although deaths from asthma were rare in New South Wales, analysis of this small sample concluded that the risk factors identified for these children included poor asthma control and poor medication adherence.

The statistics outlined above indicate that the prevalence and associated mortality of asthma varies across populations, with those in low socioeconomic circumstances being more vulnerable to the disease than others. As reported above, asthma is the most common disease of childhood. The morbidity and mortality associated with childhood asthma highlights the need to support the significant number of very young children who have the disease. The following section explores the impact of asthma by examining the burden of the disease on children, their families, and communities.

Impact of Asthma on Children, Families and Communities

The prevalence of asthma in Australia results in a significant economic burden. In 2015, a comprehensive report was commissioned by Asthma Australia and the National Asthma Council Australia to determine the cost of asthma in Australia. In this report, the economic cost of asthma in Australia in 2015 was \$3.25 billion (Deloitte Access Economics, 2015). The overall burden of disease cost for 2015 was estimated to be \$24.7 billion bringing the total cost of asthma in Australia for 2015 to almost \$28 billion (Deloitte Access Economics, 2015). Included in the economic costs associated with asthma are the health system costs of \$1.2 billion from prescription pharmaceuticals, hospitalisations, and other medical expenses incurred outside the hospital setting. A more hidden cost is productivity losses of \$1.1 billion that includes time away from work due to the disease and the need to provide informal care (Deloitte Access Economics, 2015). The magnitude of this economic burden suggests that improvements to the management of asthma in Australia could lead to significant cost savings.

Although the economic costs are significant, the burden of the disease quantifies the non-financial costs of pain, suffering and premature death. The measure of this burden is the disability-adjusted life year (DALY) which is considered equivalent to one lost year of healthy life. Asthma in Australia in 2015 was responsible for over 133,000 DALYs, with an estimated cost of \$24.7 billion (Deloitte Access Economics, 2015). When compared with the economic cost of \$3.25 billion, this less obvious burden of asthma is more than seven times higher.

Equating the impact of a disease to a dollar value is one way of considering the effect it has on the community; however, children and families face genuine challenges in managing asthma every day. Numerous studies describe the negative impact of asthma on the quality of life of children (Furtado et al., 2019; Kouzegaran et al., 2018; Miadich et al., 2015). Asthma symptoms and the management of the disease can disrupt normal daily routines and interfere with participation in normal childhood activities (Knecht et al., 2015; Miadich et al., 2015). The severity of the symptoms experienced by children also influences their quality of life. One of the significant impacts on children's quality of life is the restriction they experience in their daily activities (Melgarejo González-Conde et al., 2019). Many children with asthma find it difficult to exercise, as this is often a trigger for asthma exacerbations (Furtado et al., 2019). Children with less severe asthma have a better quality of life than those with severe asthma (Furtado et al., 2019; Miadich et al., 2015).

The impact of asthma is wide-ranging and includes physical, social and emotional aspects. A study considering different aspects of the quality of life of children aged 8 to 12 years concluded that the physical, emotional and school performance of children with asthma was lower than that of their healthy peers (Kouzegaran et al., 2018). However, the social performance of children with asthma was not impacted (Kouzegaran et al., 2018). Similarly, the social and physical quality of life of the siblings of children with asthma were

mostly unaffected; however, they had diminished emotional quality of life (Yilmaz et al., 2017).

A burden felt particularly by children with asthma is the inability to attend school or childcare due to their disease. A systematic literature review reported that children with health conditions such as asthma had increased absenteeism which adversely affected their education in primary and secondary school (McKinley Yoder & Cantrell, 2019). Of school-age children with asthma aged 5 to 11 years in California, over half were found to miss at least one day of school per year, and almost 12% missed 5% or more of the school year (Kim et al., 2019). However, not all studies have found that school absenteeism negatively affects children with asthma. A study conducted in Brazil to determine the prevalence and impact of asthma in schoolchildren aged 7 to 15 years reported no statistically significant difference in the total school performance of children with asthma when compared to children without the disease (Zacaron et al., 2020). A more typical finding within the literature was an analysis of the school records of over 760,000 Scottish children in the years 2009 to 2013 which showed that children's educational outcomes are adversely affected by asthma (Fleming et al., 2019). This same study recommended that educational interventions are required to address the adverse impact of asthma on children's education.

The impact of the disease extends to parents and the family unit. Asthma in children is associated with economic hardship, caregivers who may become demoralised, it disrupts routines, and is a source of family conflict (Wood et al., 2015). Parents of children with asthma also experience difficulties due to lack of sleep. A study of children aged 0 to 4 years reported that children experience disrupted sleep due to their asthma symptoms (Meltzer & Pugliese, 2017). As a result, the parents of these children have disrupted sleep from attending to their child's night awakenings and from the stress associated with their child's poor health (Meltzer & Pugliese, 2017; Svavarsdottir et al., 2000). The pattern of poor sleep for children

with asthma and their parents was also of concern in the Australian context (Australian Centre for Asthma Monitoring, 2009).

Parents caring for children with asthma may also need to take leave from work to care for children when they are unwell. The most recent study in the Australian context reported the time spent by parents taking their children aged 8 to 12 years to medical practitioners and hospitals totalled 13.4 hours per year (Deloitte Access Economics, 2015; Toelle et al., 1995). The lost productivity associated with the need to care for children contributes to the significant burden of asthma experienced by individuals, families and communities.

Given the significant burden of asthma, education interventions focused on understanding and managing the disease for very young children may reduce the impact of asthma on children, families and communities. Appropriate management can mitigate the burden of this disease. The following section considers the strategies that can achieve optimal control of asthma.

Managing Asthma

There are several components needed for the successful management of asthma. These include medication use, compliance with medication regimens, trigger avoidance and self-management. Educational interventions aim to improve the individual's management of their asthma by enhancing their understanding of the disease and the skills involved in managing it. This section of the literature review elaborates on the aspects of the self-management of asthma.

Medications

Optimal medical management of asthma and achieving good symptom control is dependent upon the individual with asthma complying with their prescribed medication regimen and correctly using the appropriate device to administer it (Global Initiative for Asthma, 2020). Medications are classified as relievers and controllers. Reliever medications

act in the short term and are used for quick relief to reduce symptoms and work by relaxing the muscles that surround the airways. To control the inflammation in the airways controller medications are used daily, even when symptoms are not present. Controller medications do not act quickly and are of little immediate use during an asthma attack.

Asthma medications are administered to young children using a metered-dose inhaler, also known as a puffer, together with a spacer. A spacer is a tube-shaped device that holds the medication dispensed by the inhaler to maximise the delivery of the medication. The timing and speed of inhalation when using a spacer does not need to be as precise as that required when using an inhaler by itself and makes the use of a spacer with an inhaler ideal for young children. A nebuliser can also be used to deliver the same medications during asthma attacks; however, they are no more effective than using an inhaler with a spacer (Chou et al., 1995). Some practitioners continue to have a preference for the use of nebulisers and continue to prescribe their use with young children (Melethil et al., 2018). Regardless of the medication and devices used, an individual's adherence to their prescribed medication regimen is essential for optimal management of their asthma.

Compliance and Adherence

Asthma medications are most effective when the directions for their use are followed correctly. Adherence to the dosages recommended for prescribed medication and correct inhaler technique help assist in the management of asthma (Chrystyn et al., 2019; Global Initiative for Asthma, 2020). Individuals with asthma benefit from an understanding of the need for both reliever and controller medications, taking the medication prescribed, adhering to the medication regimen given, and correctly using the required devices.

Compliance is the degree to which a patient follows the recommendations given to them by their healthcare professional regarding medication and lifestyle habits (Chakrabarti, 2014; Lourido-Cebreiro et al., 2020). Adherence is a similar concept with the important

distinction that the recommendations are agreed upon by a patient and the healthcare professional (Chakrabarti, 2014). Compliance and adherence are terms used interchangeably in the literature. The term compliance considered more paternalistic and judgemental (Fraser, 2010). However, as very young children are less likely to take an active part in decision making about their medication, the term compliance is preferred in this research to describe the degree to which the child follows their medication regimen. When citing other sources in this review, the terms used by the original authors have been maintained.

It can be challenging to determine if an individual is complying with their medication regimen. A recent study reported discrepancies between compliance assessed from a questionnaire and compliance as measured by prescription refill rates (Rodríguez-García et al., 2019). Any difference between what the medical practitioner recommends and what the individual does can result in suboptimal management of the disease. Although deaths from asthma may be rare, of those that do occur, many are considered preventable. These deaths may be the result of not following the treatment recommended by a medical practitioner (Global Asthma Network, 2018). Children's non-adherence to prescribed medication is well documented in the literature (Klok et al., 2015; Thomas, 2015). Although the majority of children have mild to moderate asthma, many of those with severe asthma have poor asthma control as a result of poor compliance with their medication regimen and poor inhaler technique (Nagakumar & Rao, 2019). Successful self-management of asthma requires children to comply with daily controller therapy.

The attitudes of a child's parents may influence the child's use of their medication. Inhaled corticosteroids are an important therapy for asthma control (Hui, 2020). Nonetheless, parents have concerns over the use of this medication, with some populations having 67% of parents with steroid-phobia (Hui, 2020). Concerns about potential adverse side effects of the drug were usually misconceptions with the only evidence-based concern being mild growth

suppression. Asthma medications may have a small impact on children's growth, but the benefits of inhaled corticosteroids are more significant than the negative effect on growth (Zhang et al., 2019). Parental steroid-phobia impacts on children's compliance and asthma control. The challenge is to develop effective education initiatives for parents that address these concerns (Hui, 2020).

Further evidence of non-compliance with medication regimens was identified through the use of new technology (Bédard et al., 2019). This technology was used to record the actual use of medication, and it showed that individuals with poor symptom control might decide to treat themselves on demand rather than adhering to their medication regimen. Similar concerns were raised when individuals chose to administer medication differently to the prescribed regimen (Rehman et al., 2018). Education in asthma management, including device use and adherence, was recommended as a means of improving asthma management and quality of life for those with asthma.

Non-compliance was also demonstrated when electronic monitoring of inhaler use was able to determine adherence accurately and enabled the identification of children with severe asthma (Jochmann et al., 2017). Although some children reported they had taken the correct dosage and still experienced severe symptoms, their asthma was not seen to be severe because they had not taken the prescribed dosage. Those with severe asthma were found to have taken the prescribed dosage but still had severe symptoms. This result provides yet another reason to improve the compliance of children with their asthma medication regimen.

One method for improving adherence among school-age children was reported in a study conducted in Brazil, where school nurses supervised once-daily inhaler use in the school setting (Gerald et al., 2019). This intervention increased adherence, and asthma control improved in the participants aged 6 to 10 years. Another strategy for improving

compliance in young children is self-management education and is considered later in this review.

Self-Management

Self-management requires individuals to take responsibility for their behaviour and well-being. The skills needed for asthma self-management include the correct use of regular medication, trigger avoidance, and seeking help when asthma symptoms are worsening (Pinnock, 2015). Self-management is recommended by asthma guidelines (Global Initiative for Asthma, 2020; National Asthma Council Australia, 2017; Pinnock, 2015; The Global Asthma Network, 2018) and is a vital skill that improves health outcomes. Yet, some individuals may need the support of healthcare professionals or caregivers in managing their asthma.

Children are increasingly able to assume responsibility for the management of their chronic disease as they mature (Christian, 2019). In two small-scale studies, children were capable of collaborating with their parents in making decisions about asthma management (Garnett et al., 2016; Sonney, Segrin, et al., 2019). However, there may be disagreement between parents' and children's perceptions of how much responsibility each accepts for managing their asthma. Children typically perceive that they are more responsible for the management of their asthma than is credited by their parents (Sonney, Segrin, et al., 2019). Children's ability to report on their asthma symptoms has been noted, and children were more likely to admit to experiencing exercise-induced asthma symptoms than their parents were (Islamovic et al., 2019). The parents of these children lacked confidence in their child's correct inhaler technique and questioned if their child would have their inhaler with them in the case of an attack. Children can contribute to the management of their asthma; however, there may be disagreement between parents and children about the level of their contribution.

There is also a discrepancy between how children perceive they are managing their asthma and how well they are performing the requisite skills (Kamps et al., 2000). Children with asthma were instructed on correct inhaler usage during either a general practitioner consultation or a pharmacy visit (Kamps et al., 2000). Even when the children believed that they were using an inhaler correctly, this study reported that only 58% of the children correctly carried out all essential steps. This result is corroborated in a literature review which identified that the percentage of children correctly using their inhaler in different studies ranged from 0.6% to 55% (Gillette et al., 2016). Education about the correct inhaler technique could potentially improve children's ability to administer their medication.

Despite children's ability to demonstrate effective spacer use, a systematic literature review considering children's use of an inhaler found that many children had poor technique (Gillette et al., 2016). Additionally, children's inhaler technique improved with age, during an exacerbation, when receiving instructions from family members, after reading asthma publications and when used independently. This review also highlighted the fact that educational interventions for correct inhaler technique had a positive impact (Gillette et al., 2016). This study links education to improved inhaler technique irrespective of who conducts the training or the setting in which it is offered. Although the inhaler technique in children was poor, strategies to optimise inhaler technique were identified. One approach was to increase the children's knowledge of what an inhaler is, how it functions and correct inhaler technique. The other strategy identified was for all members of the healthcare team to monitor the inhaler technique and correct whenever possible (Gillette et al., 2016). Poor inhaler technique is common amongst children but can be improved through the provision of appropriate education.

When considering the age of individuals, Garnett et al. (2016) commented that the level of participation in decision making demonstrated by children might be due to contextual

factors rather than chronological age. These contextual factors included the child's competence, preference for decision making, and parenting styles. Children as young as 2 years of age were taught by their mothers how to use a tube spacer correctly (Croft, 1989). The mothers modelled the use of the spacer and 75% of the participants were able to demonstrate its use immediately and subsequently improved their technique at home. Although this earlier study (Croft, 1989) showed the capability of very young children to use a spacer independently, a later study demonstrated that by the age of 7 years children had assumed responsibility for taking their daily medication only 20% of the time (Orelle-Valente et al., 2008). In highlighting the practice implications associated with children's transition towards managing their asthma, Garnett et al. (2016) recommended that children's ability to contribute to their asthma health management should be considered.

Recent advances in technology have enabled the enhancement of the devices used to deliver asthma medication (Chrystyn et al., 2019). It is now possible to provide immediate feedback to the user of an inhaler regarding the efficacy of their technique. Sensors determine when the device is activated and how this corresponds to the individual's breathing. The volume and speed of their inhalation can be monitored by the sensor, and feedback is provided to the user via a Bluetooth® connection to a smartphone running an appropriate application. These applications can warn the user if dosages are missed and if usage patterns indicate a potential worsening of symptoms. Access to the internet enables the patterns of device use and problems encountered to be communicated to healthcare professionals.

Additionally, deteriorating weather conditions or other potential triggers can be communicated to the individual with asthma (Chrystyn et al., 2019). The use of smart inhalers and mobile devices can result in improved adherence to medication regimens and improved device technique (Chrystyn et al., 2019; Jeminiwa et al., 2019). Of particular interest for this research is the ability to use reports from smart inhalers as objective measures

of device usage when counselling individuals about their inhaler usage (Chrystyn et al., 2019). The current research on smart devices does not seem to recognise the potential benefits of directly linking this information on usage to asthma education. It would seem logical to extend the functionality of the applications associated with these smart inhalers to include education about the importance of taking regular medication and modelling the correct device technique.

Written action plans are considered to be an essential component of effective asthma management (Global Initiative for Asthma, 2020). Their effectiveness with child populations is not fully understood (Waldecker et al., 2018). At the time the data for this research was collected, action plans were not a common adjunct to asthma treatment. Although there is value to action plans in the management of asthma, these will not be discussed further in this review.

This section has examined aspects of asthma management, the aim of which is to obtain good control over symptoms and to reduce the risk of future asthma-related events (Global Initiative for Asthma, 2020). An individual must be able to comply with a medication regimen and be able to use associated devices correctly to be able to self-manage their asthma. The non-compliance demonstrated by children together with their difficulty in using devices correctly needs to be addressed to improve children's self-management of asthma. The purpose of asthma education is to support children and their families by providing them with the knowledge and skills to understand and manage their asthma (Global Initiative for Asthma, 2020). For the very young children that are the focus of this research, education regarding the correct technique for using a spacer and puffer to administer medication is particularly important. The following section will outline the need for asthma education and will examine the benefits of self-management education for children.

The Need for Asthma Education

The need for asthma education to assist children's self-management is supported by the Ottawa Charter, which advocates that one of the prerequisites for health is education (WHO, 1986). Health promotion has the goal of removing inequity in health, and the Ottawa Charter articulates actions to achieve this (WHO, 1986). Included in these actions is the provision of access to information and life skills that support individuals in making healthy choices. When considering the development of personal skills, the Charter states:

Enabling people to learn throughout life, to prepare themselves for all of its stages and to cope with chronic illness and injuries is essential. This has to be facilitated in school, home, work and community settings. Action is required through educational, professional, commercial and voluntary bodies, and within the institutions themselves. (WHO, 1986, p. 3)

The following sections of the literature review examine how asthma self-management education can facilitate the meeting of this commitment.

Asthma education provides individuals and their caregivers with knowledge of the disease and the skills to manage it effectively. Successful management of asthma includes an understanding of the nature of the disease, the role of medications in managing symptoms, and an understanding of triggers and how to avoid them (Jones, 2008). The skills required include the correct use of the devices used to administer medications. When considering asthma in young children, we must acknowledge the essential role that adults assume in assisting children as they manage the disease. The provision of knowledge about the disease and how to manage it is necessary for parents, as they are the primary providers of care for young children with asthma (Margolis et al., 2019).

Another way of viewing the importance of asthma education is through the lens of health literacy. Health literacy is possessing skills and knowledge to understand information

about health and applying this information to make health-related decisions (Bröder et al., 2017). The research on health education that considers the issue from the perspective of health literacy has identified a lack of research, definitions and models that can be applied to very young children (Okan et al., 2018). Health literacy is an important way of viewing health education for primary school children and adolescents. The lack of health literacy research conducted with very young children limits its applicability to this review of asthma education for children aged 3 to 5 years.

One benefit of asthma education is that it is cost-saving and cost-effective for children with asthma and their families. A study conducted in Columbia sought to determine the cost threshold above which paediatric asthma programs are no longer cost-effective (Rodriguez-Martinez et al., 2018). The results indicate that the use of pediatric asthma education programs should become a component of routine asthma care. The use of these programs reduces the number of and saves expenditure on, both emergency department visits and hospitalisations (Rodriguez-Martinez et al., 2018). Low to moderate cost programs were cost-effective in that even if they did not save money; the benefits they provided were sufficiently large compared to the cost of the intervention. Although we could question the applicability of research conducted in a different healthcare system with different costs compared to those available in the Australian context, this study highlights an advantage of the provision of asthma education for young children.

The Need to Educate Parents and Caregivers

Parents are ultimately responsible for the management of a very young child's asthma and as such, have often been the focus of education programs. A study conducted in Japan indicated that tailored education for parents of children with asthma increased the asthma-related knowledge of the parents, their quality of life, and their self-efficacy in managing their child's asthma (Iio et al., 2017). A comprehensive literature review

considered 77 studies addressing the experiences of mothers in managing their children's asthma (Fawcett et al., 2019). This review reported that caregivers experienced challenges in the management of the disease and concluded that they required comprehensive education to understand asthma and its management. This education was needed when the child first experienced symptoms. A benefit of providing parents and caregivers with asthma education is that they can become effective managers of the disease and can assist a child in becoming a capable self-manager of their disease.

In cases where a parental understanding of asthma and its management is inadequate, carefully designed education programs may correct these parents' misconceptions. A study found that parents felt they received inadequate education about their child's disease (Archibald et al., 2015). Although the sample size of this study was small, it is concerning that parents perceived their child's condition as acute rather than chronic and made asthma management decisions based upon this incorrect belief. Education for parents could lead to improved management of their children's asthma as a chronic disease.

Not all studies have shown a clear link between caregiver asthma knowledge and improved asthma health outcomes for children. Increased parent knowledge was associated with an increased chance of hospital readmission of the child (Auger et al., 2015). The assumption that more informed carers can manage asthma better and therefore, readmission to the hospital would be less likely may not follow. One possible explanation is that parents with increased knowledge are more aware of when they need to seek help. Another possible explanation is that they are more knowledgeable because their child has more severe asthma symptoms and children with more severe asthma are more likely to be readmitted to the hospital. Any research evaluating the child's asthma health using measures such as readmission to hospital or the need for consultation with healthcare professionals has

implications for any research as does the complexity of the relationship between parental knowledge and a child's health.

The Need to Educate Children

Education of the child and their family is central to the treatment and control of asthma symptoms (Azmeah et al., 2020). These authors note that children need to understand the disease process and its management to adhere to their medication regimen.

Non-adherence rates in children aged 8 to 12 years are higher than 50% (Thomas, 2015). Education to support improved self-management may be a means of improving patient compliance with medication regimens and improving asthma control (Thomas, 2015).

One of the key components of asthma management is the provision of information and skills to parents and children for the management of asthma (National Asthma Council Australia, 2020). The development of a global children's charter for asthma has been advocated for in response to the lack of progress in asthma management for children (Lenney et al., 2019). Significantly, this charter would call for developmentally appropriate asthma education to be provided to children and their families.

The need for asthma education for young children is exemplified in a study conducted in Saudi Arabia with children aged 1 to 17 years when they visited the emergency department for asthma treatment (Al-Muhsen et al., 2015). Most of these children were found to have poor knowledge of asthma and the correct use of asthma medication. Poor asthma education was associated with frequent and unnecessary visits to the emergency department for asthma treatment. The education of children is associated with improved self-management of asthma and is a necessary component of its treatment. The following section outlines the various ways in which this education can be provided.

Asthma Education Interventions

This section of the review will examine various contemporary education interventions that support children in managing asthma. Asthma education may be provided in a range of settings by a variety of providers. A selection of these interventions will be considered, and their appropriateness for use with very young children will be addressed.

Medical Practitioners

Medical practitioners are involved in the diagnosis of asthma and the ongoing review of patients. Their expertise and contact with the patient place them in an ideal position to deliver health education, an important part of their role. Both international and Australian guidelines recommend the provision of patient and caregiver education as an essential component of asthma management (Global Initiative for Asthma, 2020; National Asthma Council Australia, 2020).

In Italy, education provided in a clinical setting by primary caregivers was successful in increasing asthma control and decreasing hospital admissions in a population of 6 to 15-year-olds (Guarnaccia et al., 2017). Another study conducted in Iran evaluated the outcome of specific education on the asthma control of children aged 6 to 14 years in a hospital setting (Kalantari et al., 2017). This study concluded that education significantly improved the asthma control and health of children with the disease. Additionally, this study called for physicians and healthcare providers to attend to the provision of special education and training for children with asthma and their families (Kalantari et al., 2017).

Although these initiatives make a valuable contribution to the lives of children with asthma, the reliance on healthcare professionals to carry out the education can sometimes be questioned. In low-income countries, even healthcare professionals have demonstrated poor knowledge and skills in the correct technique for using inhaler devices (Poudel et al., 2019). Inadequate understanding of proper inhaler technique amongst healthcare professionals may

be partially responsible for the poor technique demonstrated by asthma patients in these countries.

Medical practitioners may be the most qualified to educate patients about their asthma. However, they may not perceive the need to or may lack the time, motivation, skills and resources to do so (Boulet, 2015). An Australian study reported that general practitioners overestimate their use of asthma action plans and provision of patient education (Larson et al., 2010). Many physicians treating patients who have asthma report that they face time constraints that interfere with their ability to provide adequate asthma education. Two reasons provided for this lack of time are that patients have difficulty scheduling regular office visits and the limited time within each visit (Boulet, 2015; Cabana et al., 2008).

Despite the concerns reported in the studies above, interventions conducted by medical practitioners in supporting children to manage asthma have been generally successful. As doctors are highly trained members of the community, and their time is valuable, time spent in consultation with a doctor represents a high cost to the healthcare system. Although it is a part of a doctor's role to provide education to patients about their health, this clinical setting and its time constraints may not be the most cost-effective setting for offering extensive asthma education. A study comparing the use of an inhaler after a visit to either a general practitioner or a pharmacy found that the children involved had better inhaler technique when instructed at the pharmacy (Kamps et al., 2000). This study reported that general practitioners spent no more than five minutes of instruction on correct inhaler technique using verbal instructions and occasionally supplementing this with a demonstration. In the pharmacy setting, the instruction offered was more comprehensive as the child's technique was repeatedly checked until it was satisfactory. This educational process took up to 30 minutes so it could be concluded from this study that the education to

achieve correct inhaler technique in children requires the time for repetition and feedback. This time is not always available to medical practitioners.

Nurses and Community Health Workers

Nurses and trained community health workers who have medical training have frequent contact with patients. Like medical practitioners, their training and patient contact positions nurses and community health workers well for conducting asthma education. A variety of nurse-led education programs were developed for use in diverse settings.

In one example of a nurse-led program, nurses provided standardised education to children and their parents regarding the technique for using inhalers and spacers (Türkeli et al., 2016). This intervention in a clinical setting was associated with correct technique and asthma control for the participants aged 2.5 to 13 years. Asthma education provided by nurses to children aged up to 18 years in a University clinic in the United States resulted in less medication use and decreased urgent care visits (L. Wang et al., 2020). A registered nurse provided this asthma education with the option of a follow-up visit to assess environmental triggers in the home. Only 10% of participants took advantage of this service, yet the intervention proved successful without the additional home visit.

Nurses can also provide asthma education in school settings. The Building Bridges for Asthma Care Program was able to successfully reduce school absenteeism by 22% and significantly improve asthma control (Szeffler et al., 2019). This program was conducted by school nurses who coordinated the asthma care of children aged 5 to 14 years. The improved asthma control developed by these children resulted in fewer days away from school, and this could contribute to a decrease in educational disparities between children with and without the disease.

Community health workers can work within communities to deliver asthma education. A systematic literature review suggested that regardless of the setting, asthma

education programs provided by community health workers were successful in improving asthma health outcomes (Uchima et al., 2019). The program's success was not dependent upon the length and frequency of the intervention or the training of the community health worker. Asthma education offered by community health workers may be a cost-effective means of providing asthma education to children and families when compared to usual care (Uchima et al., 2019).

Educators

School settings have the potential to be health promoters for children with asthma. The school context can be a site for interdisciplinary teams to support children in managing their asthma (Urrutia-Pereira et al., 2017). Asthma education for the school community is a crucial step in implementing a school-based asthma programme. An educational intervention aimed at improving teachers and childcare worker's knowledge and comfort in managing asthma was conducted (Neuharth-Pritchett & Getch, 2016). Two three hour sessions were effective in increasing understanding of asthma and its management and giving the participants confidence in learning more about the disease (Neuharth-Pritchett & Getch, 2016).

Teacher-led programs are successful in improving asthma health outcomes and quality of life. A study conducted in Spain reported on asthma education conducted by physical education teachers with students in Grade 5 and Grade 6 (Praena-Crespo et al., 2017). Although the study was not successful in reducing school absenteeism, it did improve the quality of life of the participants, especially emotional functioning and reducing activity limitations. The study concluded that physical education teachers could use this program to improve asthma outcomes at school (Praena-Crespo et al., 2017).

Educating Parents and Caregivers

Providing asthma education to parents and children is reported by numerous studies to have been associated with significantly fewer school absences, emergency department visits and hospitalisations (Agusala et al., 2018; Szeffler et al., 2019). Typically, these asthma self-management education programs target older children and involve parents also (Agusala et al., 2018; Liu & Qureshi, 2016). The provision of asthma education to parents and caregivers enhances the support a child can receive when managing their asthma.

Although there is support for providing asthma education to adults to assist children, educating caregivers and parents alone has not always been effective. Group education for children aged 9 to 13 years and their caregivers was no more effective than group education for the children alone (Cano-Garcinuño et al., 2007). The same study found that group education for caregivers alone was not effective when considering morbidity. This difference may be attributable to the nature of the educational intervention that involved groups of between 6 and 10 participants. This point of difference separates this study from the majority, which indicates that educating caregivers is beneficial.

Educating Children

Numerous studies report that asthma education results in improved clinical outcomes for children with asthma (Bozkurt et al., 2013; Gillette et al., 2016; Guevara et al., 2003; Harris et al., 2019). Self-care education is associated with improved quality of life for children with asthma aged 8 to 11 years (Mosenzadeh et al., 2019). These results are indicative of the consensus of the literature, which indicates that asthma education for school-aged children is beneficial.

Asthma education is delivered to children in several ways, and one important method is group education. A study of children aged 5 to 18 years concluded that group education may be beneficial in the management of uncontrolled asthma but is not significantly better

than usual care (Arikan-Ayyildiz et al., 2016). Goal setting may be another useful addition to asthma education programs. A systematic literature review reported that the inclusion of goal setting into asthma education might improve an adult patient's control of their asthma, their quality of life, and self-efficacy (Liao et al., 2019). The usefulness of goal setting with children, however, is yet to be determined due to the lack of quality studies on this population (Liao et al., 2019).

The asthma education of older children has often been conducted in the non-clinical setting of the school. School-based asthma education programs have been trialled with varying success. In a study where two school-based programs were reviewed, it was found that programs tended to be more effective when targeting children with more severe asthma (Bruzzese & Kattan, 2019). Children with more severe asthma appear to benefit more from educational initiatives than children with less severe asthma.

A recent systematic literature review illuminates the potential of schools as a venue for effective delivery of asthma education (Isik et al., 2019). This review considered children aged 5 to 18 years, where school nurses provided education programs and targeted children and parents. Improvements were found in both asthma knowledge and health (Isik et al., 2019). School-based programs might be a superior choice when delivering asthma education to children, their parents, and school community. Teachers and other school staff were potential collaborators with school nurses in implementing asthma education programs in school settings. A recommendation was made for more studies to be conducted to refine practice in this area (Isik et al., 2019).

Another systematic review of the literature concluded that education interventions in school-based settings with children aged 2 to 17 years, while diverse in their content and delivery, consistently improved asthma knowledge, self-efficacy and asthma self-management (Coffman et al., 2009). The impact of these interventions was not as

evident. The review highlighted the need for schools to balance many competing demands that can influence the implementation of asthma education programs.

School-based asthma education programs can improve the asthma health outcomes of children with the disease. A study conducted in Thailand was the first study in that country to evaluate the health outcomes of a school-based intervention (Suwannakeeree et al., 2016). This study found an improvement in the asthma knowledge and self-management behaviour of the participants aged 6 to 15 years. These results were found immediately following the intervention and six months later, indicating that asthma education can have benefits both in the short and longer-term (Suwannakeeree et al., 2016).

The School-based Asthma Management Program (SAMPRO) uses the school setting as a focal point for communication between the child, families, school staff and clinicians (Lemanske et al., 2016). This program based in the United States of America focuses on the provision of quality asthma care by coordinating the efforts of school nurses, clinicians and families to support children with asthma. This literature review considers benefits that separate groups can bring to the provision of asthma education. SAMPRO is an example of a program that gains its strength from coordinating the efforts of some of these groups.

The Health Promoting School (HPS) framework proposed by the WHO also promotes integrated care between students, school staff, and healthcare professionals. There is some evidence that this framework, when applied, can improve some health outcomes in students. Still, insufficient evidence exists to generalise the effectiveness of this framework (Langford et al., 2014). This review of the HPS framework did not consider the impact of the HPS framework on asthma.

Delivery Methods for Asthma Education Programs

The components of a successful asthma education program will be determined to some extent by the participants' preferred mode of receiving information.

For example, parents from low-income backgrounds have shown a preference for receiving health education via a mobile phone application due to its reduced health literacy demands (Ohns, 2019). A systematic review of the literature evaluated the impact of pictogram based resources used for health education and found that patient adherence was improved when pictograms and text were used together to educate patients (Sletvold et al., 2020).

Delivery of education by video or video accompanied by written information was the preferred way of obtaining medical information related to discharge from emergency departments (Sheele et al., 2019). This preference of receiving information using video rather than only receiving written information was supported by the majority of patients, irrespective of age, education background and access to the Internet in the home. Videos were reported to be an effective method of improving patient technique when using inhaled medications (Müller et al., 2017). The effectiveness of this intervention had continuing benefits, with 72% of participants displaying the correct technique six weeks after the intervention (Müller et al., 2017).

A recent literature review addressing chronic disease education programs that blended face-to-face and computer-based components found that the programs reviewed had varying success (Sangrar et al., 2019). A cautionary note suggested that programs needed to be designed with the patient's level of technological proficiency in mind. Developing programs at the limit of current technological capability may not be cost-effective (Sangrar et al., 2019).

Another choice to be made when delivering asthma education is whether it is for individuals or groups. Notably, a study conducted in Spain, Cuba and Uruguay found that group asthma education provided to children alone reduced morbidity as measured by asthma attacks and hospital admissions (Cano-Garcinuño et al., 2007). This same study found that group education provided to parents alone was not effective (Cano-Garcinuño et al., 2007).

The number of sessions in educational interventions also varies. A meta-analysis suggested that education programs for children with more than one session and providing opportunities for interaction were associated with reduced hospitalisations and emergency department visits (Coffman et al., 2008). A different perspective on the optimal number of education sessions was offered when a single 20-minute nurse-led education session was held in a rural general practice setting (Larson et al., 2010). This single-session was successful in improving asthma health outcomes and quality of life for children aged 7 years and older (Larson et al., 2010).

Particular groups have an increased prevalence of asthma (O’Grady et al., 2018). Targeted education can address the differing needs of these groups (McCallum et al., 2017). Culturally and linguistically diverse populations such as those who have recently migrated to Australia were found to have poor adherence to asthma medication (Singh et al., 2020). Groups such as these could benefit from health education initiatives that target medication adherence. Some geographic locations had a higher prevalence of asthma due to the inequities in healthcare access and socioeconomic status. Interventions and resources need to target these groups to overcome the inequalities for those residing in these locations (K. M. Harris, 2019).

Clinics providing asthma care, including an education component, were conducted in the Torres Strait (Valery et al., 2016). The intervention involved specialist doctors, nurses, and specially trained indigenous healthcare workers. The education component was adapted from existing resources to be culturally appropriate, and the intervention met with high levels of satisfaction from the participating parents. Following the intervention, parents felt better able to manage their child’s asthma. Indigenous children experience higher rates of morbidity associated with asthma, and the location chosen for this intervention was remote. This result

indicates the potential of culturally sensitive asthma education provided for some of the more vulnerable members of society living in difficult to access locations.

Most of the educational interventions considered so far have been developed without the input of the target population. In an attempt to support parents and children aged 7 to 11 years, researchers worked with study participants to develop an asthma essentials kit (Sonney, Duffy, et al., 2019). The participants and researchers worked collaboratively to trial and evaluate a range of supportive tools to assist with asthma management. These tools ranged from inhaler and spacer instructions through to a mobile health application. Early findings from this study suggest that co-designing health interventions result in a product that is considered relevant and usable by parents and children.

Only a limited number of the educational interventions considered above were explicitly developed for very young children. Those studies that included younger children did so only with them as a part of a larger cohort. The following section will examine the provision of asthma education for very young children.

Asthma Education for Very Young Children

Principles of Educating Young Children

Very young children learn best when information is presented appropriately. Various theorists have proposed a range of explanations of how children learn. A learning theory that lends itself to health education is Social Cognitive Theory (SCT) (Bandura, 1986). SCT proposes that individuals can learn not just from their own experience, but also vicariously through observation of the experiences of others and the results of those experiences (Bandura, 1986). The SCT constructs that are of relevance to health education interventions include reinforcement and self-efficacy. Repetition and positive reinforcement by others lead to improved self-efficacy of the individual to perform a targeted skill (Bandura, 1986). As a result of improved self-efficacy, individuals believe that they can

perform these skills independently. It follows that they are then more likely to perform the skill.

Social Cognitive Theory provides ways of enhancing a learner's self-efficacy (Bandura, 1986). Firstly, the learning to be completed is broken down into small achievable steps or goals. Credible role models are then used to present and reinforce learning. The learning takes place in a social environment that can provide positive support to the learner. Reduction of any unnecessary stress on the learner is also beneficial. Incorporating these principles into the design of an education program is likely to increase the learning of the content and skills presented.

Presenters of programs need to be credible role models for this age group. Suitable presenters may include celebrities associated with children's television and child actors that are similar to the children in the target audience. Use of these celebrities and child actors makes the presentation more appealing to the child, and if chosen carefully, culturally appropriate. The use of child actors is an example of peer modelling as advocated in SCT (Bandura, 1986). Another example of a credible role model for a young child would be an early childhood educator. The use of celebrities, child actors, and early childhood educators is particularly relevant, as these are the presenters and facilitators of the educational intervention used with the very young children in this research.

A systematic literature review completed by Saxby, Beggs, Battersby, and Lawn (2019) indicated that self-management education targeted at the child's specific age or developmental stage is beneficial for children with chronic conditions including asthma. This study articulates different educational approaches that may be used in the education of children with chronic illness. These are directive learning, active and experiential learning, cooperative and peer learning, interactive play, enquiry based learning, differential learning, and integrated learning. Although the different approaches can be used at different ages or

stages of development, the effectiveness of these individual components is yet to be established. This study implies that educational resource development should use approaches that are most suitable for the age or stage of development of the children targeted (Saxby et al., 2019).

An evaluation of age-appropriate educational resources for children aged 3 to 5 years and 7 to 11 years indicated that there was a lack of appropriate educational resources developed for children in these age groups (Nicholas et al., 2009). Asthma education resources need to balance the enjoyment obtained from their use with the depth of information presented (Nicholas et al., 2009). The evaluation of the resources considered in this study also highlights their perceived usefulness as providing a basis for discussion between children and caregivers. This study highlights the importance of ensuring that the resources used in education programs for young children are enjoyable, age-appropriate, and yet still convey a suitable depth of information.

A review commissioned by the Queensland Government recognised the need for the early childhood curriculum to utilise age-appropriate pedagogies (Fluckiger et al., 2016). The use of age-appropriate pedagogies was central to the development of the educational resources used in the current research involving educators and children in early childhood centres. Policy and curriculum documents guide the delivery of programs in these centres. The next section of this chapter will consider documents that highlight the opportunities for and the importance of health education for young children when delivered in early childhood centres.

Relating Asthma Education to the Work of Early Childhood Educators

The current documents used by teachers in childcare, kindergarten and preparatory schooling in Australia outline the importance of health education for young children.

The Early Years Learning Framework (EYLF) contains five learning outcomes that guide the

practice of early childhood educators (Department of Education and Training, 2009).

Outcome 3 addresses the sense of wellbeing of young children. Wellbeing includes physical health and emphasises the need for children to increase their responsibility for their basic health routines (Department of Education and Training, 2009). This framework makes early childhood educators, in part responsible for the provision of learning experiences to meet this outcome.

This outcome in the EYLF is underpinned by the importance of developing health literacy capabilities in young children. The benefits of improving health literacy include more than increased physical and emotional health (McDaid, 2016). Increasing the health literacy of young children also results in better educational outcomes (McDaid, 2016). Even with this increased understanding of the benefits of health literacy, an overall lack of progress in early childhood education has been noted, even though this is a critical stage for establishing the prerequisites for the behaviours and skills which form the primary components of health literacy (Sorensen, 2020).

The National Quality Standards for Early Childhood Education and Care Services also make provision for supporting the health and wellbeing of children. Quality Standard 2 covers children's health and safety (Australian Children's Education and Care Quality Authority, 2018). Of particular relevance for this research is standard 2.1 concerning the support and promotion of children's health. This standard is elaborated further in 2.1.2, which specifies the promotion and implementation of children's illness management (Australian Children's Education and Care Quality Authority, 2018).

The foundation year of the Australian Curriculum outlines content descriptors that are also of interest in the context of this research. These descriptors address naming parts of the body (Australian Curriculum Assessment and Reporting Authority (ACARA), n.d., ACPPS002), demonstrating protective behaviours to keep healthy (ACARA, n.d.,

ACPPS003), and identifying actions which promote health and wellbeing (ACARA, n.d., ACPPS006). These descriptors align with the contents of asthma education programs which address the naming of components of the respiratory system, the correct use of asthma medication and devices, and the avoidance of triggers.

The documents considered above demonstrate that there is a place for the provision of health education for children in the early years of schooling. Although these documents do not mandate the provision of asthma education for very young children, asthma education achieves some of the aims of these documents. The provision of asthma education and its link to these early childhood documents will be examined further in Chapter 5 when discussing the results of the current research.

Existing Programs

One widely accepted and used program designed for the parents of children younger than 7 years was *Wee Wheezers*. *Wee Wheezers* is one of the very few programs to address the needs of very young children and has been evaluated in controlled studies (Wilson et al., 1996). This evaluation has shown the success of this program in improving parental asthma management and clinical outcomes for very young children (Wilson et al., 1996).

The Wee Wheezers program was delivered in the United States of America in multiple sessions by healthcare professionals, using the principles of SCT in its development.

Head Start programs are an early childhood education service also based in the United States of America that target children from low-income families. Head Start programs provide a suitable setting for supporting children with asthma and their families when dealing with the challenges involved in managing asthma (Ruvalcaba et al., 2019). In a subsequent study, Head Start programs have been combined with Asthma Basic Care family education resulting in improved asthma control (Eakin et al., 2020). The relationships established

between program staff and caregivers are key to the success of the Head Start programs (Ruvalcaba et al., 2019).

Wee Wheezers and Head Start programs both attend to the needs of very young children by providing asthma education to their parents. These programs acknowledge the vital role parents play as partners in their child's asthma management. Although these programs fill a need for asthma education for very young children, these programs do not directly target the children themselves.

The lack of asthma education programs designed for very young children can be attributed to a widespread acceptance of Piaget's theory of cognitive development (Piaget, 1970). Children's understanding of illness was linked to their level of cognitive development (Bibace & Walsh, 1981). Piaget's theory proposed that preschool children in the preoperational stage use pre-logical thought. These preschool children explain illness as being caused by magical thinking, imminent justice, or contagion. With magical thinking, children believe that their thoughts and desires influence the world around them. Imminent justice is the belief that illness is caused by wrongdoing. Contagion is where illness can be found in nearby things and being close but not touching these things can make you ill. Advocates of Piaget's theory believed that children did not think logically about the origins of illness, so few interventions were created to increase asthma-related knowledge of very young children. The paucity of programs designed for younger children has resulted in limited research being conducted about asthma education for children aged 3 to 5 years.

The Gap in Asthma Education

The literature reviewed has established that asthma education can increase an individual's knowledge of asthma and improve their asthma self-management. These improvements in knowledge and management of the disease can lead to improved health outcomes for children with asthma.

The asthma education programs considered were provided to a range of target audiences, including children, parents, educators, and medical professionals. These education programs were delivered in a variety of settings, including clinical, school, home, and community. Those responsible for delivering the programs included specialist physicians, general practitioners, pharmacists, nurses, teachers, and community health workers. The education programs have utilised diverse modes of delivery, including on-line, face-to-face, group, individual and accompanied by a parent or caregiver. Various combinations of the target audience, setting, provider and mode of delivery have been applied with varying degrees of success.

Children aged 3 to 5 years are one target audience that is under-represented in the current literature. Previously children in this age group were believed to not benefit from health education. This belief and an uncertain diagnosis of asthma for this age group resulted in few programs that attempted to meet the unique needs of very young children. Some resources developed specifically for very young children will now be considered.

In recognising the need for quality asthma education programs for very young children, Mohay and Masters (1991, 1992, 1993) and Holzheimer (1993) collaboratively developed the Children's Asthma Education Resource Package (CAERP). These materials are educational resources specifically designed for joint use by children aged two to five years and their caregivers in Australia. These resources aimed to enhance children's health by equipping them with a better understanding of asthma and its management and increased feelings of self-efficacy in managing the condition. The CAERP aims to offer high-quality asthma education to enhance knowledge and self-management skills amongst those with asthma and understanding and empathy amongst children and adults without the disease. This program may offer a cost-effective means of educating children across all sectors of the Australian community; including those in urban, rural and remote areas of the country.

The provision of asthma education in community settings would be especially beneficial to those whose access to clinical settings may be limited due to time constraints, financial reasons, or geographical remoteness.

Earlier studies that evaluated the CAERP components in controlled experimental settings (University, medical centres, and hospitals) found that these resources significantly improved children's knowledge and management of asthma. Use of the CAERP improved their compliance with medication regimens; and as a result, improved the health outcomes of children with asthma (Holzheimer et al., 1998; Mohay et al., 1993a, 1993b). Therefore, the gap in the literature, and consequently the problem to be explored in this research, is to evaluate whether the independent use of the CAERP by children, parents and educators in community settings can be effective in improving the knowledge of asthma and its management amongst all children.

This research intends to establish that the independent use of this resource package can demonstrate the effectiveness of an age-appropriate asthma education program for very young children in non-clinical community settings. It is proposed that children, parents, and educators will be able to use the resource without the involvement of healthcare professionals. This research will determine whether this program increases the asthma knowledge of children with and without the disease, while also improving self-management of asthma and the health of children with the disease. Completing this research will close a gap in the literature that exists regarding the provision of asthma education for very young children in community settings.

Summary

This literature review has established the importance of asthma as a chronic disease and the profound impact it can have on children. The review also explored the highly prevalent nature of the disease and the management strategies used to reduce the preventable

burden of the disease. Asthma education is an essential means of improving asthma knowledge, self-management and health. The diversity of education programs were explored to illuminate the benefits of asthma education. A lack of programs specifically designed for young children was highlighted. Social Cognitive Theory was outlined as a theoretical framework that is useful in the design of asthma education programs.

A gap in the literature was identified. Can asthma education be successfully provided directly to very young children, and can this education can be delivered independently by educators or parents in community settings? Evaluation of The Children's Asthma Education Resource Package may be a means to fill this gap in our current understanding of asthma education. The evaluation of this program in non-clinical community settings is the focus of this research.

The following chapter outlines the methodology adopted for this research. The research utilises two studies to evaluate the effect of the CAERP. One study considers the effect on children's knowledge, and the second study evaluates the effect on children's asthma health outcomes.

Chapter Three

Methodology

Introduction

This research aimed to evaluate the effectiveness of asthma education resources for young children aged 3 to 5 years at home and in early childhood centres. Two quasi-experimental studies were conducted and aimed to evaluate the effect of the Children's Asthma Education Resource Package (CAERP) when used independently by children with their parents and educators in the community without the input of healthcare professionals. The need for this research is highlighted by the lack of significant research that focuses on very young children with asthma in non-clinical settings and the need for age-appropriate asthma education resources that are rigorously evaluated for use with very young children (Holzheimer et al., 1998). This chapter will outline the rationale, participants, instruments, and procedures used for both studies.

Study One evaluated the effects of the CAERP on the asthma-related knowledge of children with, and children without a diagnosis of asthma. Study Two evaluated the effects of the CAERP on the asthma self-management and the health of children with a medical diagnosis of asthma who required daily asthma medication.

Research Questions

The data for both studies were collected in 1997 by the researcher to address the following research questions.

Research Question 1

Does the use of the Children's Asthma Education Resource Package (CAERP) improve the asthma knowledge of children aged 3 to 5 years when used in non-clinical settings?

To further understand the effect of the CAERP and to potentially identify other factors that may have influenced the asthma-related knowledge of the children, some additional questions were included.

Question 1a

What were the educator's perceptions about asthma before and after the CAERP intervention?

Question 1b

What were the perceptions of the educators who used the CAERP regarding its usefulness for increasing educator and child knowledge about asthma and its management?

Research Question 2

Was the use of the Children's Asthma Education Resource Package (CAERP) associated with improvement in the asthma health and self-management of children aged 3 to 5 years with asthma when used in non-clinical settings?

To further understand the effect of the CAERP and potentially identify other factors that may have influenced the asthma self-management and health of the children, additional questions were included.

Question 2a

Was there a difference in parental knowledge about asthma and its management between parents that used the CAERP with their children and those that did not?

Question 2b

Were there differences in perceptions about the management of asthma between parents who used the CAERP with their children and those who did not?

Ethics

Approval to conduct this research was obtained from the Queensland University of Technology (QUT UREC 821) (see Appendix A). After moving the study to Central Queensland University, this research was subsequently exempted by Central Queensland University Office of Ethics (21367). The ethical implications and measures that were taken in this research were deemed to be appropriate and in accordance with the *National Health and Medical Research Council Statement on Human Experimentation and Supplementary Notes* (National Health and Medical Research Council, 2018).

Before seeking the participant's involvement, permission to research at each of the education and care centres was obtained from the Principal administrator or Director of the education or care centre. Study participation was voluntary, and informed consent was obtained from each staff member and each child's parent or legal guardian. Participants were free to withdraw from the study at any time.

Research Design

Both studies utilised a longitudinal quasi-experimental research design. The quasi-experimental approach is one of three types of experimental designs: preliminary experimental, true experimental, and quasi-experimental (Campbell & Stanley, 1963). Quasi-experimental designs differ from the other types of experimental designs in that a pre-experimental design is intended as an initial step for assessing the potential effectiveness of an intervention, and a true experimental design must include a manipulation, a control group, and a process of randomisation.

These studies employed a quasi-experimental design because the participants were not assigned randomly to the control and experimental groups. A random assignment would have been impractical in this situation as the independent variable was the provision of an educational intervention to the experimental group. In Study One, this intervention was

delivered by an educator to a class group, making it impractical to have members of both the control and experimental groups in the same class. For this reason, whole class groups will be assigned to either the experimental or control group. All classes at a particular early childhood centre were assigned to the same group to minimise the sharing of information between the experimental and control groups. For the same reason, all early childhood centres in a geographic location were assigned to the same group.

In Study Two, the intervention was provided to children in their homes. Children and parents living near each other could potentially share information. This proximity introduced the potential sharing of information between the control and experimental groups. For this reason, the control and experimental groups were drawn from different geographic locations. This non-random allocation to the control and experimental groups made necessary the use of a quasi-experimental design.

Study One: Assessing Asthma-Related Knowledge

Study One employed a longitudinal quasi-experimental research design. The longitudinal research design allows for comparison of different groups of individuals (independent variable) with one another regarding the asthma-related knowledge of children. One of the most useful characteristics of longitudinal research occurs in situations, such as this study, where changes in the same variables over a period are studied (M. Wang et al., 2017).

The longitudinal research design is appropriate for this study, as the data were collected over time from children from different locations. One possible difficulty with the longitudinal design is that participant response rates are sometimes low when ineffective data collection strategies are used (Udtha et al., 2015). To mitigate this concern in Study One, the ongoing involvement of participants was encouraged by follow up visits to the early

childhood centres by the researcher at the scheduled assessments. Post-test 1 was conducted two weeks, and Post-test 2, six weeks after the commencement of the study.

The independent variables for the analysis were the intervention groups, the socioeconomic status, asthma experience and geographic location of the children. The dependent variable measured over time from each of the children was the asthma-related knowledge scores. By using the longitudinal research design, it is possible to assess causation by determining whether a change made to the independent variable precedes a change to the dependent variable. Therefore, over time, it can be determined whether the independent variable has an effect on the dependent variable.

Quasi-experimental designs may have issues regarding internal validity, as the experimental and control groups may not be comparable at baseline. Non-equivalent groups design assumes that the groups are not comparable at baseline and statistically compensates for this (Privitera & Ahlgrim-Delzell, 2018). Pre-test-post-test design measures the dependent variable both before and following the intervention. A change in the result between the pre-test and the post-test is assumed to have been caused by the intervention (Privitera & Ahlgrim-Delzell, 2018). In Study One, a combination of quasi-experimental designs was used, which combines the benefits of both the non-equivalent groups design and the pre-test-post-test design. The question with this combined design is whether the experimental group improved more than the control group between the pre-test and the post-test.

Other studies evaluating components of the CAERP in controlled experimental settings (University, medical centres and hospitals) found that these resources significantly improved children's knowledge and their self-management of asthma (Holzheimer et al., 1998; Mohay et al., 1993a, 1993b). This research sought to build on the previous findings of Holzheimer (1994) to determine if independent use of the CAERP by children and educators

in community settings was effective in enhancing the knowledge of asthma and its management among children with and without asthma.

Participants

Five hundred and sixty-four children aged 3 to 5 years who may or may not have had asthma were enrolled into the study to evaluate the effect of the CAERP on children's asthma-related knowledge when used in early childhood centres. Participants were recruited using information brochures forwarded to Education Queensland preschools, community kindergartens and childcare centres in metropolitan and regional areas of Queensland.

Study One participants were located in six discrete geographical communities and were recruited from areas representative of high and low socioeconomic status. The determination of the socioeconomic status of locations was made by the Australian Bureau of Statistics (2009) based on census data. The Australian Bureau of Statistics defines socioeconomic status in terms of access to resources which include medical and transport services.

Educational settings from each of the geographical locations were recruited and assigned to one of three experimental or one of three control groups. Group allocations were pre-determined by geographic location. Geographical areas were carefully selected to prevent contamination between the control (those not exposed to the CAERP), and experimental groups (those exposed to the CAERP) in Study One and Study Two. The potential for contamination between groups was reduced by avoiding placement of control and experimental groups in close geographical proximity to each other. The groups most at risk of cross contamination were in the inner metropolitan suburbs of Brisbane which were separated into North and South Brisbane.

Where possible, experimental and control groups were balanced for sex, age, and centre type. As Study One aimed to assess the effect of the education package on children's

knowledge of asthma, it was not necessary for participants to have asthma. Location details and socioeconomic descriptors for each group are detailed in Table 1.

Table 1

Location and socioeconomic descriptors for each experimental and control group in Study One

	Group	Location	Location Type	Socio-Eco Indicators*
Subset 1	Experimental Group 1	Brisbane	Inner Metropolitan Suburb	High SES
Subset 1	Control Group 1	Brisbane	Inner Metropolitan Suburb	High SES
Subset 2	Experimental Group 2	Ipswich	Outer Metropolitan Region	Low SES
Subset 2	Control Group 2	Brisbane	Outer Metropolitan Region	Low SES
Subset 3	Experimental Group 3	Bundaberg	Regional	Low SES
Subset 3	Control Group 3	Hervey Bay/ Maryborough	Regional	Low SES

(*As indicated by Australian Bureau of Statistics, 1997)

The baseline level of asthma-related knowledge for a group may have been influenced by the number of participants in that group who had asthma. Participants with asthma may have more experience with the disease and therefore, more knowledge than those without asthma. Although the CAERP was developed for children aged 2 to 5 years, children aged 3 to 5 years were enrolled into the study to ensure that the younger children attending childcare or kindergarten were able to follow instructions and had an adequate attention span to complete the twenty questions.

The Asthma Education Resources

The educational resource used in these studies was the Children's Asthma Education Resource Package (CAERP). The CAERP is a specially designed program that uses age-appropriate resources to allow very young children and their parents and caregivers to develop

knowledge of asthma and asthma self-management. Each component of the package was previously evaluated in three separate studies (Holzheimer et al., 1998; Mohay et al., 1993a, 1993b). These earlier studies demonstrated that the CAERP increased children's knowledge of asthma and asthma self-management in controlled, clinical environments. Additionally, these previous studies reported that the CAERP was associated with improvements in children's asthma self-management and asthma health.

The CAERP consists of three video segments and a children's picture book. The first video segment was *The Adventures of Kooky the Kookaburra and Cassie the Koala* (Mohay & Masters, 1991) (see Appendix B). This recording features actors dressed as the main characters and conveys the message regarding the symptoms of asthma, its effects on the lungs and the impact of asthma medication.

The second video segment is *The Agro Asthma Show* (Mohay & Masters, 1992) (see Appendix C). This recording features the puppet Agro, a popular children's television character and two young children. Agro engages the children in conversation about the skill of using a spacer and a puffer. The children model the assembly of the spacer and puffer and then demonstrate the correct use of both.

The third video is *Young Children Managing Asthma* (Mohay & Masters, 1993) (see Appendix D). This recording features Benita Collins, a television host of *Play School*, a popular daily children's television program at the time the research was conducted. Benita engages the children in conversations about how they manage their asthma. The children model the assembly of the spacer and puffer and then demonstrate the correct use of both the spacer and puffer, and a nebuliser. The conversation emphasises the importance of taking daily medication to manage asthma, asthma triggers, and activities that children can complete while using a nebuliser.

The fourth component of the CAERP is the children's picture book, *What's That Noise?* (Holzheimer, 1993) (see Appendix E). This 17-page picture book reinforces messages about the correct use of nebulisers, spacers and puffers, the avoidance of asthma triggers and the need to take daily medication. Other messages include the ability of children with asthma to participate in normal childhood activities and the acceptance of peers with asthma.

Instrumentation

These current studies evaluated the effectiveness of the CAERP when used in non-clinical community settings. The earlier studies assessed the use of the CAERP in clinical settings and were used as pilot studies for this research. Instrumentation used in the previous studies, therefore, could be modified for use in this research. The instruments outlined below were those developed by the researcher based on the instruments used in the earlier research.

Children's Asthma Knowledge Test

The researcher developed the Children's Asthma Knowledge Test (CAKT) for this study (see Appendix F). This test was designed to evaluate children's knowledge of asthma and its management. The CAKT allows changes over time in asthma-related knowledge to be documented in a series of re-tests (Holzheimer, 1994). The test format was based upon similar test formats used in previous studies evaluating CAERP components (Holzheimer et al., 1998; Mohay et al., 1993a, 1993b).

The CAKT was specifically designed to evaluate the CAERP and would not be suitable for evaluating children's asthma knowledge in other contexts. Question content is directly related to information communicated through the CAERP videos and picture book. Questions assess children's knowledge of lung physiology, asthma pathogenesis, asthma triggers, the function of asthma medication, delivery devices (spacer and nebuliser), device usage procedures, and associated quality of life issues.

The CAKT is a pictorial multiple-choice test consisting of nineteen questions, the first of which is an unrelated rehearsal item. The pictorial format was selected to facilitate ease of responses to questions for young children, who might find it hard to respond verbally, in the context of an unfamiliar situation. Three potential answers are presented in pictorial form for each question. Children were required to select the picture representing the only correct response to that question. As the children were young, and the researcher was unfamiliar to the children, they were only required to identify their answer by pointing their finger at the chosen picture. By using pictures representing answers, the literacy requirements were reduced such that even the youngest of the children in the study were able to identify their response accurately (Haladyna, 2004).

Correct responses were randomly distributed to avoid position effects. Without careful distribution of correct answers, construct validity might be compromised (Attali & Bar-Hillel, 2003). Three possible answers were presented for each question. Therefore, approximately one-third of children in each group would correctly answer each question by chance alone. Excessive familiarity with correct response positions may result from repeated use of the test as identified in a previous study (Holzheimer, 1994). The current format was produced to allow for random rearrangement of the three possible responses for each question, at each subsequent assessment of children's asthma-related knowledge. A random rearrangement of these responses was performed before each subsequent assessment.

The test questions related to asthma self-management were asked from the perspective of a young boy, Thomas, who has asthma. The presentation of this scenario was essential to avoid the suggestion that children who do not have asthma should perform practices related to asthma management, such as taking asthma medication. Children's answers to the CAKT at Pre-Test 1 and Post-Tests 1 and 2 were recorded on the Children's Asthma Knowledge Test Score Sheet (see Appendix G).

General Information Parent Questionnaire

The General Information Parent Questionnaire (see Appendix H) is a 21 item questionnaire adapted from the work of Chung and Price (1994) to record participants' demographic details and experience of asthma. The participant's parent or guardian completed this questionnaire. Demographic information requested for the General Information Parent Questionnaire included children's sex and date of birth, parental/guardian education, and occupation levels.

Eleven items relate to the participant's experience of asthma and allow for the identification of children who have previously experienced asthma symptoms, those believed to have asthma, and those diagnosed with asthma. Additionally, family history of asthma was also recorded. Information of this nature was valuable as prior experience with asthma may be associated with improved knowledge of asthma and its medical management (Elliott et al., 2014; Zahradnik, 2011). Additionally, previous studies showed that caregiver knowledge of asthma and asthma treatment could improve asthma control and severity in children (Largo et al., 2011).

Children's Health Status and Asthma-Related Knowledge Questionnaire for Parents of Children with Asthma

Parents of participants identified from the General Information Parent Questionnaire as experiencing asthma symptoms were requested to complete the Children's Health Status and Asthma-Related Knowledge Questionnaire for Parents of Children with Asthma (see Appendix I). This follow-up questionnaire is an adaptation and expansion of similar questionnaires used by Chung and Price (1994), which provides more detailed information about the participant's asthma and assesses parental asthma-related knowledge.

The first subset of questions identified the child participant's frequency of asthma symptoms, the age at which a medical diagnosis was made, the severity of their asthma, level

and the frequency of medical consultations, current medication regimen and number of recent absences from care or educational settings due to asthma. Parent's or guardian's knowledge of asthma and its management were assessed with the second subset of multiple-choice questions. Some general asthma fact questions were adapted from the work of Atchison and Cuskelly (1994), while others are an extension of questions presented in the CAKT. Finally, 14 statements about asthma management adapted from Chung and Price (1994) were used. Respondents were asked to identify their level of agreement with each statement on a five-point rating scale. Questions and the statements are consistent with information conveyed in the CAERP and explore issues of asthma pathogenesis, symptoms, triggers, medication and delivery device use, and general management concerns. Three additional questions gauge parental interest in gaining further asthma knowledge.

Teacher and Caregiver Questionnaires

Teacher Questionnaire One (see Appendix J), designed for all participating teachers and caregivers, aims to assess pre-intervention asthma-related knowledge. Questions were similar to those of the Children's Health Status and Asthma-Related Knowledge Questionnaire for Parents of Children with Asthma. Information about the educator's personal and professional experience with asthma and its management in early childhood centres is requested. Additionally, levels of professional education and experience in early childhood environments were also detailed.

Teacher Questionnaire Two (see Appendix K), was given at the study's conclusion and aimed to reassess and evaluate any changes in asthma-related knowledge that occurred over time. Experimental group teachers and caregivers who used the CAERP completed this questionnaire. The questionnaire requested details about the usage of the CAERP and its perceived usefulness and effectiveness as an educational resource.

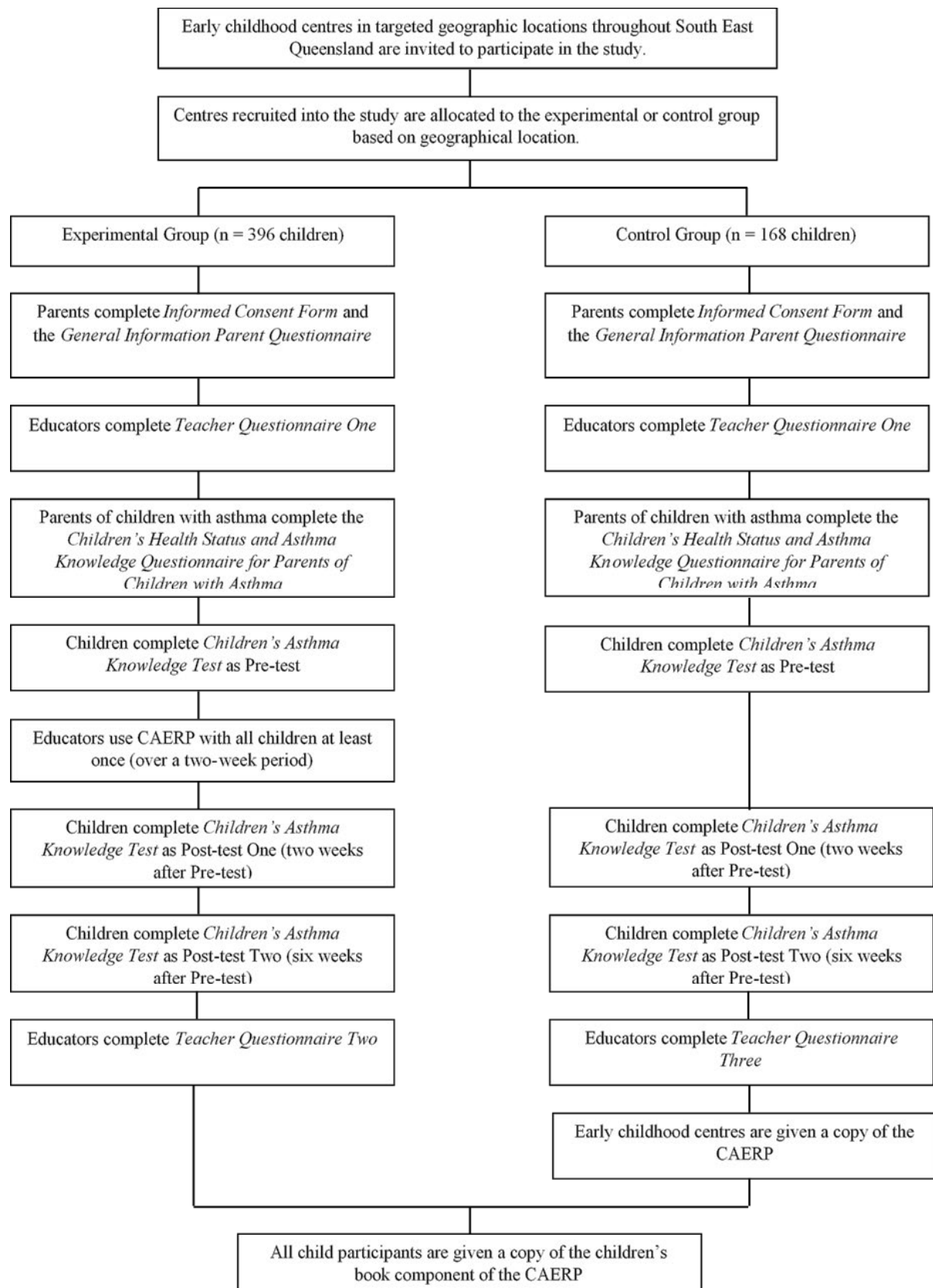
Control group educators who did not use the CAERP with groups of children during the experiment were given Teacher Questionnaire Three after the study (see Appendix L). This questionnaire contained only asthma-related knowledge questions (identical to those presented in the first and second questionnaires) and aimed to re-evaluate asthma-related knowledge.

Procedures

The procedure used in Study One is presented in Figure 1. Upon recruitment, the parents of all children were given the General Information Parent Questionnaire for completion to provide general demographic details and identify children with asthma. Parents of children identified via this questionnaire as experiencing asthma symptoms were requested to complete the Children's Health Status and Asthma Knowledge Questionnaire for Parents of Children with Asthma. All teachers and caregivers were requested to complete Teacher Questionnaire One to assess asthma-related knowledge and experience, and professional background.

Figure 1

Summary of the Procedure Used for Study One



Current asthma-related knowledge of all child participants was assessed using the CAKT. Individual assessments were conducted by the researcher in the early childhood centre. The test was presented consistently for all children, with the standard question format. Test responses were recorded on the Children's Asthma Knowledge Test Score Sheet (see Appendix G). This initial assessment (Pre-Test 1) provided baseline data against which any subsequent changes in asthma-related knowledge was compared. Upon completion of the initial assessments, the procedures for experimental and control groups were followed as outlined in the following sections.

Experimental Groups

Experimental class groups were given the CAERP to use with children for six weeks. All children were tested individually for their knowledge of asthma at the commencement of the study, two weeks following the baseline test and six weeks following the baseline test.

The educators in the experimental group were instructed to use each of the three video segments and the children's picture book of the CAERP with all children participating in the study. While staff were asked to use the CAERP in a manner most suited to individual and group needs, minimum requirements for use were established. All participants viewed each video segment at least once and a participating staff member read the book to the children at least once during the following two weeks. Questionnaire data were also collected on the actual use of the resources by teachers and children.

Two weeks after distribution of the CAERP to the experimental groups, the Children's Asthma Knowledge Test was readministered (Post-Test 1) to experimental group participants to evaluate any short-term changes in their asthma-related knowledge. Longer-term changes in asthma-related knowledge were assessed using Post-Test 2 that was administered four weeks after the second test (Post-Test 1) to the same experimental group. Before the commencement of these second and third assessments, the positions of correct

responses were randomly redistributed. Post-Test 1 and Post-Test 2 results were compared against data obtained at the first assessment (Pre-Test 1) of asthma-related knowledge.

All experimental group staff were given Teacher Questionnaire Two to evaluate any changes in asthma-related knowledge resulting from use of the CAERP. This questionnaire also established how educators used the CAERP with groups of children and they perceived its effectiveness and usefulness.

Control Groups

The data from the control groups was compared to the experimental group data. Children and educators in this control group were not exposed to the CAERP until the completion of Study One. Therefore, the procedure for control groups was similar to that of the experimental groups.

The Children's Asthma Knowledge Test was readministered two weeks after completion of baseline measures (Post-Test 1) and again four weeks after Post-Test 1 (Post-Test 2). The positions of correct responses on the Children's Asthma Knowledge Test for the control group were consistent with those of the experimental group. This group, however, acted as a control for score increases resulting from other factors.

After these assessments, all control group educators were given Teacher Questionnaire Three to reassess asthma-related knowledge. The assumption was that there would be no significant change in the knowledge of teachers and caregivers when scores from this questionnaire (Post Test) are compared against those of Teacher Questionnaire One (baseline measure). However, the resulting data was used as a comparative for experimental group data and controlled for testing effects and other random events. Upon completion of these assessments, each control group early childhood centre was then provided with a copy of the CAERP for use with children, and each child received a copy of the asthma book.

The effect of the CAERP on children's asthma-related knowledge was assessed by comparing the knowledge of the experimental groups who used and viewed the CAERP against that of the control group who did not receive CAERP exposure until the completion of Study One.

Procedures for Coding of Data

Children's responses on the CAKT were marked as correct or incorrect and tallied on the CAKT score sheet. Questionnaire responses were assigned numerical values, with possible responses for each question given different values. Statistical analysis was completed using the rating scale responses that were categorised numerically, and open-ended question responses were also classified and assigned numerical values.

Study Two: Assessing Asthma Self-Management

Participants

Study Two involved 92 participants aged 3 to 5 years who were diagnosed with asthma and required daily medication. To ensure that the largest sample size was obtained, it was necessary to request the assistance of medical practitioners to actively encourage the parents of children with asthma to participate in the study. Additionally, the research was publicised using radio and television interviews conducted with the researcher.

Medical practitioners practising in the target locations were approached and invited to assist with the recruitment of paediatric asthma patients and their parents into the study. Upon agreement, each practitioner was provided with information brochures, which described the nature of the research and sought patient participation. As a result of this request, children and their parents were referred to the study by general medical practitioners, paediatricians and respiratory specialists who had been consulted about the child's asthma.

Participation in the study was voluntary, and informed consent was obtained from each parent or legal guardian of children participating in the study. Information brochures,

letters and consent forms were given to participants. Participants were free to withdraw from the study at any time.

The non-random selection process used, potentially introduced a bias into the sample as those parents who were either more interested or in greater need of asthma education for their children may have been more likely to volunteer. Similarly, the medical practitioners themselves may have influenced the sample by recommending participation to those they felt would benefit most as opposed to recommending participation equally to all patients. The medical practitioner's attitude towards asthma education may have resulted in them advocating participation more strongly to their patients. The sample could potentially have an over-representation from medical practitioners who were more inclined to have already educated their patients about their asthma.

Participants were assigned to one of two research groups based on their area of residency. Participants located north of the centre of Brisbane were allocated to the control group, and those participants south of the centre of Brisbane formed the experimental group. The two groups were located in different areas of the greater Brisbane region to avoid possible contamination between experimental and control groups.

Instrumentation

Children's Health Status and Asthma Knowledge Questionnaire for Parents of Children with Asthma

The 38-item questionnaire (see Appendix M) sought to detail a range of demographic details, information regarding the status of the child's asthma during the past twelve months, family history of asthma, and parental knowledge of asthma and its management.

Components of the General Information Parent Questionnaire (see Appendix I) and Children's Health Status and Asthma Knowledge Questionnaire for Parents of Children with Asthma (see Appendix K) were combined to develop this questionnaire. This questionnaire

was used to provide a range of baseline data against which any subsequent changes in children's health, children's asthma management practices or parents' asthma-related knowledge was compared.

Children's Asthma Management and Health Status Diary

The Children's Asthma Management and Health Status Diary (see Appendix N) was developed to evaluate the changes in the children's asthma management practices and asthma health as a result of CAERP use. The diary format was similar to that previously used and was considered a useful measure, with completion rates reported at 90% (Holzheimer, 1994; Mohay et al., 1993a, 1993b).

Parents completed the diary daily and recorded:

- the occurrence of asthma symptoms.
- compliance with asthma medication regimens.
- changes in asthma medication and medication dosages.
- need for asthma-related medical consultation:
 - phone calls to the doctor.
 - visits to the doctor.
 - emergency visits to hospital.
 - hospital admission.
- activity restriction due to asthma.

An open comments section was also provided, to document further details of management practices or health.

Parental Asthma-Related Knowledge Questionnaire

This 24 item questionnaire (see Appendix O) evaluated changes in the asthma-related knowledge of parents of children with asthma, that occur over time. It was an abbreviated

form of the Questionnaire for Parents of Children with Asthma described above.

The questionnaire contained only asthma-related knowledge questions.

Childhood Asthma Education Resource Package Use Questionnaire

This questionnaire completed by parents who use the CAERP with their child with asthma (see Appendix P) aimed to detail the frequency and style of use of the CAERP.

Respondents were requested to rate the effectiveness of the CAERP in educating themselves and their child about asthma and its management indicated by responses on a 3-point Likert scale.

Procedures

The procedure used in Study Two is presented in Figure 2. Upon enrolment, each child's parents were given the CAERP and encouraged to view these resources with their child at least once during the first two weeks of the study, with no limit placed on the maximum number of exposures throughout the study. Parents completed a daily diary noting the information on the child's asthma symptoms, adherence to medication regimens, use of medical services and activity restriction due to asthma.

Figure 2

Summary of the Procedure Used for Study Two



The status of each child's asthma during the past twelve months was assessed using the Children's Health Status and Asthma Knowledge Questionnaire for Parents of Children with Asthma (see Appendix M). This questionnaire assessed parental asthma-related knowledge and gathered demographic information. The researcher mailed this questionnaire to participants upon enrolment into the study and asked parents to complete the questionnaire.

All parents were also given a copy of the Children's Asthma Management and Health Status Diary and requested to complete it daily for the following three months (90 days). The diary was presented in monthly segments to ensure continued maintenance and safe return of the diary information to the researcher. Parents were mailed subsequent monthly diaries and were provided with a reminder notice encouraging daily diary completion.

The researcher mailed children and parents in the Experimental Group a copy of the CAERP for at-home use. Parents were instructed to view the three video segments and read the picture book with their child as often as they chose during the following three months. However, as a minimum requirement, each child and parent were asked to view the video segments and read the picture book at least once during the first two weeks. Participants in the Control Group did not receive the CAERP. Control group data served as a comparative basis for assessment of changes in the asthma management and health status of experimental group participants using the CAERP.

After 90 days, all parents were asked to complete the Parental Asthma-Related Knowledge Questionnaire to reassess parental knowledge about asthma and its management (see Appendix O). Consequently, any knowledge changes resulting from exposure to the CAERP could be evaluated. Additionally, all parents in the experimental group were given the Childhood Asthma Education Resource Package Use Questionnaire to determine how the CAERP was used and the frequency of its use (see Appendix P). This questionnaire assessed parental perceptions about the effectiveness and suitability of the resource for young children. Upon completion of Study Two, all control group participants received a copy of the CAERP to keep for at-home use.

Procedures for Coding of Data

Questionnaire responses were assigned numerical values, with possible responses for each question given different values. Statistical analysis was completed using the rating scale

responses that were categorised numerically, and open-ended question responses were also classified and assigned numerical values. The occurrence and frequency of events on the Children's Asthma Management and Health Status Diary were tallied and coded for each of the three months.

Summary

This chapter outlined the methodology used to gather data for Study One and Study Two. The chapter also details the recruitment strategies, the particulars in collecting the data, and the instrumentation used in each study. The following chapter, Chapter Four, summarises the data analysis techniques used and presents the results of Study One and Study Two.

Chapter Four

Results

Introduction

In this chapter, the results from Study One and Study Two are presented and examined in detail. The results of the tests and questionnaires conducted will be used to answer the research questions addressed in each study.

Study One

Demographics

The parents of children enrolled in this study completed the General Information Parent Questionnaire that included items that provided demographics useful for describing the families and the children who participated in the study. The children were allocated to either the experimental group, (n = 396) or the control group, (n = 168). In both groups, the ages of the children ranged from 3 to 5 years, with the average being age being 5 years old. Table 2 shows that the percentages of boys and girls were similar for both groups, with the majority of the children coming from homes located in areas representative of lower socioeconomic status (SES).

Table 2*Demographics for the Experimental and Control Groups*

Demographic	Experimental		Control	
	n	%	n	%
Gender				
Boy	196	50	75	45
Girl	159	40	62	37
No Response	41	10	31	19
SES				
Upper	36	9	48	29
Lower	360	91	120	71
Has your child been diagnosed with asthma by doctor?				
Yes	106	27	36	21
No	51	13	22	13
No Response	239	60	110	66
Adult/s in Household With Asthma				
Yes	111	28	36	21
No	242	61	101	60
No Response	43	11	31	19

Results

This section provides the results related to the research questions presented earlier for Study One. Each question is restated, followed by the results of the analysis employed.

Research Question 1

Does the use of the Children's Asthma Education Resource Package (CAERP) improve the asthma-related knowledge of children aged 3 to 5 years when used in non-clinical settings?

The Children's Asthma Knowledge Test was used to answer this question and was administered three times to the experimental and control group children. The first administration of the test served as a pre-test before the CAERP intervention. The test was

administered as Post-test 1 two weeks after the Pre-test to evaluate the short-term effect. It was then, administered as Post-test 2 six weeks after the Pre-test to assess the longer-term effect. There were complete data available for 424 children, with 284 being in the experimental group and 140 in the control group. There was an expectation that there should be a minimal difference between the groups on the pre-test; however, if the intervention had an effect, the experimental group would score higher on the two post-tests.

Analysis of covariance (ANCOVA) was employed to test for a statistical difference between the means of the two groups on the post-tests. ANCOVA is an extension of the traditional analysis of variance or t-test. However, it adds precision to an analysis by statistically controlling for possible initial differences between the groups. This test is important because if the groups differ on the variable of interest before the intervention, and if they differ after the intervention, it is difficult to interpret the end difference as a consequence of the intervention. Thus, as was the case in this study, a pre-test can be administered and used as a control variable (covariate). The process statistically adjusts post-test scores to account for initial differences that may exist. If a difference remains after the adjustment, more confidence can be attributed to the effect of the intervention.

Two ANCOVAs were conducted, one to test for a difference between the experimental and control groups on Post-test 1 and the other to test for a difference on Post-test 2. There was also interest in whether there was a difference in the post-tests associated with upper and lower socioeconomic status (SES) regarding asthma-related knowledge, as measured by the Children's Asthma Knowledge Test. The .05 level of probability was used to test for statistical differences.

Table 3 presents the means associated with the statistical tests. Part i shows the overall means for the experimental group (E), the control group (C), upper SES, and lower SES. The Group by SES means is shown in Part ii of the table.

Table 3

Pre- and Post-test Mean Children's Asthma Knowledge Test Scores and Standard Deviations by Group, SES, and Group by SES as a Function of the CAERP

Source	Pre-test			Post-test 1		Post-test 2	
	n	M	SD	M	SD	M	SD
Part i							
E Group	284	9.70	2.74	13.01	3.17	13.58	3.09
C Group	140	9.19	2.76	9.08	2.94	9.42	2.91
Upper	80	8.95	2.61	10.80	3.71	10.75	3.63
Lower	344	9.67	2.77	11.92	3.55	12.55	3.52
Part ii							
E Group							
Upper	34	9.75	2.74	13.74	3.04	13.68	2.73
Lower	250	9.74	2.74	12.91	3.18	13.57	3.14
C Group							
Upper	46	8.67	2.51	8.63	2.45	8.59	2.54
Lower	94	9.45	2.85	9.30	3.15	9.83	2.99

The number of children in each of the combinations of groups is in the 'n' column. For example, there were 284 children in the experimental group and 140 in the control group. Overall, there were 80 children from homes in upper SES areas, while the majority (344) were from homes in lower SES area. The numbers of children in the various group by SES combinations are in Part ii. That is, of the 284 children in the experimental group, 34 were from homes in upper SES areas while 250 were from homes in lower SES areas. In the control group, 46 were from homes in upper SES areas, with 94 from homes in lower SES areas.

Before reporting the results of the ANCOVAs, several comments may be useful to place some perspective regarding the means shown in Table 3. Firstly, observation of the pre-test (covariate) means (M) column suggests that the groups were similar before the

intervention. The means ranged from 8.67 to 9.75—just over a one-point difference.

The ANCOVA procedure controlled for these initial differences, and this was desirable because any post-test statistical difference could be attributed with greater confidence to the intervention.

Secondly, under Part i, observation of the overall means for the experimental (E) and control (C) groups (disregarding SES) on Post-tests 1 and 2 showed that the experimental group scored higher on both post-tests ($M = 13.01$, $M = 13.58$) than the control group ($M = 9.08$, $M = 9.42$). Although the differences were small, the overall means for SES (disregarding group membership) shows that the children from homes in lower SES areas scored higher ($M = 11.92$, $M = 12.55$) than the children from homes in upper SES areas ($M = 10.80$, $M = 10.75$).

Part ii of the Table provides the means for each combination of group by SES. Therefore, neither group nor SES is disregarded. In each of the combinations of group by SES for Post-tests 1 and 2, the experimental group children scored higher than the control group children regardless of SES. Notably, the Post-test 1 and 2 means for the control group changed slightly from their pre-test means, and this change was not unexpected as the control group did not receive the CAERP. To determine if the observed differences in the means described were statistically significant, two ANCOVAs were conducted, and these are discussed in the following sections.

Table 4 presents the results of the ANCOVA conducted on Post-test 1.

Table 4

Analysis of Covariance of Post-test 1 Children's Asthma Knowledge Test Scores as a Function of CAERP and SES, with Pre-test Children's Asthma Knowledge Test Scores as Covariate

Source of Variation	Df	MS	F
Covariate (Pre-test)	1	1384.85	221.58*
Group	1	989.60	158.34*
SES	1	13.67	2.18
Group x SES	1	24.22	3.87
Error	423	6.25	

* $p < .05$

The statistical procedure separated the overall score variation into components associated with the main factors (Group and SES) as well as the interaction (Group x SES). The more variation that can be assigned to those components, the more likely there will be a statistically significant difference. The error variance is variation that is 'leftover'. Therefore, the smaller the error variance, the more likely there will be a difference. The asterisk indicates a statistically significant difference at the probability level selected.

In Table 4, two sources of variation were statistically significant. Although the pre-test differences were quite small, they were statistically significant ($F = 221.58$, $p < .05$) and were controlled for by the analysis. The difference between the experimental and control groups was statistically significant ($F = 158.34$, $p < .05$). In Table 3, the experimental group mean was greater than that of the control group. There was no overall difference between the children from homes in upper and lower SES areas on Post-test 1 or an interaction between group and SES. These results support the expectation that the CAERP had a short-term effect (two weeks) in the desired direction after the intervention and that SES was not a factor.

The second ANCOVA was conducted on Post-test 2. Table 5 demonstrates that the results were the same as for Post-test 1 and adds further support for the effect of the CAERP on increasing the asthma-related knowledge of children. More importantly, since Post-test 2 was administered four weeks after Post-test 1, these findings suggest that the CAERP may have a longer-term effect.

Table 5

Analysis of Covariance of Post-test 2 Children's Asthma Knowledge Test Scores as a Function of CAERP use and SES, with Pre-test Children's Asthma Knowledge Test Scores as Covariate

Source	Df	MS	F
Covariate	1	1374.71	234.19*
Group	1	1016.97	173.25*
SES	1	1.76	0.30
Group x SES	1	19.19	3.27
Error	419	5.87	

*p < .05

Although the primary focus of Study One was on the administration and the effect of the CAERP on children's asthma-related knowledge, interest was also on educators' perceptions and knowledge about asthma. Also, feedback was obtained about how the teachers in the experimental group viewed the usefulness of the content of the CAERP. The next section addresses these areas and presents several demographics associated with the experimental and control group educators.

In Table 6, there were more educators in the experimental group (N = 42) than in the control group (N = 22). In both groups, most teachers were employed in state preschools and childcare centres.

Table 6*Demographics for Experimental (N = 42) and Control (N = 22) Group Teachers*

Demographic	E		C	
	n	%	n	%
Workplace				
Childcare centre	18	43	15	68
Private Kindergarten/preschool	2	5	2	9
State preschool	18	43	5	23
Not provided	4	10	0	0
	Median		Median	
Number of children cared for	31		24	
Number known to have asthma	5		4	
Others thought to have asthma	2		1	

Note. Percentages may not add to 100 due to rounding.

Question 1a

What were the educator's perceptions about asthma before and after the CAERP intervention?

A questionnaire designed for the participating educators in both groups assessed Pre- and Post-perception about asthma (see Appendix J, Appendix K and Appendix L). As described in Chapter Three, the statements were responded to on a LIKERT scale from agree to disagree. Each statement is listed in Table 7 with the pre and post percentages on the scale. A large number of educators in both groups were not available for the post-intervention perception questionnaire. The study concluded at the end of the school year with many of the childcare educators taking leave for the Christmas vacation.

Table 7*Teacher's Pre- and Post-perception about Asthma*

Asthma attacks can be prevented				
	Pre-perception		Post-perception	
	E(38)	C(22)	E(24)	C(9)
	%	%	%	%
Agree	74	73	67	89
Uncertain	24	27	13	11
Disagree	1	0	21	0
Asthma medications should be used regularly for the best results				
Agree	68	67	75	67
Uncertain	32	29	21	33
Disagree	0	5	4	0
Asthma medications are addictive if they are used all the time				
Agree	8	9	13	0
Uncertain	34	45	33	56
Disagree	58	45	54	44
The use of asthma medication every day should be discouraged if the child with asthma does not have any symptoms				
Agree	41	22	33	25
Uncertain	35	50	29	25
Disagree	24	27	38	50
Children who get asthma when running should be encouraged to play quiet games				
Agree	42	46	46	33
Uncertain	21	18	17	11
Disagree	37	36	38	57
It is easy to give an overdose of medication with asthma nebulisers				
Agree	13	18	17	13
Uncertain	42	32	25	25
Disagree	45	50	58	63
Asthma medications stop being effective if they are taken regularly for long periods of time				
Agree	3	5	8	0
Uncertain	58	59	38	22
Disagree	40	36	54	78

	Pre-perception		Post-perception	
	E(38)	C(22)	E(24)	C(8)
	%	%	%	%
I feel that my knowledge of asthma and its management is satisfactory				
Agree	38	57	50	44
Uncertain	27	24	29	44
Disagree	35	19	21	11
Parents of children with asthma are usually over-anxious about their child's asthma				
Agree	42	18	33	22
Uncertain	13	32	21	44
Disagree	45	50	46	33
Children with asthma symptoms should be kept at home				
Agree	21	14	4	13
Uncertain	8	9	0	0
Disagree	71	77	96	88
Inhalers (puffers) are safer than nebulisers				
Agree	8	9	0	0
Uncertain	57	68	46	56
Disagree	35	23	54	39
Asthma attacks are often triggered by emotional responses				
Agree	51	55	54	78
Uncertain	37	32	29	11
Disagree	11	14	17	11
Young children should be encouraged to accept responsibility for the management of their asthma under adult supervision and guidance				
Agree	72	77	100	100
Uncertain	14	14	0	0
Disagree	14	9	0	0
Children with asthma can participate in all normal childhood activities if their asthma is well managed				
Agree	86	96	100	90
Uncertain	3	4	0	11
Disagree	11	0	0	0

	Pre-perception		Post-perception	
	E(36)	C(22)	E()	C()
	%	%	%	%
Childcare workers/teachers should always consult with parents before adjusting a child’s asthma medication regime.				
Agree	89	86	Data not collected	
Uncertain	0	0		
Disagree	11	14		
It is extremely difficult for a childcare worker/teacher to assume responsibility for the management of a child’s asthma				
Agree	45	43	Data not collected	
Uncertain	8	10		
Disagree	47	47		
Childcare workers/teachers should not have to take responsibility for giving asthma medications.				
Agree	16	14	Data not collected	
Uncertain	8	14		
Disagree	76	73		

One unexpected result from this questionnaire is the change in educators' perceptions regarding the preventability of asthma attacks. Following the intervention, educators in the experimental group showed an increase in those who believed that asthma attacks could not be prevented. This result was contradictory to the message provided in the CAERP that asthma attacks were preventable with good management. There may have been some misconception regarding the incurable nature of asthma and the preventability of asthma attacks. As expected, more educators indicated that their knowledge of asthma and its management was satisfactory after use of the CAERP. Educators using the CAERP increasingly felt that children experiencing asthma symptoms did not need to be kept at home and could participate in all normal childhood activities if their asthma was well managed.

Question 1b

What are the perceptions of the experimental group educators about the usefulness of the CAERP material for increasing educator and child knowledge?

A questionnaire designed for the participating educators in the experimental group assessed their perceptions of the usefulness of the CAERP for increasing educator and children's knowledge, as described in Chapter Three (see Appendix K). Each area of asthma-related knowledge addressed by the CAERP is listed in Table 8 with responses recorded on a three-point LIKERT scale from very useful to not useful.

Table 8

Perceptions of the Usefulness of CAERP for Increasing Educator and Child Knowledge about Asthma (N = 22)

	Very Useful	Some Use	Not Useful
CAERP	n	n	n
Increase of teacher knowledge (N = 22)			
Structure and function of the lungs	6	16	0
Asthma as a health condition	16	5	1
Asthma triggers	15	7	0
Purpose and function of asthma medications	15	6	1
Use of nebulisers and spacers	17	5	0
Increase in children's knowledge (N = 21)			
Structure and function of the lungs	9	11	1
Asthma as a health condition	14	6	1
Asthma triggers	12	7	2
Purpose and function of asthma medications	16	5	0
Use of nebulisers and spacers	17	4	0

Table 8 shows that most educators found the CAERP to be very useful, increasing both educator and children's knowledge except in the content related to the structure and

function of the lungs. Educators still found this content to be of some use, and very few reported the CAERP was not useful.

Educators in the experimental group used the CAERP resources with the children in their care different numbers of times. The number of times these resources were used with the whole group ranged from once to six times with the CAERP being used twice on average. In the 22 centres considered, only three centres used the resources more than three times. While there was some variability in the number of times the CAERP was used, most teachers used the resources one, two, or three times with the whole group.

Study Two Results

Demographics

Parts i and ii of Table 9 provide several overall demographics for the families and the children by group. The genders of the children in the experimental (E) and control (C) groups were reasonably equally distributed with boys outnumbering the girls by a margin of over two to one in each group. This distribution of children with asthma is similar in the general Australian population. The two groups were equally distributed with respect to siblings with asthma as well as their living situations. In relation to household adults with asthma, the control group had a considerably larger percentage than the experimental group (61.0% to 43.1 %).

Part ii of the table shows the median age (in months) of the children at the onset of the study, the median age (in months) when asthma was first diagnosed, and several asthma-related medical and school issues over the 12 months preceding the study.

The distributions were skewed somewhat, and the medians are shown rather than the means because they are a better indicator of the average or typical measure when describing the group. The medians of the two groups were similar at the beginning of the study. The ranges were also similar, although it appears that the control group upper range for emergency ward

(12), hospital admission (12) and school absences (92) were greater for the control group.

However, this was due to one child. If this child's data was removed, the ranges would be nearly the same.

Table 9

Family Asthma Demographics for the Experimental (N = 51) and Control (N = 41) Groups

Demographic	E	C
	%	%
Part i		
Gender		
Boy	72.50	68.30
Girl	27.50	31.70
Siblings with asthma		
Yes	51.00	43.90
No	49.00	56.10
Adult/s in the household with asthma		
Yes	43.10	61.00
No	56.90	39.00
Family living situation		
Respondent, spouse, and child/children	92.20	87.80
Respondent and child/children	5.90	4.90
Respondent, spouse, child/children, and other family members	2.00	2.40
Respondent, child/children, and other family members	0.00	4.90
Part ii		
Age at time of the study (Months)	Median	Range
E	51.00	36-71
C	50.00	36-71
Age of asthma diagnosis (Months)		
E	24.00	2-58
C	24.00	6-53

Demographic	E %	C %
Child in the past 12 months		
Times attended the emergency ward		
E	0.00	0-6
C	0.00	0-12
Times admitted to hospital		
E	0.00	0-5
C	0.00	0-12
Times absent from school		
E	4.00	0-48
C	2.00	0-92

Asthma Characteristics

Table 10 describes the children in terms of several characteristics related to their asthma. As with the demographics reported in Table 9, the two groups were similar across almost all of the characteristics.

Table 10

Children's Asthma Characteristics by Group

Characteristic	E(51) %	C(41) %
Child's asthma symptoms		
Cough	100.0	95.10
Wheeze	78.40	73.20
Difficulty breathing	70.60	75.60
Chest tightness	43.10	43.90
Other	15.70	14.60
Frequency of symptoms		
Most days	27.50	17.10
Weekly	35.30	24.4
Monthly	15.70	39.00
3-5 months	17.60	14.60
6-11 months	2.00	0.00
Once a year	0.00	2.40
Less than once a year	0.00	2.40

Characteristic	E(51) %	C(41) %
Frequency of asthma attacks		
More than once a week	9.80	4.90
Once a week	11.80	12.20
Once a month	29.40	26.80
Every three months	9.80	31.70
Every six months	7.80	12.20
Once a year	0.00	0.00
Less than once a year	0.00	9.80
Treatment of the child's asthma		
General practitioner only	47.10	48.80
Asthma specialist only	3.90	2.40
Paediatrician only	3.90	2.40
General practitioner and specialist	23.5	19.50
General practitioner and Paediatrician	29.4	24.40
Other	2.00	4.90
Frequency of treatment		
Once a week	3.90	2.40
Once a month	45.10	36.60
Every three weeks	43.10	43.9
Every six months	7.80	17.10
Administration of asthma medication		
Nebuliser only	7.80	9.80
Puffer only	0.00	2.40
Puffer and spacer	11.8	12.20
Puffer and spacer with a nebuliser for acute attacks	78.40	75.6
Other	9.80	0.00
Instructed on how to take medication		
General practitioner	47.10	48.80
Paediatrician	23.50	9.80
Nurse	29.40	19.50
Asthma educator	17.60	17.10
Other	5.90	7.30
Correct spacer technique checked in taking medication		
Yes	80.40	48.80
No	19.6	51.2

Results

This section provides the results related to the research questions presented earlier for Study Two. Each question is restated, followed by the results of the analysis employed.

Research Question 2

Was the use of the Children's Asthma Education Resource Package (CAERP) associated with improvement in the asthma health and self-management of children aged 3 to 5 years with asthma when used in non-clinical settings?

As described in the previous chapter, each family was requested to maintain a diary for 90 days. Daily, they recorded the number of times asthma-related events occurred in respect to eight variables. At the end of the 90 days, the weekly tallies were summed to obtain the total number of times the event occurred. It was expected that if the CAERP had an effect that the experimental participants would show fewer incidences for each event.

Preliminary observation of the means and standard deviations of the eight measures revealed large variations as well as skewed distributions. As such, the Mann-Whitney procedure was applied to test for differences between the groups on the eight events. It is one of the most widely used tests in situations where the data may not meet the parametric assumptions. The Mann-Whitney ranks the two groups on a particular measure as if they were one group. It is based on the premise that if there are little differences in the intermingled rankings, the groups do not differ. On the other hand, if most of the rankings for one group are higher/lower than the other group in the intermingled rankings there will be a difference between the two groups. Thus, the Mann-Whitney is a test of between rank differences and is analogous to the independent samples t-test or one-way analysis of variance for parametric data.

Table 11 shows the results for the eight Mann-Whitney tests. As expected, if the CAERP were effective, the experimental group would show fewer incidences over the eight

events. As can be seen in the table, this occurred with the experimental group means rankings being lower than the control group for all eight events, although the differences were small.

Table 11

Mann-Whitney Test and Effect Sizes for Group Differences on Eight Asthma-Related Dependent Variables

Variable	E(N = 40)	C(N = 33)	z	p	r
	Mean Rank	Mean Rank			
Wheezed/coughed	33.09	41.74	1.74	0.08	0.20
Medication change	34.38	40.18	1.17	0.24	0.14
Refused medication	34.66	39.83	1.13	0.26	0.13
Phoned doctor	35.19	39.20	0.97	0.33	0.11
Visited doctor	32.23	42.79	2.17	0.03	0.25
Visited emergency department	34.70	39.79	1.49	0.14	0.17
Admitted to hospital	35.84	38.41	1.08	0.28	0.12
Activity restriction	34.10	40.52	1.29	0.20	0.15

The 'z' and 'p' columns allow for the statistical interpretation of the Mann-Whitney test. The z-ratio is analogous to the t-ratio for the t-test. The larger the z, the more likely there is a statistical difference at a particular probability level. The .05 probability level was used as the criterion for statistical significance for these data. The p column provides the actual probabilities associated with the z-ratios. One of the p values was statistically significant ($z = 2.17$, $p = .03$) indicating that the experimental group required statistically significantly fewer doctor visits for asthma than did the control group. Therefore, from a statistical significance perspective, there was one difference between the two groups.

An increasingly common way to analyse data is to include effect sizes in addition to statistical tests. Statistical significance tests only provide information about the probability of a reliable difference between groups at some probability level. Statistical significance is not an indicator of the importance of a difference. Effect size is an indicator of importance

regardless of statistical significance and therefore, an important contribution to the interpretation of differences between groups. There are numerous indicators of effect sizes.

For the Mann-Whitney, a common indicator of effect size is the correlation between the groups and the mean rankings. The correlation can be obtained from the z-ratio and the overall number of participants used in the analysis ($N = 73$). It is calculated simply by dividing the z-ratio by the square root of N (8.54). For example, the effect size for wheezed/coughed is 0.20 ($1.74/8.54$). The correlations are negative for all eight events indicating that the greater the mean ranks the fewer the events. An effect size, based on correlation, is commonly interpreted as follows:

- Small effect size 0.10
- Medium effect size 0.25
- Large effect size 0.40

A perusal of the effect sizes suggests that two were of medium strength (wheezed/coughed and doctor visits) and several others are in between small and medium effects. Therefore, regardless of statistical significance, the experimental group reported consistently fewer occurrences of asthma-related health events across all eight events. From an effect size perspective, the strength of the differences was small to moderate.

In summary, the analysis for Research Question 2 showed that the experimental group reported fewer incidences of asthma-related health events than the control group, but there was little statistical support for this result from a statistical significance perspective. However, the importance of the differences based on effect sizes suggests that the CAERP did have a small to medium effect on decreasing the eight asthma-related health events in the experimental group when compared to the control group.

Question 2a

Was there a difference in parental knowledge about asthma and its management between parents that used the CAERP with their children and those that did not?

The Parental Asthma-Related Knowledge Questionnaire (see Appendix O) was used to answer this question. The first section of the questionnaire contained seven asthma-related knowledge questions. The items were summed to arrive at a total knowledge score for each of the respondents. One item had two correct answers, and therefore, the highest score possible was eight and the lowest zero. The Parental Asthma-Related Knowledge Questionnaire was given both before and after use of the CAERP; therefore, each respondent had two knowledge scores.

Preliminary screening for statistical assumptions showed that the parents' asthma-related knowledge scores on average were high and negatively skewed for both groups on both the pre and post CAERP measures. This result was expected because both groups consisted of parents who were experienced, and seasoned asthma managers and the knowledge questionnaire only asked basic questions. Due to the nature of the non-normal distributions, the Mann-Whitney non-parametric test was used to determine if there was a difference between the two groups on asthma-related knowledge as measured by the Parental Asthma-Related Knowledge Questionnaire.

Table 12 presents the results of the Mann-Whitney analysis of parental asthma-related knowledge. For the knowledge measure, the higher the mean rank reflected greater knowledge. There was no difference between the two groups ($z = 0.61$, $p = 0.54$) on the pre-measure. This result established that the two groups were similar in asthma-related knowledge before the start of the CAERP. There was a difference between the two groups using the .05 level for statistical significance in favour of the experimental group on the post

measure ($z = 2.38$, $p = 0.02$). Additionally, the effect size was medium with respect to importance.

Table 12

Mann-Whitney Test and Effect Sizes Between Groups on Pre- and Post CAERP Parental Asthma-Related Knowledge

Measure	E	C	z	p	R
	Mean Rank	Mean Rank			
Pre-Asthma Knowledge	42.87(46)	39.75(36)	0.61	0.54	0.06
Post-Asthma Knowledge	41.55(40)	30.19(32)	2.38	0.02	0.28

Note: The Ns for pre and post measures are shown in parentheses

In summary, although both groups were knowledgeable about asthma, the experimental group scored better on their asthma-related knowledge. The difference was both statistically significant as well as the effect size being medium with respect to importance.

Question 2b

Were there differences in perceptions about the management of asthma between parents who used the CAERP with their children and those who did not?

A series of 14 statements about asthma management were responded to by the participants before and after the use of the CAERP. These statements were incorporated into the Children's Health Status and Asthma Knowledge Questionnaire for Parents of Children with Asthma (see Appendix M) and the Parental Asthma-Related Knowledge Questionnaire (see Appendix O). Parents were asked to identify their level of agreement with each statement on a five-point rating scale (strongly agree, agree, uncertain, disagree, and strongly disagree). The statements were consistent with information conveyed in the CAERP and explored issues of asthma pathogenesis, symptoms, triggers, medication delivery device use, and general management concerns. Chi-square was used to test for differences between the experimental and control groups on the 14 statements before use of the CAERP and again at

the completion of the study. The 0.05 level was used as the criterion for statistical significance. For analysis and presentation purposes, the five-point scale was collapsed to three points---agree, uncertain, and disagree.

Table 13 shows the percentages for pre and post-tests and the resulting chi-square results. There were no statistical differences between the two groups before the beginning of the study. These results established that they were similar at the beginning of the study with respect to their perceptions about the 14 statements. There were three statistically significant differences in their post-CAERP perceptions, and these are shown in bold type.

Table 13

Parents' Pre- and Post-perception about Asthma

Asthma Attacks can be Prevented						
	Pre-perception		χ^2	Post Perception		χ^2
	E(50)	C(41)		E(44)	C(39)	
	%	%		%	%	
Agree	66	66	0.001	80	54	6.54*
Uncertain	22	22		16	31	
Disagree	12	11		5	15	
Asthma Medications Should be Used Regularly for the Best Results						
Agree	90	83	1.23	91	95	0.94
Uncertain	4	5		2	0	
Disagree	6	12		7	5	
Asthma Medications are Addictive if They are Used All the Time						
Agree	8	5	2.54	9	3	6.66*
Uncertain	26	42		13	36	
Disagree	66	54		78	62	

The Use of Asthma Medication Every Day Should be Discouraged If the Child with Asthma does not Have Any Symptoms

	Pre-perception		χ^2	Post Perception		χ^2
	E(50)	C(41)		E(44)	C(39)	
	%	%		%	%	
Agree	18	20	1.24	13	18	2.49
Uncertain	10	17		7	16	
Disagree	72	63		80	66	
Children who get asthma when running should be encouraged to play quiet games						
Agree	22	22	0.7	13	5	0.78
Uncertain	18	24		13	21	
Disagree	61	54		73	67	
It is easy to give an overdose of medication with asthma nebulisers.						
Agree	16	10	1.26	7	10	1.77
Uncertain	28	37		17	23	
Disagree	57	54		80	67	
Asthma medications stop being effective if they are taken regularly for long periods of time						
Agree	14	5	3.19	2	3	1.45
Uncertain	22	34		11	21	
Disagree	65	61		87	77	
I feel that my knowledge of asthma and its management is satisfactory						
Agree	70	59	2.36	86	64	7.95*
Uncertain	14	27		11	15	
Disagree	16	15		2	21	
Parents of children with asthma are usually over-anxious about their child's asthma						
Agree	46	40	0.85	48	33	2.19
Uncertain	16	13		14	23	
Disagree	38	48		39	4	
Children with asthma symptoms should be kept at home						
Agree	8	17	4.21	9	3	1.8
Uncertain	12	2		4	8	
Disagree	80	81		87	90	

Inhalers (puffers) are safer than nebulisers

	Pre-perception		χ^2	Post Perception		χ^2
	E(50)	C(41)		E(44)	C(39)	
	%	%		%	%	
Agree	10	5	3.16	9	8	2.91
Uncertain	39	58		36	54	
Disagree	51	38		56	39	

Asthma attacks are often triggered by emotional responses

Agree	33	29	4.99	38	31	2.69
Uncertain	35	56		36	26	
Disagree	31	15		27	44	

Young children should be encouraged to accept responsibility for the management of their asthma under adult supervision and guidance

Agree	84	76	1.88	96	90	1.6
Uncertain	2	7		0	3	
Disagree	14	17		4	8	

Children with asthma can participate in all normal childhood activities if their asthma is well managed

Agree	90	97	2.2	98	100	0.9
Uncertain	4	0		2	0	

Table 13 shows three statistically significant results. The first of these is that more parents perceived asthma as being preventable after using the CAERP. More parents also perceived that asthma medications were not addictive and that their knowledge of asthma and its management was satisfactory.

Participant Feedback

The Children's Asthma Education Resource Use Questionnaire (see Appendix P) was designed for the participating parents in the experimental group. This questionnaire assessed their perceptions of the usefulness of the CAERP for increasing the knowledge of the parent and the child as described in Chapter Three. Each area of asthma-related knowledge

addressed by the CAERP is listed in Table 14 with responses recorded on a three-point LIKERT scale from very useful to not useful.

Table 14

Experimental Group Feedback on Increasing Knowledge about Asthma (N = 45)

CAERP	Very Useful %	Some Use %	Not Useful %
Increasing my knowledge			
Structure and function of the lungs	40	51	9
Asthma as a health condition	53	42	4
Asthma triggers	41	50	9
Purpose and function of asthma medications	58	36	7
Use of nebulisers and spacers	56	40	4
Increasing the child's knowledge			
Structure and function of the lungs	41	40	19
Asthma as a health condition	64	33	2
Asthma triggers	51	40	9
Purpose and function of asthma medications	80	20	0
Use of nebulisers and spacers	84	16	0

Note: Percentages may not sum to 100 due to rounding.

Most parents reported that the CAERP was of some use or very useful in all content areas addressed. All parents indicated that the package was useful when used to increase the child's knowledge of the purpose and function of asthma medications and the use of nebulisers and spacer. Table 15 records the number of viewings of the CAERP components reported by the parents. In this result, the median of 10 is a more useful indication of the number of viewings of the video segments than the mean. The mean was skewed due to one child who viewed the video segments 72 times. Similarly, the median of 6 is a better indication of the number of readings of the book component. These results indicate that the children made extensive use of the CAERP when used in the home.

Table 15*Reported use of CAERP Components by Experimental Group*

CAERP Components	Child Viewings of Component		
	Mean	Median	Mode
Kookie and Cassie	20.78	10	3
Argo Asthma Show	20.78	10	3
Young Children Managing Asthma	20.78	10	3
What's That Noise?	11.71	6	3

This Chapter has presented the key results from Study One and Study Two. It should be noted that the data analysed was gathered using instruments which were relevant to the time and context of the study and may require updating for use in the current context. The statistical analysis used was described and the results, in general, support the use of the CAERP in improving the asthma-related knowledge of very young children in early childhood centres. The results also support the use of the CAERP in improving asthma self-management and asthma health when used in the home. Chapter Five will discuss the significance of these results for the provision of asthma education for very young children.

Chapter Five

Discussion

Introduction

This research sought to determine if very young children could be educated about asthma and its management and if this education could result in better asthma health outcomes for children with the disease. The CAERP was presented to participants in Study One by early childhood educators. The use of these resources successfully increased the asthma-related knowledge of children with and without the disease. In Study Two, asthma health-related outcomes were recorded where the asthma education resources were given to the children and their families to use independently in their own homes. The results for Study Two suggest that there was little statistically significant improvement in asthma health-related outcomes. However, this asthma education was associated with a small to medium effect on asthma health events.

These studies differ from previous work in the field as the settings for these studies were non-clinical and focused on children aged 3 to 5 years, a previously underserved population. The following discussion will summarise the results of both studies and outline the significance and limitations of these results. The chapter will conclude by providing recommendations for asthma education for very young children.

Study One Results

Study One was a quasi-experimental study which addressed the following research question:

- Does the use of the CAERP improve the asthma-related knowledge of children aged 3 to 5 years when used in non-clinical settings?

Study One found that when measuring the increase in children's asthma-related knowledge, the results indicated that the difference between the experimental and control

groups was statistically significant ($F = 158.34$, $p < 0.05$). The use of the CAERP increased the children's knowledge of asthma and its management. These results demonstrated the success of an asthma education package that was developed using the principles of Social Cognitive Theory (Bandura, 1986) and which considered the age of the participants.

This study was the first to demonstrate the successful use of asthma education resources with very young children in non-clinical community settings.

Study Two Results

Study Two was a quasi-experimental study which addressed the following research question:

- Was the use of the CAERP associated with improvements in the asthma health and self-management of children aged 3 to 5 years with asthma when used in non-clinical settings?

The results from the study of the use of the CAERP by the experimental group to improve asthma self-management and health was not statistically significant ($p < 0.05$). The experimental group did, however, report fewer incidences of asthma-related health events than the control group and the use of the CAERP did have a small to medium effect in decreasing the frequency of these events. There was a statistically significant result showing that the experimental group required fewer doctor visits ($p < 0.03$). In summary, the results of Study Two show that the use of these asthma education resources is associated with fewer medical consultations for asthma. Additionally, it was found that the use of asthma education resources positively impacts the number of asthma-related health events such as wheezing, coughing or visiting the emergency department.

Educators and Parents using Community Settings to Provide Asthma Education

Providing Asthma Education in Early Childhood Centres

A key result of this research was that the use of the CAERP in non-clinical community settings was linked to an increase in very young children's knowledge of asthma and its management. Previous evaluations of the CAERP conducted in controlled clinical settings indicated that the individual components of the CAERP were effective in increasing the asthma-related knowledge of children who were diagnosed with the disease (Holzheimer, Mohay, & Masters, 1998; Mohay, Masters, & O'Neil, 1993a, 1993b). Study One differed from these previous studies as the current research was conducted in non-clinical settings in the community and included children without asthma.

In Study One, the community settings selected were a range of early childhood centres including kindergartens, preschools, and childcare centres, located in Queensland. The educators in each of these centres were provided with the CAERP to use with children aged 3 to 5 years. The selection of early childhood centres provided access to very young children, both with and without asthma. Therefore, Study One could evaluate the effect of the CAERP on the asthma-related knowledge of children who had experienced the disease and those who had not.

The educators participating in the study were not provided with specific training in the use of the resources. The picture book and video segments in the CAERP were similar to resources typically used in early childhood settings. The staff used their professional judgement to determine how to use the CAERP best. These resources were used at least once in the first two weeks of the study. This use of the resources was the only requirement placed upon the staff.

The staff using the resources were not required to have any specific knowledge of asthma nor any medical qualification other than the first-aid training mandated by their

respective employers. The early childhood centres and staff delivering the package represented individuals with no particular medical expertise or knowledge. These educators perceived that the CAERP was very useful in increasing children's knowledge of the purpose and function of asthma medications and knowledge of the use of nebulisers and spacers. The improvements gained by these educators in using the CAERP implies that it can be used to increase asthma-related knowledge in non-clinical settings without the intervention of healthcare professionals.

The policies guiding the management of early childhood education and care centres have changed in the years following the collection of the data for this study with the introduction of *The National Quality Framework* and the *Early Years Learning Framework* (Australian Children's Education and Care Quality Authority, 2018; Department of Education and Training, 2009). However, while the policy context has changed, the findings of Study One relating to children's knowledge of asthma and its management continue to have relevance. The findings of this study support children's capacity to assume increasing responsibility for their own health and wellbeing as highlighted in Outcome 3 of the *Early Years Learning Framework* (Department of Education and Training, 2009). The findings of Study One are consistent with current policy in early childhood education as these findings demonstrate the agency of the child in managing their own health.

Providing Asthma Education in Home Environments

In Study Two, the community setting was the children's own homes. The components of the CAERP used for asthma education were previously evaluated in clinical settings (Holzheimer et al., 1998; Mohay et al., 1993a, 1993b), so Study Two has extended this previous work by utilising children's homes as an environment for asthma education. This research is the only study in Australia that has evaluated the effect of asthma education delivered in the home environment on very young children's asthma management and health.

As the results indicate some positive changes related to asthma management and health, it seems that the home environment was supportive of asthma education.

The parents of children with asthma were supplied with the CAERP. These parents were instructed to use the resources at least once with their child in the first two weeks of the study, which were the same instructions given to the educators in early childhood centres. No training was given to parents regarding the use of the resources. The parents providing this education had no particular medical expertise or knowledge. Still, it was assumed that they had some knowledge of asthma and its management, as this knowledge would have been gained from caring for a child with the disease. As with the early childhood centres in Study One, the home environments of Study Two were shown to be supportive of asthma education.

The Implications of Using Non-Medical Staff to Provide Asthma Education

Asthma education programs for young children are conducted in diverse settings which can be categorised as clinical or non-clinical. The providers of these programs could similarly be divided into those with medical training and those without medical training. Doctors, pharmacists, and nurses are considered to have medical training, whereas parents and educators would typically be assumed not to have such training. This study has achieved positive results without the intervention of medical staff or the use of clinical settings.

The results of this study support the work of subsequent researchers who found that asthma education can be successfully provided by parents and educators (Iio et al., 2017; Praena-Crespo et al., 2017). These previous researchers worked with older children, so this study widens the applicability of the results to very young children. This study has found that asthma education can be successfully provided to children 3 to 5 years of age by educators and parents.

Reduced Burden on the Healthcare System

Asthma Education can be Conducted without Healthcare Professionals

Many asthma education programs have been developed by and for use by medical practitioners. These programs are implemented by a variety of healthcare professionals, including general medical practitioners, specialists, and emergency physicians and nurses. These programs can be expensive due to the time required by the professional to deliver the program (Deloitte Access Economics, 2015). The use of the CAERP represents cost-savings as doctors and nurses are not needed to conduct asthma education. The complimentary use of education programs such as the CAERP could allow healthcare professionals to devote more time to caring for patients and share the responsibility for health education with parents in the home, and with educators in early childhood centres.

Asthma Education Results in Fewer Medical Consultations

The use of the CAERP in Study Two resulted in a small to medium positive effect on all the asthma events reported by parents.

These events included:

- consultation with doctors
- visits to emergency departments
- admissions to hospital.

Of these events, the experimental group required fewer visits for treatment of asthma to the doctor when compared to the control group. This result was statistically significant, indicating that use of the CAERP in some way reduced the parents' reliance on doctor consultations. It is unknown whether this reduction in consultations with doctors was due to improved asthma health or due to parental confidence in managing the disease. Regardless of the reason, this result represents a significant potential cost-saving to the healthcare system due to reduced burden.

Children in the experimental group also required fewer visits to the emergency department and had fewer hospital admissions for asthma. Although not statistically significant, this result also suggests a decrease in reliance on the healthcare system as a result of using the CAERP. Asthma education resulting in reduced use of hospital services can only be considered positive, as this is associated with lower healthcare costs.

Accessibility of Asthma Education

The use of non-clinical settings, including early childhood services and children's homes, potentially maximises the number of children who can access asthma education. Previously, asthma education programs offered by a healthcare professional required the child and their family to visit a hospital or medical practice. (Guarnaccia et al., 2017; Kalantari et al., 2017). For programs conducted during school hours, this would represent a disruption to the child's education and routine. The timing of these programs would also inconvenience parents who may have work commitments or be caring for other family members. Attendance at an asthma education program may require travel that can be time-consuming and involve additional costs such as parking and increased time away from work for a parent. As Australia is a vast country with almost one-third of its population living outside major cities (Australian Bureau of Statistics, 2016), attendance at an in-person program may be impractical due to location. Although parents may believe in the value of the program, time, work, and financial considerations may influence their willingness and capacity to attend.

The ability of the CAERP to be used successfully outside the healthcare system makes asthma education accessible to more children. Therefore, asthma education can be implemented in situations where families find it difficult to access adequate healthcare. Families residing in rural and remote areas of Australia, developing countries, and those unable to access healthcare for other reasons may now benefit from access to quality asthma

education. The possibility for asthma education to be delivered independently of the healthcare system can significantly alter how our society manages this disease.

Increasing the accessibility of this education for young children who might not have access to adequate healthcare is consistent with public health models as described by the WHO. “Meeting the health literacy needs of the most disadvantaged and marginalized societies will particularly accelerate progress in reducing inequities in health and beyond” (WHO, 2016, para. 1). The use of the CAERP in community settings increases the access of previously underserved populations of children to asthma education and may reduce inequities in health for these populations.

The Conduciveness of Community Settings for Asthma Education

Existing asthma education programs may occur during an emergency department visit or be offered at the time of diagnosis. Most patients receive health education in an ad-hoc manner and at the time of diagnosis (Fawcett et al., 2019). Studies indicate that healthcare professionals who present information to children and their families may often give information at a time and in a manner that leads to misconceptions about the disease and its treatment (Archibald et al., 2015; Boulet, 2015; Poudel et al., 2019). Therefore, information about asthma and its management may not be presented in a coherent and logically sequenced way, or at a time when the child or their parents may be open to receiving or comprehending these important messages. These clinical settings are limited in their capacity to offer repeated and optional exposure to the content and the opportunity to ask questions.

The CAERP was used in early childhood centres and the children’s homes. These non-clinical settings were considered relaxed environments where children naturally receive an education, often in the context of playing with family, peers, and educators. These supportive learning environments are conducive to effective learning (Department of Education and Training, 2009). The use of non-clinical settings allows children and their

caregivers more opportunities to access the resources and seek clarification. The CAERP can be used in early childhood centres, allowing the educators to present the information at a time that they consider most appropriate to maximise learning. Educators and parents can follow up on any questions the children may have and therefore address any misconceptions. For these reasons, early childhood centres and homes are ideally suited to the provision of health education for young children.

Access to the CAERP in community settings would enable children to receive asthma education at the time they first experience symptoms. At this time, they may be more receptive to its content and curious about how to manage their disease better. Early education would decrease the need to correct any misconceptions about asthma or the need to modify any incorrect techniques for managing the disease. Although young children are not expected to assume full responsibility for managing their asthma, providing appropriate asthma education to children and their parents facilitates better management of the disease at an early age.

Educating Young Children about Asthma

Educators can Effectively Deliver Asthma Education

The staff of early childhood centres are trained and experienced in how to deliver educational messages to young children. Current approaches place healthcare professionals in charge of providing asthma education, but they may have little or no knowledge of how to educate very young children. It seems logical that the best combination of professional expertise would be to draw upon the knowledge of healthcare professionals to advise on the content and allow educators to develop and deliver the education program.

The CAERP had the advantage of being developed by a multi-disciplinary team. This team included a respiratory physician, a psychologist, and an educator. The team approach to the development of the CAERP ensured the content knowledge was accurate and able to be

delivered effectively to the target audience. The ability of the CAERP to increase the asthma-related knowledge of children aged 3 to 5 years implies that the multi-disciplinary approach to designing asthma education resources can be effective.

Very Young Children can Learn about Asthma

Young children have rarely been the focus of asthma education programs, so rigorous evaluations of programs targeting this age group have seldom been conducted (Holzheimer et al., 1998). At the time of writing, no evaluations of programs that specifically educated very young children about asthma and its management were identified. Research into the effectiveness of asthma education programs has mainly been conducted with school-aged children, adolescents, and adults. During the 1970s and early 1980s, the lack of educational interventions and subsequent research with children aged 3 to 5 years resulted from a belief that young children could not comprehend health concepts and therefore could not benefit from health education (Bibace & Walsh, 1981). Asthma education for very young children often targeted their parents in programs such as Wee Wheezers (Wilson et al., 1996). Since that time, Piagetian notions supporting young children's inability to understand health concepts have been challenged (Springer & Ruckel, 1992). There is now an acceptance that even very young children can understand health information when it is presented appropriately and therefore benefit from health education initiatives (Australian Children's Education and Care Quality Authority, 2018). The CAERP was found to increase the asthma-related knowledge of very young children aged 3 to 5 years. Therefore, this research is one of the few evaluations able to demonstrate that young children can benefit from asthma education.

A component of Study One evaluated the CAERP in terms of the effect it had on both short and longer-term knowledge gains. The CAERP was successful in increasing asthma-related knowledge of children across both short term (two weeks), and longer-term (six

weeks). This retention of the key messages is indicative of more in-depth learning of the content than may otherwise have been the case. Children would have an increased opportunity to apply the knowledge gained, which in turn could lead to improved asthma management.

Asthma Education Using Age Appropriate Resources

The success of the CAERP in educating young children may be attributed to its design, which is both age-appropriate, community based and employs sound learning principles. The content was distilled to an age-appropriate level, and the length of the presentations was brief. In keeping with Bandura's Social Cognitive Theory (Bandura, 1986), the key messages about asthma and its management were repeated and modelled, and engagement was increased through the use of celebrities (Holzheimer et al., 1998). The modelling of the proper procedure for devices used to deliver medication is believed to have increased the children's self-efficacy in managing their health. The improved self-efficacy is considered to have contributed to the enhanced management of their asthma and resultant asthma health. Design of asthma education programs should be informed by learning theory and consider the learning needs of the participants. The design and delivery in the community of other health education programs employing the same principles and approaches could potentially extend the applicability of these results to other childhood diseases such as epilepsy and diabetes.

Asthma Education for Children without the Disease

Study One provided asthma education to children with and without asthma simultaneously. The education of very young children without the disease has seldom been conducted and evaluated (Holzheimer, 1994; Holzheimer et al., 1998). The results of Study One are significant in that they demonstrated that the CAERP was used successfully with very young children with and without asthma. Children without asthma were able to increase

their knowledge of asthma and its management. This result is significant as children without asthma may develop the disease at a later stage in life. Therefore, early learning about asthma and its management may reduce the need to provide extensive education for children who develop the disease when they are older. A pre-existing knowledge of the disease may serve to reduce the anxiety of children and young adults when they are diagnosed with asthma.

Having a population of young children who are aware of asthma and its management could provide significantly improved attitudes towards those with the disease. Peers who are knowledgeable about asthma could assist those with the disease. This assistance could potentially save lives in the event of asthma attacks. A knowledgeable population with the ability to help those with the disease would reduce social anxiety around having asthma. This study has shown that very young children without asthma can benefit from asthma education. A population knowledgeable about asthma and its management may provide additional support and understanding for those with the disease.

Knowledge Gains were not Dependent on Socioeconomic Status

Asthma education, such as the CAERP could provide a cost-effective solution to asthma education in disadvantaged communities throughout Australia and the world. This result is particularly important as many studies report that children from low socioeconomic populations are more prone to experiencing the disease (K. M. Harris, 2019; Kinghorn et al., 2019; O’Grady et al., 2018; Wei & Feeny, 2019). A result of Study One was that children increased their knowledge of asthma and its management, irrespective of their socioeconomic status. This result suggests that the resources may be useful in a range of socioeconomic populations.

Caution should be used in generalising this result in more diverse populations as these studies were conducted in a limited number of geographic regions in Queensland.

These communities may be considered relatively homogenous when viewed in the broader

world context. While acknowledging the relatively homogenous nature of the research participants involved in these studies, the benefits of a program able to be used independently of healthcare services and with disadvantaged populations are significant. Suggestions regarding the use of the CAERP across diverse communities are made in the recommendations section of this chapter.

The Relevance of Asthma Education to Early Childhood Educators

Early childhood educators engage with numerous documents that support their work with young children. Support for the adoption of asthma education for very young children in early childhood settings is found in a number of these documents. *The Early Years Learning Framework for Australia* states that young children should “take increasing responsibility for their health and physical wellbeing” (Department of Education and Training, 2009, p. 35). This growing responsibility is evidenced when children “show an increasing independence and competence in personal hygiene, care and safety for themselves and others” (Department of Education and Training, 2009, p. 35). The use of the CAERP provides an opportunity to demonstrate this increased independence as it encourages children to assume more responsibility for the management of their asthma.

The Early Years Learning Framework for Australia also promotes children having a strong sense of identity (Department of Education and Training, 2009). Empowering children by enabling them to manage their asthma supports the development of their emerging autonomy and sense of agency. This sense of identity includes learning “to interact in relation to others with care, empathy and respect” (Department of Education and Training, 2009, p. 24). A finding of this research is that young children without asthma were able to learn about the disease and its management. This knowledge enables children without asthma to relate to those with the disease in a caring, empathetic, and respectful way.

The National Quality Framework establishes standards as a benchmark for early childhood centres which are rated in seven quality areas. Quality Area 2 relates to children's health and safety. Descriptor 2.1 refers to health and advocates that "each child's health and physical activity is supported and promoted" (Australian Children's Education and Care Quality Authority, 2018, p. 2). Descriptor 2.1 is elaborated upon in descriptor 2.1.2, which requires that "effective illness and injury management and hygiene practices are promoted and implemented" (Australian Children's Education and Care Quality Authority, 2018, p. 2). The provision of asthma education for very young children supports this standard by assisting educators in implementing and promoting effective illness management about asthma.

With a message that echoes *The Early Years Learning Framework for Australia*, quality standard 1.2.3 regarding child-directed learning requires that "[e]ach child's agency is promoted, enabling them to make choices and decisions that influence events and their world" (Australian Children's Education and Care Quality Authority, 2018, p. 2). The child with asthma can be empowered to make the choices and decisions required to manage their asthma when provided with appropriate asthma education. The growing independence of the child to make decisions about their health is reflected in their increasing agency.

Those children aged 5 years in the target group of very young children will be engaging with the foundation year of the *Australian Curriculum*. "[D]eveloping knowledge, understanding and skills for students to lead healthy, safe and active lives" (ACARA, n.d., p. 13) is fundamental to the Health and Physical Education strand in this year. There is also the opportunity to learn about the "simple actions they can take to keep themselves and their classmates healthy and safe" (ACARA, n.d., p. 13). When considering these priorities, and that a focus area of the Foundation Year is the safe use of medicines, it seems appropriate to implement some form of asthma education in this year level.

In December 2019, Australian Education Ministers committed to a new declaration on education goals called *The Alice Springs (Mparntwe) Education Declaration*. Of relevance to this research is the second goal of the Declaration which calls for young Australians to be given the knowledge and skills required to maintain a healthy life (Council of Australian Governments. Education Council, 2019). This Declaration, together with the relevant sections of the frameworks, standards and curriculum highlighted above, make the provision of asthma education in early childhood centres both relevant and desirable.

Asthma Education Positively Effects Children's Asthma Health and Management

Use of the CAERP Decreased the Frequency of Asthma Events

The use of the CAERP in Study Two had a small to medium positive effect on all the asthma events reported by parents. Earlier in this chapter, the effect of the CAERP on children's need for medical consultation was discussed, and the potential reduction in the burden on the health care system was considered. The parents also recorded information that indicated positive effects in the following areas:

- the occurrence of symptoms,
- the need for medication changes,
- compliance with medication regimens,
- the level of activity restriction due to asthma.

These results suggest that children exposed to the CAERP experienced fewer days with symptoms, required fewer medication changes, demonstrated more days of compliance with medication regimens and experienced fewer days with activity restriction due to asthma. This result may indicate that the use of the CAERP resulted in improved asthma self-management and compliance. The goal of asthma education programs is to bring about improved asthma health as a result of improved asthma management. These results suggest that this goal was achieved to some degree.

Research Related to the Effect of Asthma Education on Asthma Health and Management

The results of Study Two suggest that there is a positive effect on asthma health and management resulting from use of the CAERP. Previous research conducted with older children indicated the success of asthma education on children's asthma health and management (Bozkurt et al., 2013; Gillette et al., 2016; Guevara et al., 2003; K. Harris et al., 2019). Similar success was demonstrated in clinical settings with very young children (Holzheimer et al., 1998; Mohay et al., 1993a, 1993b). The results of Study Two, while not statistically significant, suggest that the same positive effect can be demonstrated with very young children in non-clinical settings.

Previous studies have shown that obtaining positive changes in asthma management and asthma health is difficult to achieve. Having a better knowledge and understanding of asthma may not relate to improved management of the disease. The changes in children's asthma management and health found in Study Two are considered to result from knowledge improvements associated with CAERP use as this was demonstrated in earlier evaluations of individual components of the CAERP (Holzheimer et al., 1998; Mohay et al., 1993a, 1993b). Although children's use of the CAERP was associated with positive changes in their asthma management and their asthma health, the link between increased asthma-related knowledge and asthma health outcomes has not been demonstrated conclusively in this research.

The Role of Parents in Asthma Education

The Effect of the CAERP on the Asthma-Related Knowledge of Parents

As a component of Study Two, an additional research question was posed.

- Was there a difference in parental knowledge about asthma and its management between parents that used the CAERP with their children, and those that did not?

The Parent Asthma-Related Knowledge Questionnaire was given to parents to determine their pre-existing knowledge of asthma and its management. The results of this

questionnaire indicated that parents who enrolled in the study already had a high level of asthma-related knowledge. Parents in both the experimental and control groups had similar levels of asthma-related knowledge before the commencement of Study Two. After the study, parents in the experimental group had significantly higher asthma-related knowledge compared to the parents in the control group ($z = 2.38, p < 0.02$).

Use of the CAERP by parents with their children can be associated with increased asthma-related knowledge for the parents. Parents with more knowledge can reinforce the educational messages contained in the resources with their children. This reinforcement may increase the effectiveness of the CAERP and be partially responsible for improvements in asthma management and asthma health in the experimental group. The role played by parents in delivering the CAERP makes parents integral to the success of the education process.

Use of the CAERP with parents and children in their homes, acknowledges the vital role parents and families play in the lives of young children (Hayes et al., 2018). Parents are frequently the child's first teacher, and it is logical that any asthma education target both the child and their parents simultaneously. Providing children and parents with access to the same education at the same time has the potential to increase the asthma-related knowledge of the family unit. Having the same information available to all family members increases the shared knowledge needed to manage the child's asthma.

The Effect of the CAERP on Parents' Perceptions of Asthma Management

As a component of Study Two, a further research question was posed.

- Were there differences in perceptions about the management of asthma between parents who used the CAERP with their children and those who did not?

A follow-up questionnaire was given to parents to determine their perceptions of asthma-management after the study. There were three areas where the responses of the experimental group differed significantly from that of the control group.

Asthma attacks can be prevented

Parents who used the CAERP developed an understanding that asthma attacks were preventable. The goal of asthma self-management is to prevent asthma attacks.

Understanding the preventability of asthma attacks may have allowed parents to take a proactive approach in managing their children's asthma.

Asthma medications are addictive if they are used all the time

A further understanding that parents gained from using the CAERP was that asthma medications were not addictive. If a parent believed that taking daily asthma medication was addictive, they might not encourage their children to take medicine as required.

An understanding that there is no risk of addiction to the medication would allow them to be more proactive in ensuring the daily medication is taken.

I feel that my knowledge of asthma and its management is satisfactory

Having a newfound knowledge of asthma and its management would suggest that parents were now more confident and competent in addressing their child's asthma management. This perceived increase in knowledge could have provided parents with the confidence to manage their child's asthma with less involvement of medical practitioners. This confidence is a contributing factor to the finding that the use of the CAERP resulted in significantly fewer doctor visits.

Finally, participant feedback on the use of the CAERP and its effectiveness produced some interesting results. Notably, the content of the CAERP addressing the purpose and function of asthma medications, and the use of nebulisers and spacers, was perceived by 80% or more of the parents to be very useful in increasing the child's knowledge. Improved knowledge and understanding of devices and medications may account for the moderate positive changes in children's asthma management and health.

Overall, the respondents perceived the CAERP to be useful in increasing both their own and their child's knowledge of asthma. This result suggests that both parents and children gained new information about the disease and its management. This increased knowledge may lead to improved management of the disease, which could result in better health outcomes for children with asthma.

Limitations

Study One found that asthma education was successful for very young children in non-clinical settings. Study Two indicated that there might be positive asthma health benefits derived from the use of the same asthma education resources in non-clinical settings. Without diminishing the importance of these findings, it is necessary to consider the limitations of these studies before generalising these outcomes to other contexts.

Study One only measured changes in asthma-related knowledge and did not account for health behaviour or attitudinal change. The link between asthma knowledge and asthma management was not explored in Study One or Study Two. Three earlier evaluations of the CAERP components did show that increased asthma-related knowledge was associated with improvement in asthma management and health outcomes (Holzheimer et al., 1998; Mohay et al., 1993a, 1993b). However, the applicability of the results for Study One should be tempered with the understanding that they apply to knowledge only, and not necessarily to an improvement in asthma management and health.

The manner and number of times the resources were used in different centres varied. The only instruction given to the educators was to use the package with the children at least once during the first two weeks of Study One. The educators were not given any advice or structured lesson plans for the use of the CAERP. This lack of specific instruction introduced another element of variability between the centres. The educators used the CAERP between one and six times with the children in their care. The correlation between the number of times

the CAERP was used and the improvement of children's asthma-related knowledge was not analysed in this research. Similarly, educators in different centres may have had existing expertise in delivering health education, which would affect how they chose to use the CAERP. These two factors that affect the way the CAERP was used introduced unknown variability into the results related to children's knowledge gains. It should also be noted that educators leaving at the end of the school year made the gathering of post-perceptions problematical. Adjusting the timing of future research would alleviate this concern.

Although data for these two studies were collected in Queensland in the late 1990s, the results remain relevant. Using results from this earlier time may be thought to limit their applicability to contemporary populations of children as the resources used were specific to Queensland in the 1990s. However, there has been no research in Australia conducted since this time that demonstrates these important findings. Nor has there been any asthma education programs developed specifically for very young children for use in community settings. To adapt the CAERP for current use is quite simple. The CAERP was designed with sound principles of learning and development in mind, and those principles are still used currently as a foundation for current resource development.

The resources featured celebrities popular with children at that time to present the information, and the media used were a children's picture book and VHS Cassette videos. It is possible to update the resources for use by contemporary populations by using current celebrities and media familiar to the children. The content would need to be revised to reflect the current National Guidelines for Asthma Management (National Asthma Council Australia, 2020). These guidelines place less emphasis on nebuliser use than was applicable at the time the resources were developed. Making these changes to the resources would contemporise without compromising the sound educational principles upon which the CAERP was designed.

A further limitation was that the cultural diversity of the participants was not recorded in either study. Not knowing this demographic detail makes it difficult to determine the applicability of these results to specific groups such as Aboriginal and Torres Strait Islanders and migrant populations. The sample size was large enough to have represented the diversity of Queensland's population in the mid-1990s, but, the exact nature of this diversity and therefore the effect of the asthma education on particular groups cannot be determined from the results.

Study Two's use of a diary completed by parents could be considered a limitation of this study. Diary entries record a parent's perceptions and recall of events. The accuracy of the data gathered when parents reported on their children's asthma symptoms may have been inaccurate. As there is mixed evidence available on the accuracy of parents' self-reports of asthma symptoms, a more objective measure of these symptoms could be used. Objective measures of a child's asthma health could include monitoring by spirometry and peak flow metre. However, peak flow meter diaries were found to be unreliable when used by children aged 5 to 16 years, and it has been recommended that electronic peak flow meters be used when accurate data is required (Brouwer et al., 2006). The challenge for the use of electronic peak flow meters is the cost of around \$100 each. Therefore, the cost for each participant to have been given a device to use would have been prohibitive. Spirometry, while more accurate, can only be performed successfully by children aged six years and older and needs to be completed in a clinical setting. Therefore, these more objective measures of asthma health were considered unsuitable for children aged 3 to 5 years, leaving the parental self-reporting diary as a satisfactory option.

A potential difference between the experimental and control groups was their geographical locations. Study Two recorded the effect of the CAERP on asthma health and management, and participants were assigned to either the control or experimental group

based on their location. Participants in one group may have been exposed to asthma triggers that were not present for the other group. An example of this would be the smoke caused by a bushfire or a thunderstorm that impacted on one location but not the other. The allocation of participants to either the control or experimental groups based on location was made to limit the potential sharing of the CAERP between the control and experimental groups. The effect of this allocation, if any, is unknown.

The participants in Study Two were required to be diagnosed with asthma by a medical practitioner and to require daily medication. These factors may have led to a bias where those participants enrolled had less controlled or more severe asthma at the commencement of the study than was expected. Participants in this study may have already been proficient in managing their disease, so the potential effect of the asthma education on health outcomes may have been limited. The same education provided to a less experienced group of children with asthma may have had a more significant effect on asthma health outcomes.

Similarly, the Parental Asthma-Related Knowledge Questionnaire indicated that the parents of participants knew about asthma and its management before the study. These parents may have already provided an appropriate level of asthma education for their children. This prior knowledge may have limited the effect of the CAERP on the children's asthma self-management. The implication of having participants with more severe forms of asthma together with parents already knowledgeable about asthma and its management may have limited the effect of the CAERP. Therefore, children experiencing less severe forms of the disease or with less knowledgeable parents may benefit more from the asthma education than was shown in the results of Study Two.

In community-based research, it is difficult to control for any outside education that parents or children may have received. Participation in this study may have piqued the

interest of the children's parents to seek other information about asthma and the management of the disease. This additional education could account for any improvements in the children's asthma management and their health.

Recommendations

The two studies that formed the basis of this research show that it is possible to improve the knowledge of asthma and its management in very young children in community settings. The studies' results have indicated that this education may lead to improved asthma management and health outcomes, although the support for this claim is not as strong. Although the framework for these resources was Bandura's (1986) Social Cognitive Theory, the recommendations arising from these results should be considered using the health promotion framework as articulated in the Ottawa Charter (WHO, 1986). This international agreement sought to achieve the goal of universal health by enabling people to assume responsibility for their own health. The Charter identifies five action areas and where appropriate, the following recommendations are presented with reference to these areas.

All Young Children should have Access to Asthma Education

The fourth action area of the Ottawa Charter addresses the development of personal skills. This area emphasises the need for individuals to have access to information and education about their health. "Enabling people to learn, throughout life, to prepare themselves for all of its stages and to cope with chronic illness and injuries is essential. This has to be facilitated in school, home, work and community settings" (WHO, 1986, p. 3). The CAERP used in these studies provided asthma education successfully to children at an early stage of their life, which may assist them in exercising more control over their health. Consistent with the Ottawa Charter, this education was provided in community settings, and it is recommended that the CAERP be made available to children aged 3 to 5 years.

The CAERP Resources should be Updated

The fifth action area of the Ottawa Charter addresses the reorientation of health services (WHO, 1986). By contemporising the existing CAERP resources, health services can focus more on supporting individuals and communities as they manage asthma. The existing CAERP resources should be redeveloped while still incorporating the same educational principles as were used in its initial development. The celebrities and child actors used to present the information should be selected to appeal to contemporary young children and be sensitive to the cultural needs of their communities. The content should be revised to ensure that the educational messages represent the current asthma guidelines. The format of the updated resources should also reflect contemporary media.

Provision of updated CAERP resources in a digital format will enable very young children and their families to have access to asthma education specific for their age group. The provision of such resources online allows children in previously underserved populations to readily access the information. Very young children living in rural and remote areas would be one population group that could benefit from the digitalisation of the resources.

The CAERP resources could be adapted for use with contemporary multi-media such as audiobooks and computer applications which could provide a more personalised education that focuses on management and the child's needs. Using applications could also provide instant feedback to the individual with asthma, and if desired, collect data for research with the child's parents' permission. This focus on health research is also advocated in the fifth action area.

The use of applications could extend the amount and type of data available regarding asthma-related knowledge and children's management of the disease. Potentially, technology may allow for the linking of medication use to the application so that medical practitioners would have access to their patient's patterns of use. This technology could enable doctors to

monitor the suitability of prescribed medication and to modify their advice based on the data provided. This enhanced ability on the part of doctors to understand their patient's asthma management could be accompanied by the education sector, assuming some of the responsibility for asthma education.

Asthma Education should be Made Available to All Children in Early Childhood Centres

The Ottawa Charter (WHO, 1986) participants pledged to share responsibility with other sectors and disciplines as a part of action area one on building healthy public policy. Educators of young children are capable of delivering asthma education when given well-designed resources. As discussed earlier, providing such education in early childhood centres supports the current curriculum. For these reasons, it is recommended that asthma education be made available to all children in early childhood services.

The creation of supportive environments is the second action area outlined by the Ottawa Charter (WHO, 1986). Ensuring that all children are provided with asthma education will create a culture where the disease is understood widely, and asthma management optimised. Children currently without a diagnosis of asthma may benefit from this education as they may develop the disease later in life. The knowledge gained may also assist the children in managing their disease or that of a peer or family member with asthma.

The notion of reciprocal maintenance may be advanced by extending asthma education to all children.

The implementation of asthma education in early childhood centres is extensively supported by the current standards, frameworks and curriculum that govern the work of early childhood educators (ACARA, n.d.; Australian Children's Education and Care Quality Authority, 2018; Department of Education and Training, 2009). No policy change is necessary to support the implementation of asthma education for very young children in this community setting. What is necessary is a change in the practice of educators so that the

implementation of asthma education programs is a common occurrence. One way to ensure the widespread implementation of asthma education in this context is to make readily available high-quality resources for educators to use with very young children. Increasing educator's access to and awareness of resources like the CAERP will encourage their widespread adoption in line with current policy.

Asthma Education should be Made Available to Very Young Children in their Homes

Very young children without access to early childhood centres may benefit from asthma education being available in their homes. The updated version of the CAERP should be made available as a free or low-cost resource for use by families with children at home. Making the resource available as inexpensively as possible would allow children from a diverse range of socioeconomic backgrounds to capitalise on the benefits of asthma education. The provision of the resource would then reinforce the aim of the Ottawa Charter "to acknowledge people as the main health resource; to support and enable them to keep themselves, their families and friends healthy ..." (WHO, 1986, p. 1)

The CAERP could be Adapted for Use with Other Diseases

The CAERP made use of the principles of Social Cognitive Theory (Bandura, 1986). Modelling, repetition, and use of esteemed personalities were strategies used to convey the educational message. These educational principles and practices may be used to develop resources for other diseases and medical procedures. Previously, the same principles were used to develop a picture book to educate very young children about cardiac surgery (Holzheimer et al., 2000). This study showed that children who viewed the picture book, *Sarah's Story* had increased knowledge of the surgical procedures they would experience. The same educational principles should be adapted to develop resources about other health concerns, including chronic diseases such as diabetes and epilepsy. Employing the Ottawa

Charter's Health Promotion Framework would allow any new health education initiatives like the CAERP to be relevant to children and their communities.

This chapter discusses the significant results of this research, along with the implications these results have for the asthma education of very young children. The ability of very young children to benefit from asthma education leads to some important recommendations for the provision of health education in community settings. The final chapter will highlight the significance of this research and outline possible directions for future research.

Chapter Six

Conclusion

This research intended to improve the health of very young children with asthma and to enhance their quality of life. In pursuit of this aim, this research set out to determine if it was possible to educate children aged 3 to 5 years about asthma and its management in non-clinical settings. Community settings were used without the expertise of healthcare professionals to determine the effect of asthma education on children's asthma management and health.

This research aimed to answer two questions:

- Can children aged 3 to 5 years improve their asthma-related knowledge when presented with asthma education provided by educators in early childhood centres?
- Can children aged 3 to 5 years improve their asthma health and management when presented with the same education by parents in their home?

The results of this research indicate that asthma education provided in early childhood centres was successful in improving the asthma-related knowledge of very young children. The same education was provided in the home to very young children with asthma and was associated with improvements in asthma health and management. These improvements in asthma health and its management were not statistically significant; however, the education did have a small to medium effect size. The only statistically significant improvement was a reduction in the number of visits to the doctor for asthma.

Asthma education was provided using the Children's Asthma Education Resource Package (CAERP). This package consisted of three video segments and a children's picture book that provided messages about asthma and its management. These resources were designed by a multi-disciplinary team consisting of a respiratory specialist, a psychologist,

and an educator. Social Cognitive Theory was used to ensure these age-appropriate resources presented the content in a way that ensured that young children could understand the messages (Bandura, 1986). The CAERP had been previously evaluated in clinical settings and significantly improved asthma-related knowledge and asthma management and health in children aged 2 to 5 years (Holzheimer et al., 1998; Mohay et al., 1993a, 1993b).

Previous studies and reports have demonstrated that asthma education was successful with older children and adults and has shown that very young children can benefit from asthma education delivered in clinical settings (Azmeah et al., 2020; Global Initiative for Asthma, 2020; Guarnaccia et al., 2017; Holzheimer et al., 1998; Kalantari et al., 2017; Mohay et al., 1993a, 1993b; National Asthma Council Australia, 2020). These earlier studies left a gap in the literature that has now been addressed by this study, which has shown that it is possible to educate children aged 3 to 5 years in community settings about asthma and its management. The results of this study confirm previous work, indicating that asthma education improves asthma-related knowledge and is associated with some improvements in asthma-related health for very young children (Holzheimer et al., 1998; Mohay et al., 1993a, 1993b).

Some studies have shown that improvements in asthma-related knowledge may not lead to improvements in asthma-related health while other studies have been able to demonstrate this link. This research, in part, supports the notion that education leads to improved health as some improvements to asthma-health outcomes were noted. This result should be considered with the understanding that the results did not reach the level of statistical significance required for a more definitive statement of support.

This research demonstrates that when provided with quality asthma education, very young children can learn about asthma and its management. This improved knowledge may lead to improved asthma management and therefore improved asthma health. Improving the

asthma health of young children reduces their morbidity and mortality due to asthma.

For a disease as prevalent as asthma, improvements in how asthma is managed may have a significant positive impact on the health of the community.

Significance of this Research for Healthcare

Of note in this research is the non-reliance on the existing healthcare system to provide asthma education. The use of a children's picture book and videos to convey the educational messages meant that asthma education could be delivered independent of healthcare professionals by educators and parents in the home and early childhood centres. Based on this study's findings, healthcare professionals can share responsibility for the delivery of asthma education.

The use of community settings to provide asthma education empowers all stakeholders in the education process. The healthcare professional does not need to be the sole source of knowledge about asthma as educators, parents, and the children themselves can assume some of the responsibility for any asthma education required. One benefit of using a collection of resources like the CAERP is about providing a consistent message to all stakeholders. The findings of this research support the idea that health issues can be addressed with a community response rather than just a medical one.

These findings do not diminish the critical role played by healthcare professionals in the care and treatment of very young children with asthma. Instead, the healthcare professional now have options on how to provide asthma education for very young children. A healthcare professional could supplement the education they provide by giving their patients access to an education program like the CAERP. For a healthcare professional not skilled in the delivery of education to very young children, the resources provide an avenue to communicate the important messages about asthma management.

There can also be significant economic benefits in using this form of asthma education. The time required by a healthcare professional to deliver asthma education to their very young patients can now be reduced. Education programs designed using the same principles as the CAERP empower parents and educators to provide asthma education to very young children, reducing the time spent on education by healthcare professionals. This time saving for healthcare professionals reduces the burden that asthma places on the healthcare system.

Children who do not have adequate access to robust healthcare systems can now access asthma education independently. The impact of asthma is experienced most severely by populations in low socioeconomic circumstances, and it is these same populations that can have difficulty in accessing healthcare (Wei & Feeny, 2019). Provision of a low-cost asthma education program like the CAERP allows communities to support children with asthma. The provision of asthma education to the most vulnerable members of society is now considerably easier.

Accessing medical services in remote areas of Australia is sometimes challenging due to the large distances involved. Children in rural and remote areas of Australia can now improve their asthma-related knowledge and asthma health without the need to attend education sessions provided by healthcare professionals. The benefit to the families of children with asthma is a significant reduction in the need to travel to participate in in-person asthma education. Considering the potential distances involved, the savings in time and money for the family could be considerable.

The implications of this research for the healthcare system are subtle yet significant. By utilising the ability of very young children to learn about their asthma independently, an opportunity exists for parents, educators, and the children themselves to assume greater responsibility in the management of the disease. Permitting others to play a part by adopting

some of the responsibility for asthma education does not diminish the essential role played by healthcare professionals. It empowers other stakeholders in the community to support children with asthma and the healthcare system itself, through the provision of asthma education.

Significance of this Research for Early Childhood Education

The main implication for the field of education is that it confirms that children aged 3 to 5 years are capable of learning about their health. These children typically attend early childhood centres, so these results impact on the provision of early childhood education. Support for the use of asthma education in early childhood centres is found in the documents that guide the work of educators (ACARA, n.d.; Australian Children's Education and Care Quality Authority, 2018; Department of Education and Training, 2009). Therefore, these findings empower early childhood educators to provide quality health education for very young children in their care.

Educators in early childhood centres can provide relevant, meaningful, child-centred education about health and wellbeing. The results of this research not only support the children's ability to learn about asthma and its management, but they also demonstrated that early childhood educators could provide the education. The educators in this research showed they could deliver health education to very young children without the assistance of healthcare professionals or additional training. Educators can be trusted to implement health education for very young children.

Recognising the potential of both children and educators as partners in health education should lead to changes in policy surrounding its provision in early childhood centres. General health outcomes should be supplemented with specific learnings about asthma and other chronic diseases. Support for these learnings can be provided in the form of readily available health kits that address different diseases and how to manage them.

These findings confirmed that children without asthma were also able to learn about the disease. Providing widespread education about asthma to all children increases their awareness and understanding of asthma. The empathy and potential assistance provided by those without asthma can result in less stigmatisation or misunderstanding for those experiencing asthma. Widespread knowledge of asthma management could also be potentially lifesaving in situations where a child experiencing an acute episode needs assistance from those around them.

Significance of this Research to Children's Agency

The capacity of children to influence their health and the health of others is referred to as children's agency (Montreuil & Carnevale, 2016). This research has shown that very young children if given the opportunity, are capable of influencing their health by contributing to the co-management of their asthma. One implication that could be drawn from this research is that you can educate young children successfully about real, meaningful issues that affect their lives. By educating children to assume responsibility for their asthma, children are treated with respect and trusted to act responsibly. As researchers come to understand more about children's agency in health management, more health education programs could be developed which keep the child's agency in focus.

Future Research

The research conducted in these studies demonstrated that young children's knowledge of asthma could be enhanced by asthma education. The ability of this education to improve asthma management and health was not proven, and this link between knowledge and health behaviour is crucial if the full benefits of asthma education are to be realised. Further research needs to be conducted to evaluate the effect of asthma education resources on young children's asthma health and management when the resources are used in community settings such as early childhood centres or the child's own home.

A longer term longitudinal study that follows children's asthma management and health as they develop would inform the longevity of asthma education on children's asthma-related knowledge and management.

This research project did not identify cultural groups within the populations studied. The asthma education provided was age-appropriate, but more could be done to make the program responsive to the needs of different cultural groups. As Indigenous Australians are one of the populations that are affected more by asthma than others (O'Grady et al., 2018), research is needed to determine if the CAERP can be adapted for use with this group and other cultural groups. This adaptation of the resources could be achieved by selecting culturally relevant celebrities and themes and evaluating their effects on the target populations.

Asthma is one of the many chronic diseases experienced by young children (Australian Institute of Health and Welfare, 2020b). The success of the CAERP in educating very young children about asthma suggests that similar programs can be developed for other chronic diseases by applying the same educational principles and practices employed in the CAERP. Further research is required to develop and evaluate the effect of similar education programs on children's knowledge and management of other chronic diseases such as diabetes and epilepsy. This research could be extended to include education about medical procedures such as blood tests and surgery.

The role of early childhood educators has increased in complexity since the time the data for this research was collected. While the focus of this research was to establish that very young children could learn about asthma, the additional demands placed upon educators should now be considered. Further research considering the perspective of the educators implementing the education initiatives could be conducted to determine the impact such initiatives have on their work. Similarly, the perspectives of the children and parents involved

in education interventions of this type should also be the focus of additional research.

Expanding the data collection to include information about the quality ratings of the early childhood centres involved, and the qualifications of the staff of these centres, would allow consideration of other variables that may impact on the asthma education intervention.

Recent advances in technology have provided educators with new tools for educating children. Smart inhalers are now available with the capability of providing feedback to users and their healthcare providers (Chrystyn et al., 2019). Creating interactive applications that pair asthma education with instant feedback on device usage has the potential to revolutionise traditional asthma education. Technology provides avenues for making the education appealing to a young audience while keeping the healthcare professional updated on progress through the education and on the use of the inhaler. Use of new technology has the potential to close the feedback loop between doctor and patient, however, as with other forms of asthma education, the use of new technologies may not be effective in the provision of health education to very young children. Research is needed into both the development and rigorous evaluation of educational programs that utilise this new technology when used with very young children.

Contribution of this Research

The original contribution to knowledge of this research is to demonstrate that very young children can learn about asthma and its management when education is offered in a community setting. As the only study conducted in Australia that evaluates an asthma education program specifically designed for very young children, the result that this education can be delivered independently by early childhood educators and parents makes a significant contribution to our understanding of asthma education.

This research has demonstrated that very young children can learn about asthma and its management. In doing so, this research has taken a significant step towards the

overarching goal of improving the quality of life of children with asthma. It is the hope of this researcher that more children will now be empowered to manage their asthma “... and live life to the fullest.” (Hotz, 2015)

References

- Agusala, V., Vij, P., Agusala, V., Dasari, V., & Kola, B. (2018). Can interactive parental education impact health care utilization in pediatric asthma: A study in rural Texas. *Journal of International Medical Research*, 46(8), 3172–3182.
<https://doi.org/10.1177/0300060518773621>
- Al-Muhsen, S., Horanieh, N., Dulgom, S., Assiri, Z., Vazquez-Tello, A., Halwani, R., & Al-Jahdali, H. (2015). Poor asthma education and medication compliance are associated with increased emergency department visits by asthmatic children. *Annals of Thoracic Medicine*, 10(2), 123–131. <https://doi.org/10.4103/1817-1737.150735>
- Archibald, M. M., Caine, V., Ali, S., Hartling, L., & Scott, S. D. (2015). What is left unsaid: An interpretive description of the information needs of parents of children with asthma. *Research in Nursing and Health*, 38(1), 19–28.
<https://doi.org/10.1002/nur.21635>
- Arikan-Ayyildiz, Z., Isik, S., Caglayan-Sozmen, S., Anal, O., Karaman, O., & Uzun, N. (2016). Efficacy of asthma education program on asthma control in children with uncontrolled asthma. *Turkish Journal of Pediatrics*, 58(4), 383–388.
<https://doi.org/10.24953/turkjped.2016.04.006>
- Atchison, J. M., & Cuskelly, M. M. (1994). Educating teachers about asthma. *Journal of Asthma*, 31(4), 269–276. <https://doi.org/10.3109/02770909409089474>
- Attali, Y., & Bar-Hillel, M. (2003). Guess where: The position of correct answers in multiple-choice test items as a psychometric variable. *Journal of Educational Measurement Summer*, 40(2), 109–128. <https://doi.org/10.1111/j.1745-3984.2003.tb01099.x>
- Auger, K. A., Kahn, R. S., Davis, M. M., & Simmons, J. M. (2015). Pediatric asthma readmission: Asthma knowledge is not enough? *Journal of Pediatrics*, 166(1), 101-108.e1. <https://doi.org/10.1016/j.jpeds.2014.07.046>

- Australian Bureau of Statistics. (2009). *Perspectives on Education and Training: Social Inclusion*, Cat. no. 4250.0.55.001. <http://www.abs.gov.au/>
- Australian Bureau of Statistics. (2016). *Snapshot of Australia: 2016 Census data summary*. 1–4. <http://www.abs.gov.au/>
- Australian Bureau of Statistics. (2019). National health survey: First results, 2017–18. Cat. no. 4364.0.55.001. *Table 21: Victoria, December*. <http://www.abs.gov.au/>
- Australian Centre for Asthma Monitoring. (2009). Asthma in Australian children : fFindings from Growing up in Australia, the longitudinal study of Australian children. Australian Institute of Health and Welfare.
- Australian Children’s Education and Care Quality Authority. (2018). *National Quality Framework*.
- Australian Curriculum, Assessment and Reporting Authority (n.d.). *The Australian Curriculum*. <https://www.australiancurriculum.edu.au/f-10-curriculum/health-and-physical-education/>
- Australian Curriculum, Assessment and Reporting Authority. (n.d.). *The Australian Curriculum: Health and physical education foundation year* (pp. 1–38). <https://www.australiancurriculum.edu.au/>
- Australian Institute of Health and Welfare. (2020a). *Asthma* (Issue Cat. no. ACM 33). <https://www.aihw.gov.au/reports/chronic-respiratory-conditions/asthma>
- Australian Institute of Health and Welfare. (2020b). *Australia’s children*. <https://doi.org/10.1186/1472-6963-14-349>
- Azmeh, R., Greydanus, D. E., Agana, M. G., Dickson, C. A., Patel, D. R., Ischander, M. M., & Lloyd, R. D. (2020). Update in pediatric asthma: Selected issues. *Disease-a-Month*, 66(4). <https://doi.org/10.1016/j.disamonth.2019.100886>

- Bandura, A. (1986). Theories of child development. In *Social foundations of thought and action: A social cognitive theory*. Prentice-Hall.
- Bédard, A., Basagaña, X., Anto, J. M., Garcia-Aymerich, J., Devillier, P., Arnavielhe, S., Bedbrook, A., Onorato, G. L., Czarlewski, W., Murray, R., Almeida, R., Fonseca, J., Costa, E., Malva, J., Morais-Almeida, M., Pereira, A. M., Todo-Bom, A., Menditto, E., Stellato, C., ... Bousquet, J. (2019). Mobile technology offers novel insights into the control and treatment of allergic rhinitis: The MASK study. *Journal of Allergy and Clinical Immunology*, *144*(1), 135–143.e6.
<https://doi.org/10.1016/j.jaci.2019.01.053>
- Biagini Myers, J. M., Schauburger, E., He, H., Martin, L. J., Kroner, J., Hill, G. M., Ryan, P. H., LeMasters, G. K., Bernstein, D. I., Lockey, J. E., Arshad, S. H., Kurukulaaratchy, R., & Khurana Hershey, G. K. (2019). A pPediatric Aasthma Risk Sscore to better predict asthma development in young children. *Journal of Allergy and Clinical Immunology*, *143*(5), 1803–1810.e2. <https://doi.org/10.1016/j.jaci.2018.09.037>
- Bibace, R., & Walsh, M. E. (1981). Children's conceptions of illness. *New Directions for Child and Adolescent Development*, *1981*(14), 31–48.
<https://doi.org/10.1002/cd.23219811404>
- Boulet, L. P. (2015). Asthma education: An essential component in asthma management. *European Respiratory Journal*, *46*(5), 1262–1264.
<https://doi.org/10.1183/13993003.01303-2015>
- Bozkurt, G., Yildiz, S., Ulupinar, S., & Oren, B. G. (2013). The effect of asthma education on the clinical condition of children with asthma. *HealthMED*, *7*(1), 198–203.

- Bröder, J., Okan, O., Bauer, U., Bruland, D., Schlupp, S., Bollweg, T. M., Saboga-Nunes, L., Bond, E., Sørensen, K., Bitzer, E. M., Jordan, S., Domanska, O., Firnges, C., Carvalho, G. S., Bittlingmayer, U. H., Levin-Zamir, D., Pelikan, J., Sahrai, D., Lenz, A., ... Pinheiro, P. (2017). Health literacy in childhood and youth: A systematic review of definitions and models. *BMC Public Health*, 17(1).
<https://doi.org/10.1186/s12889-017-4267-y>
- Brouwer, A. F. J., Roorda, R. J., & Brand, P. L. P. (2006). Home spirometry and asthma severity in children. *European Respiratory Journal*, 28(6), 1131–1137.
<https://doi.org/10.1183/09031936.06.00118205>
- Bruzzese, J. M., & Kattan, M. (2019). School-based interventions: Where do we go from here? In *Journal of Allergy and Clinical Immunology* (Vol. 143, Issue 2, pp. 550--551). Mosby Inc. <https://doi.org/10.1016/j.jaci.2018.10.031>
- Cabana, M. D., Chaffin, D. C., Jarlsberg, L. G., Thyne, S. M., & Clark, N. M. (2008). Selective provision of asthma self-management tools to families. *Pediatrics*, 121(4), 900–905. <https://doi.org/10.1542/peds.2007-1559>
- Campbell, D. T., & Stanley, J. C. (1963). *Experimental and quasi-experimental designs for research*. Houghton Mifflin Company.
- Cano-Garcinuño, A., Díaz-Vázquez, C., Carvajal-Urueña, I., Praena-Crespo, M., Gatti-Viñoly, A., & García-Guerra, I. (2007). Group education on asthma for children and caregivers: A randomized, controlled trial addressing effects on morbidity and quality of life. *J Investig Allergol Clin Immunol*, 17(4), 216–226.
- Chakrabarti, S. (2014). What's in a name? Compliance, adherence and concordance in chronic psychiatric disorders. *World Journal of Psychiatry*, 4(2), 30.
<https://doi.org/10.5498/wjp.v4.i2.30>

- Chou, K. J., Cunningham, S. J., & Grain, E. F. (1995). Metered-dose inhalers with spacers vs nebulizers for pediatric asthma. *Archives of Pediatrics and Adolescent Medicine*, 149, 201–205.
- Christian, B. J. (2019). Translational research – family management and parenting stress associated with chronic conditions in children. In *Journal of Pediatric Nursing* (Vol. 45, pp. 73–75). W. B. Saunders. <https://doi.org/10.1016/j.pedn.2019.02.031>
- Chrystyn, H., Audibert, R., Keller, M., Quaglia, B., Vecellio, L., & Roche, N. (2019). Real-life inhaler adherence and technique: Time to get smarter! In *Respiratory Medicine* (Vol. 158, pp. 24–32). W. B. Saunders Ltd. <https://doi.org/10.1016/j.rmed.2019.09.008>
- Chung, D., & Price, D. (1994). The Final Report of the Asthma Control Education Project, Adelaide.
- Coffman, J. M., Cabana, M. D., & Yelin, E. H. (2009). Do school-based asthma education programs improve self-management and health outcomes? *Pediatrics*, 124(2), 729–742. <https://doi.org/10.1542/peds.2008-2085>
- Coffman, J. M., Cabana, M. D., Halpin, H. A., & Yelin, E. H. (2008). Effects of asthma education on children's use of acute care services: A meta-analysis. *Pediatrics*, 121(3), 575–586. <https://doi.org/10.1542/peds.2007-0113>
- Council of Australian Governments. Education Council. (2019). *Alice Springs (Mparntwe) Education Declaration* (Issue December). <http://nla.gov.au/nla.obj-2391375250>
- Croft, R. D. (1989). 2 Year old asthmatics can learn to operate a tube spacer by copying their mothers. *Archives of Disease in Childhood*, 64(5), 742–743. <https://doi.org/10.1136/adc.64.5.742>

- D'Amato, G., Vitale, C., Molino, A., Stanziola, A., Sanduzzi, A., Vatrella, A., Mormile, M., Lanza, M., Calabrese, G., Antonicelli, L., & D'Amato, M. (2016). Asthma-related deaths. In *Multidisciplinary Respiratory Medicine* (Vol. 11, Issue 1, pp. 1–5). BioMed Central Ltd. <https://doi.org/10.1186/s40248-016-0073-0>
- de Jong, C. C., & Mozun, R. (2019). The reference standard in diagnostic studies on childhood asthma. In *Respiratory Medicine* (Vol. 160). W. B. Saunders Ltd. <https://doi.org/10.1016/j.rmed.2019.105812>
- Decrue, F., Gorlanova, O., Usemann, J., & Frey, U. (2020). Lung functional development and asthma trajectories. *Seminars in Immunopathology*, 42(1), 17–27. <https://doi.org/10.1007/s00281-020-00784-2>
- Deloitte Access Economics. (2015). *The Hidden Cost of Asthma*.
- Department of Education and Training. (2009). *Belonging, Being and Becoming - The Early Years Learning Framework for Australia*.
- Eakin, M. N., Zaeh, S., Eckmann, T., Ruvalcaba, E., Rand, C. S., Hilliard, M. E., & Riekert, K. A. (2020). Effectiveness of a home- and school-based asthma educational program for head start children with asthma: A randomized clinical trial. *JAMA Pediatrics*, 174(12), 1191–1198. <https://doi.org/10.1001/jamapediatrics.2020.3375>
- Ebmeier, S., Thayabaran, D., Braithwaite, I., Bénamara, C., Weatherall, M., & Beasley, R. (2017). Trends in international asthma mortality: analysis of data from the WHO Mortality Database from 46 countries (1993–2012). *The Lancet*, 390(10098), 935–945. [https://doi.org/10.1016/S0140-6736\(17\)31448-4](https://doi.org/10.1016/S0140-6736(17)31448-4)
- Elliott, J. P., Marcotullio, N., Skoner, D. P., Lunney, P., & Gentile, D. A. (2014). Impact of student pharmacist-delivered asthma education on child and caregiver knowledge. *American Journal of Pharmaceutical Education*, 78(10), 188. <https://doi.org/10.5688/ajpe7810188>

- Fawcett, R., Porritt, K., Stern, C., & Carson-Chahhoud, K. (2019). Experiences of parents and carers in managing asthma in children: A qualitative systematic review. *JBIR Database of Systematic Reviews and Implementation Reports*, 17(5), 793–984. <https://doi.org/10.11124/JBISRIR-2017-004019>
- Ferrante, G., & La Grutta, S. (2018). The burden of pediatric asthma. In *Frontiers in Pediatrics* (Vol. 6). Frontiers Media S. A. <https://doi.org/10.3389/fped.2018.00186>
- Fischer, G. B., Sarria, E. E., Camargos, P., Mocelin, H. T., Soto-Quiroz, M., Cruz, A. A., Bousquet, J., & Zar, H. J. (2019). Childhood asthma in low and middle-income countries: Where are we now? In *Paediatric Respiratory Reviews* (Vol. 31, pp. 52--57). W. B. Saunders Ltd. <https://doi.org/10.1016/j.prrv.2018.10.002>
- Fitzpatrick, A. M., & Bacharier, L. B. (2019). One step forward, 2 steps back: The enigma of preschool wheeze. In *Journal of Allergy and Clinical Immunology* (Vol. 143, Issue 5, pp. 1734–1735). Mosby Inc. <https://doi.org/10.1016/j.jaci.2019.01.005>
- Fleming, M., Fitton, C. A., Steiner, M. F. C., McLay, J. S., Clark, D., King, A., MacKay, D. F., & Pell, J. P. (2019). Educational and health outcomes of children treated for asthma: Scotlandwide record linkage study of 683716 children. *European Respiratory Journal*, 54(3), 1–10. <https://doi.org/10.1183/13993003.02309-2018>
- Fluckiger, B., Dunn, J., & Wheeley, E. (2016). *Age-appropriate pedagogies for the early years of schooling: Foundation paper*. Department of Education and Training, Queensland Government. https://www.researchgate.net/publication/299510003_Age-appropriate_Pedagogies_for_the_Early_Years_of_Schooling_-_Foundation_Paper
- Fraser, S. (2010). Concordance, compliance, preference or adherence. *Patient Preference and Adherence*, 4, 95–96. <https://doi.org/10.2147/ppa.s17167>

- Friend, M., & Morrison, A. (2015). Interventions to improve asthma management of the school-age child. *Clinical Pediatrics*, 54(6), 534–542.
<https://doi.org/10.1177/0009922814554500>
- Furtado, P. R., Maciel, Á. C. C., Barbosa, R. R. T., Silva, A. A. M. da, Freitas, D. A. de, & Mendonça, K. M. P. P. de. (2019). Association between quality of life, severity of asthma, sleep disorders and exercise capacity in children with asthma: A cross-sectional study. *Brazilian Journal of Physical Therapy*, 23(1), 12–18.
<https://doi.org/10.1016/j.bjpt.2018.08.010>
- Garnett, V., Smith, J., & Ormandy, P. (2016). Child-parent shared decision making about asthma management. *Nursing Children and Young People*, 28(4), 16–22.
<https://doi.org/10.7748/ncyp.28.4.16.s20>
- Gerald, J. K., Fisher, J. M., Brown, M. A., Clemens, C. J., Moore, M. A., Carvajal, S. C., Bryson, D., Stefan, N., Billheimer, D., & Gerald, L. B. (2019). School-supervised use of a once-daily inhaled corticosteroid regimen: A cluster randomized trial. *Journal of Allergy and Clinical Immunology*, 143(2), 755–764.
<https://doi.org/10.1016/j.jaci.2018.06.048>
- Geryk, L. L., Roberts, C. A., & Carpenter, D. M. (2017). A systematic review of school-based interventions that include inhaler technique education. In *Respiratory Medicine* (Vol. 132, pp. 21–30). W. B. Saunders Ltd.
<https://doi.org/10.1016/j.rmed.2017.09.001>
- Gillette, C., Rockich-Winston, N., Kuhn, J. B. A., Flesher, S., & Shepherd, M. (2016). Inhaler technique in children with asthma: A systematic review. In *Academic Pediatrics* (Vol. 16, Issue 7, pp. 605–615). Elsevier Inc.
<https://doi.org/10.1016/j.acap.2016.04.006>

- Global Initiative for Asthma. (2019). Global initiative for asthma. Global strategy for asthma management and prevention. *Practice Nurse*, 49(5).
- Global Initiative for Asthma. (2020). *Global Strategy for Asthma Management and Prevention*. <http://www.ginasthma.org>
- Green, A., Mahrshahi, S., Innes-Highes, C., O'Hara, B., McGill, B., & Rissel, C. (2020). Implementation of an early childhood healthy eating and physical activity program in New South Wales, Australia: *Munch & Move Frontiers in Public Health*.
<https://doi.org/10.3389/fpubh.2020.00034>
- Guarnaccia, S., Pecorelli, G., Bianchi, M., Cartabia, M., Casadei, G., Pluda, A., Quecchia, C., Grotter, V., & Bonati, M. (2017). IOEASMA: An integrated clinical and educational pathway for managing asthma in children and adolescents. *Italian Journal of Pediatrics*, 43(1). <https://doi.org/10.1186/s13052-017-0374-8>
- Guevara, J. P., Wolf, F. M., Grum, C. M., & Clark, N. M. (2003). Effects of educational interventions for self management of asthma in children and adolescents: sSystematic review and meta-analysis. *BMJ*, 326(7402), 1308–1309.
<https://doi.org/10.1136/bmj.326.7402.1308>
- Gürhopur, F. D. T., & Dalgiç, A. I. (2018). The effect of a modular education program for children with epilepsy and their parents on disease management. *Epilepsy & Behavior*, 78, 210–218.
- Haladyna, T. M. (2004). *Developing and validating multiple-choice test items*. ProQuest Ebook Central. <https://ebookcentral.proquest.com>
- Harris, K. M. (2019). Mapping inequality: Childhood asthma and environmental injustice, a case study of St. Louis, Missouri. *Social Science & Medicine*, 230, 91–110.
<https://doi.org/10.1016/j.socscimed.2019.03.040>

- Harris, K., Kneale, D., Lasserson, T. J., McDonald, V. M., Grigg, J., & Thomas, J. (2019). School-based self-management interventions for asthma in children and adolescents: A mixed methods systematic review. *Cochrane Database of Systematic Reviews*, 2019(1). <https://doi.org/10.1002/14651858.CD011651.pub2>
- Hayes, N., O'Toole, L., & Halpenny, A. M. (2018). The bioecological model of human development. *Introducing Bronfenbrenner*, 13–27. <https://doi.org/10.4324/9781315646206-2>
- Herrera, A. M., & Fitzgerald, D. A. (2018). Question 1: Why do children still die from asthma? In *Paediatric Respiratory Reviews* (Vol. 27, pp. 40–43). W. B. Saunders Ltd. <https://doi.org/10.1016/j.prrv.2018.02.001>
- Holzheimer, L. (1993). *What's That Noise?* Queensland University of Technology.
- Holzheimer, L. (1994). *Asthma Education for Young Children Aged 2-5 Years*. Queensland University of Technology.
- Holzheimer, L., Mohay, H., & Masters, I. B. (1998). Educating young children about asthma: Comparing the effectiveness of a developmentally appropriate asthma education video tape and picture book. *Child: Care, Health and Development*, 24(1), 85–99.
- Holzheimer, L., Winkel, L., Henshelwood, F., & Justo, R. (2000). Paediatric presurgical education program improves knowledge of surgical events and outcomes. *Heart Lung and Circulation*, 9(10), 1046. <https://doi.org/10.1046/j.1443-9506.2000.08011.x>
- Hotz, S. R. (2015). *No apple keeps the doctor away*. Don't Hide It, Flaunt It Celebrating a World of Differences. <http://www.donthideitflauntit.com/apple-keeps-doctor-away-sydney-hotz-age-17/>
- Hui, R. W. H. (2020). Inhaled corticosteroid-phobia and childhood asthma: Current understanding and management implications. In *Paediatric Respiratory Reviews* (Vol. 33, pp. 62–66). W. B. Saunders Ltd. <https://doi.org/10.1016/j.prrv.2019.03.009>

- Iio, M., Hamaguchi, M., Narita, M., Takenaka, K., & Ohya, Y. (2017). Tailored education to increase self-efficacy for caregivers of children with asthma: A randomized controlled trial. *Computers, Informatics, Nursing*, 35(1), 36–44. www.cinjournal.com
- Isik, E., Fredland, N. M., & Freysteinson, W. M. (2019). School and community-based nurse-led asthma interventions for school-aged children and their parents: A systematic literature review. *Journal of Pediatric Nursing*, 44, 107–114. <https://doi.org/10.1016/j.pedn.2018.11.007>
- Islamovic, F., Silver, E. J., & Reznik, M. (2019). Do urban minority parents and children agree on asthma symptoms with exercise, worries, and confidence in disease management? *Academic Pediatrics*, 19(6), 624–630. <https://doi.org/10.1016/j.acap.2019.05.007>
- Jeminiwa, R., Hohmann, L., Qian, J., Garza, K., Hansen, R., & Fox, B. I. (2019). Impact of eHealth on medication adherence among patients with asthma: A systematic review and meta-analysis. *Respiratory Medicine*, 149, 59–68. <https://doi.org/10.1016/j.rmed.2019.02.011>
- Jochmann, A., Artusio, L., Jamalzadeh, A., Nagakumar, P., Delgado-Eckert, E., Saglani, S., Bush, A., Frey, U., & Fleming, L. J. (2017). Electronic monitoring of adherence to inhaled corticosteroids: An essential tool in identifying severe asthma in children. *The European Respiratory Journal*, 50(6). <https://doi.org/10.1183/13993003.00910-2017>
- Jones, M. A. (2008). Asthma self-management patient education. *Respiratory Care*, 53(6), 778–784.

- Kakumanu, S., & Lemanske, R. F. (2019). Asthma in schools: How school-based partnerships improve pediatric asthma care. In *Immunology and Allergy Clinics of North America* (Vol. 39, Issue 2, pp. 271–281). W. B. Saunders.
<https://doi.org/10.1016/j.iac.2018.12.011>
- Kalantari, A., Movahedi, M., Moin, M., Gharagozlou, M., Khodadadi, B., & Hosseininejad, S. M. (2017). Effect of education on asthma control in children: A quasi-experimental study. *International Journal of Pediatrics*, 5(12), 6421–6429.
<https://doi.org/10.22038/ijp.2017.26728.2302>
- Kamps, A. W. A., Van Ewijk, B., Roorda, J., & Brand, P. L. P. (2000). Poor inhalation technique, even after inhalation instructions, in children with asthma. In *Pediatr Pulmonol* (Vol. 29).
- Kim, C. H., Gee, K. A., & Byrd, R. S. (2019). Excessive absenteeism due to asthma in California elementary schoolchildren. *Academic Pediatrics*, 20(7), 950–957.
<https://doi.org/10.1016/j.acap.2019.12.003>
- Kinghorn, B. A., Fretts, A. M., O’Leary, R. A., Karr, C. J., Rosenfeld, M., & Best, L. G. (2019). Socioeconomic and environmental risk factors for pediatric asthma in an American Indian community. *Academic Pediatrics*, 19(6), 631–637.
<https://doi.org/10.1016/j.acap.2019.05.006>
- Klok, T., Kaptein, A. A., & Brand, P. L. P. (2015). Non-adherence in children with asthma reviewed: The need for improvement of asthma care and medical education. *Pediatric Allergy and Immunology*, 26(3), 197–205. <https://doi.org/10.1111/pai.12362>
- Knecht, C., Hellmers, C., & Metzger, S. (2015). The perspective of siblings of children with chronic illness. A literature review. *Journal of Pediatric Nursing*, 30(1), 102–116.
<https://doi.org/10.1016/j.pedn.2014.10.010>

- Kouzegaran, S., Samimi, P., Ahanchian, H., Khoshkhui, M., & Behmanesh, F. (2018). Quality of life in children with asthma versus healthy children. *Open Access Macedonian Journal of Medical Sciences*, 6(8), 1413–1418.
<https://doi.org/10.3889/oamjms.2018.287>
- Kyfonidis, C., & Lennon, M. (2019, May). Making diabetes education interactive: Tangible educational toys for children with type-1 diabetes. In proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (pp. 1–12).
- Lai, C. K. W., Beasley, R., Crane, J., Foliaki, S., Shah, J., Weiland, S., Ait-Khaled, N., Anderson, H. R., Asher, M. I., Beasley, R., Björkstén, B., Brunekreef, B., Crane, J., Ellwood, P., Flohr, C., Foliaki, S., Forastiere, F., García-Marcos, L., Keil, U., ... Wong, G. (2009). Global variation in the prevalence and severity of asthma symptoms: Phase three of the international study of asthma and allergies in childhood (ISAAC). *Thorax*, 64(6), 476–483. <https://doi.org/10.1136/thx.2008.106609>
- Langford, R., Bonell, C. P., Jones, H. E., Poulou, T., Murphy, S. M., Waters, E., Komro, K. A., Gibbs, L. F., Magnus, D., & Campbell, R. (2014). The WHO health promoting school framework for improving the health and well-being of students and their academic achievement. *Cochrane Database of Systematic Reviews*, 2014(4).
<https://doi.org/10.1002/14651858.CD008958.pub2>
- Largo, T. W., Borgialli, M., Wisinski, C. L., Wahl, R. L., & Priem, W. F. (2011). Healthy Homes University: A home-based environmental intervention and education program for families with pediatric asthma in Michigan. *Public Health Reports*, 126(1_suppl), 14–26. <https://doi.org/10.1177/00333549111260S104>
- Larson, A., Ward, J., Ross, L., Whyatt, D., Weatherston, M., & Landau, L. (2010). Impact of structured education and self management on rural asthma outcomes. *Australian Family Physician*, 39(3), 141–144.

- Lemanske, R. F., Kakumanu, S., Shanovich, K., Antos, N., Cloutier, M. M., Mazyck, D., Phipatanakul, W., Schantz, S., Szeffler, S., Vandlik, R., & Williams, P. (2016). Creation and implementation of SAMPRO™: A school-based asthma management program. *Journal of Allergy and Clinical Immunology*, 138(3), 711–723.
<https://doi.org/10.1016/j.jaci.2016.06.015>
- Lenney, W., Adachi, Y., Bush, A., Fischer, G. B., Hong, J., Ostrem, A., Pedersen, S., Sly, P. D., Szeffler, S. J., Tilak, R., Zar, H. J., Akinbami, L. J., Blake, K. V., Cabana, M., Cicutto, L. C., Custovic, A., Doull, I., Fitzgerald, D. A., Fletcher, M., ... Williams, S. (2019). Asthma: Moving toward a global children's charter. *The Lancet Respiratory Medicine*, 7(4), 299–300.
[https://doi.org/10.1016/S2213-2600\(19\)30074-8](https://doi.org/10.1016/S2213-2600(19)30074-8)
- Lenney, W., Bush, A., Fitzgerald, D. A., Fletcher, M., Ostrem, A., Pedersen, S., Szeffler, S. J., & Zar, H. J. (2018). Improving the global diagnosis and management of asthma in children. *Thorax*, 73(7), 662–669. <https://doi.org/10.1136/thoraxjnl-2018-211626>
- Liao, Y., Gao, G., & Peng, Y. (2019). The effect of goal setting in asthma self-management education: A systematic review. In *International Journal of Nursing Sciences* (Vol. 6, Issue 3, pp. 334–342). Chinese Nursing Association.
<https://doi.org/10.1016/j.ijnss.2019.04.003>
- Liu, Z., & Qureshi, K. (2016). Efficacy of an asthma self-management education intervention for children (9-13 years) with asthma and their caregiver in Wuhan, China. *Journal of US-China Medical Science*, 13, 117–128. <https://doi.org/10.17265/1548-6648/2016.03.001>
- Lourido-Cebreiro, T., Facal, D., Rodriguez-Garcia, C., & Gonzalez-Barcala, F.-J. (2020). Asthma control: A continuing challenge. *Open Respiratory Archives*, 2(1), 5–6.
<https://doi.org/10.1016/j.opresp.2019.11.002>

- Margolis, R. H. F., Bellin, M. H., Bookman, J. R. M. F., Collins, K. S., Bollinger, M. E., Lewis-Land, C., & Butz, A. M. (2019). Fostering effective asthma self-management transfer in high-risk children: Gaps and opportunities for family engagement. *Journal of Pediatric Health Care*, 33(6), 684–693. <https://doi.org/10.1016/j.pedhc.2019.05.004>
- McCallum, G., Morris, P., Brown, N., & Chang, A. (2017). Culture-specific programs for children and adults from minority groups who have asthma. *Cochrane Database of Systematic Reviews*, 8. <https://doi.org/10.1002/14651858.CD006580.pub5>. www.cochranelibrary.com
- McDaid, D. (2016). Investing in health literacy. Policy briefs and summaries. World Health Organization Regional Office for Europe, European Observatory on Health Systems and Policies: Copenhagen.
- McKinley Yoder, C. L., & Cantrell, M. A. (2019). Childhood disability and educational outcomes: A systematic review. In *Journal of Pediatric Nursing* (Vol. 45, pp. 37–50). W. B. Saunders. <https://doi.org/10.1016/j.pedn.2019.01.003>
- Melethil, S., Yousaf, M., & Yousaf, A. (2018). Physicians perspective and preference in the choice of metered dose inhaler with spacer vs nebulizer. *Annals of Allergy, Asthma & Immunology*, 121(5), s41–s41. <https://doi.org/https://doi.org/10.1016/j.anai.2018.09.130>
- Melgarejo González-Conde, V., Pérez-Fernández, V., Ruiz-Esteban, C., & Valverde-Molina, J. (2019). Impact of self-efficacy on the quality of life of children with asthma and their caregivers. *Archivos de Bronconeumologia*, 55(4), 189–194. <https://doi.org/10.1016/j.arbr.2019.02.004>
- Meltzer, L. J., & Pugliese, C. E. (2017). Sleep in young children with asthma and their parents. *Journal of Child Health Care*, 21(3), 301–311. <https://doi.org/10.1177/1367493517712064>

- Miadich, S. A., Everhart, R. S., Borschuk, A. P., Winter, M. A., & Fiese, B. H. (2015). Quality of life in children with asthma: A developmental perspective. *Journal of Pediatric Psychology, 40*(7), 672–679. <https://doi.org/10.1093/jpepsy/jsv002>
- Mohay, H., & Masters, I. B. (1991). *The Adventures of Kooky the Kookaburra and Cassie the Koala*. TSN11.
- Mohay, H., & Masters, I. B. (1992). *The Agro Asthma Show*. TSN11.
- Mohay, H., & Masters, I. B. (1993). *Young Children Managing Asthma*. TSN11.
- Mohay, H., Masters, I. B., & O’Neil, M. (1993a). An asthma self management programme for preschool children. *Health Psychology Conference*.
- Mohay, H., Masters, I. B., & O’Neil, M. (1993b). An asthma self management programme for young children. *Australian Early Intervention Association (Queensland) Conference*.
- Montreuil, M., & Carnevale, F. A. (2016). A concept analysis of children’s agency within the health literature. *Journal of Child Health Care, 20*(4), 503–511. <https://doi.org/10.1177/1367493515620914>
- Moral, L., Vizmanos, G., Torres-Borrego, J., Praena-Crespo, M., Tortajada-Girbés, M., Pellegrini, F. J., & Asensio, Ó. (2019). Asthma diagnosis in infants and preschool children: a systematic review of clinical guidelines. *Allergologia et Immunopathologia, 47*(2), 107–121. <https://doi.org/10.1016/j.aller.2018.05.002>
- Mosenzadeh, A., Ahmadipour, S., Mardani, M., Ebrahimzadeh, F., & Shahkarami, K. (2019). The effect of self-care education on the quality of life in children with allergic asthma. *Comprehensive Child and Adolescent Nursing, 42*(4), 304–312. <https://doi.org/10.1080/24694193.2018.1513098>

- Müller, T., Müller, A., Hübel, C., Knipel, V., Windisch, W., Cornelissen, C. G., & Dreher, M. (2017). Optimizing inhalation technique using web-based videos in obstructive lung diseases. *Respiratory Medicine*, 129, 140–144.
<https://doi.org/10.1016/j.rmed.2017.06.009>
- Nagakumar, P., & Rao, S. (2019). When is difficult asthma severe? In *Paediatrics and Child Health (United Kingdom)* (Vol. 29, Issue 4, pp. 161–166). Churchill Livingstone.
<https://doi.org/10.1016/j.paed.2019.01.018>
- National Asthma Council Australia. (2020). *Australian Asthma Handbook, Version 2.1*.
<http://www.asthmahandbook.org.au>
- National Health and Medical Research Council. (2018). National statement on ethical conduct in human research, 2007 (Updated 2018). In *Australian Government: National Health and Medical Research Council* (Issue Updated 2018).
<https://www.nhmrc.gov.au/about-us/publications/national-statement-ethical-conduct-human-research-2007-updated-2018>
- Neuharth-Pritchett, S., & Getch, Y. Q. (2016). The effectiveness of a brief asthma education intervention for child care providers and primary school teachers. *Early Childhood Education Journal*, 44(6), 555–561. <https://doi.org/10.1007/s10643-015-0751-0>
- Nicholas, D. B., Dell, S. D., Fleming-Carroll, B., & Selkirk, E. K. (2009). An evaluation of pediatric asthma educational resources. *Social Work in Health Care*, 48(4), 450–461.
<https://doi.org/10.1080/00981380802589936>
- O’Grady, K., Hall, K., Bell, A., Chang, A., & Potter, C. (2018). Review of respiratory diseases among Aboriginal and Torres Strait Islander children. *Australian Indigenous Health Bulletin*, 18(2). <http://healthbulletin.org.au/articles/review-of-respiratory-diseases-among-aboriginal-and-torres-strait-islander-children>

- Ohns, M. J. (2019). Identifying the preferred method to educate low income caregivers about common childhood illnesses: A step toward health literacy through a focus group study. *Journal of Pediatric Nursing*, 47, 131–135.
<https://doi.org/10.1016/j.pedn.2019.05.003>
- Okan, O., Lopes, E., Bollweg, T. M., Bröder, J., Messer, M., Bruland, D., Bond, E., Carvalho, G. S., Sørensen, K., Saboga-Nunes, L., Levin-Zamir, D., Sahrai, D., Bittlingmayer, U. H., Pelikan, J. M., Thomas, M., Bauer, U., & Pinheiro, P. (2018). Generic health literacy measurement instruments for children and adolescents: A systematic review of the literature. *BMC Public Health*, 18(1).
<https://doi.org/10.1186/s12889-018-5054-0>
- Orelle-Valente, J. K., Jarlsberg, L. G., Hill, L. G., & Cabana, M. D. (2008). At what age do children start taking daily asthma medicines on their own? *Pediatrics*, 122(6), 1186–1192. <https://doi.org/10.1542/peds.2008-0292>
- Perez, M., Donaldson, M., Jain, N., & Robinson, J. K. (2018). Sun protection behaviors in head start and other early childhood education programs in Illinois. *JAMA dermatology*, 154(3), 336–340.
- Piaget, J. (1970). *Science of education and the psychology of the child*. Trans. D. Coltman. Orion.
- Pinnock, H. (2015). Supported self-management for asthma. In *Breathe* (Vol. 11, Issue 2, pp. 99–109). European Respiratory Society. <https://doi.org/10.1183/20734735.015614>
- Pitchon, R. R., Alvim, C. G., de Andrade, C. R., Lasmar, L. M. de L. B. F., Cruz, Á. A., & Reis, A. P. dos. (2019). Asthma mortality in children and adolescents of Brazil over a 20-year period. *Jornal de Pediatria*. <https://doi.org/10.1016/j.jped.2019.02.006>

- Poudel, R. S., Shrestha, S., & Adhikari, S. (2019). Healthcare professionals' competence in using inhaler devices: A wake-up call for immediate action in low-income countries. *Research in Social and Administrative Pharmacy*, 15(11), 1377–1378. <https://doi.org/10.1016/j.sapharm.2019.08.007>
- Praena-Crespo, M., Aquino-Llinares, N., Fernández-Truan, J. C., Castro-Gómez, L., & Segovia-Ferrera, C. (2017). Asthma education taught by physical education teachers at grade schools: A randomised cluster trial. *Allergologia et Immunopathologia*, 45(4), 375–386. <https://doi.org/10.1016/j.aller.2016.10.022>
- Privitera, G. J., & Ahlgrim-Delzell, L. (2018). *Research Methods for Education*. Sage.
- Radhakrishnan, D. K., Dell, S. D., Guttmann, A., Shariff, S. Z., Liu, K., & To, T. (2014). Trends in the age of diagnosis of childhood asthma. *Journal of Allergy and Clinical Immunology*, 134(5), 1057-1062.e5. <https://doi.org/10.1016/j.jaci.2014.05.012>
- Rehman, A., Amin, F., & Sadeeqa, S. (2018). Prevalence of asthma and its management: A review. *Journal of the Pakistan Medical Association*, 68(12), 1824–1828.
- Rodríguez-García, C., Lourido-Cebreiro, T., & González-Barcala, F.-J. (2019). The ATAUD study: The need to improve adherence. *Archivos de Bronconeumología (English Edition)*, 55(10), 509–510. <https://doi.org/10.1016/j.arbr.2019.01.014>
- Rodriguez-Martinez, C. E., Sossa-Briceño, M. P., & Castro-Rodriguez, J. A. (2018). A cost-effectiveness threshold analysis of a multidisciplinary structured educational intervention in pediatric asthma. *Journal of Asthma*, 55(5), 561–570. <https://doi.org/10.1080/02770903.2017.1348512>

- Ross, K. R., Gupta, R., DeBoer, M. D., Zein, J., Phillips, B. R., Mauger, D. T., Li, C., Myers, R. E., Phipatanakul, W., Fitzpatrick, A. M., Ly, N. P., Bacharier, L. B., Jackson, D. J., Celedón, J. C., Larkin, A., Israel, E., Levy, B., Fahy, J. V., Castro, M., ... Gaston, B. (2020). Severe asthma during childhood and adolescence: A longitudinal study. *Journal of Allergy and Clinical Immunology*, 145(1), 140-146.e9.
<https://doi.org/10.1016/j.jaci.2019.09.030>
- Ruvalcaba, E., Callaghan-Koru, J., Rand, C. S., & Eakin, M. N. (2019). Integrating asthma management and care in Maryland Head Start Programs: A qualitative assessment of opportunities and needs. *Evaluation and Program Planning*, 77, 101684.
<https://doi.org/10.1016/j.evalprogplan.2019.101684>
- Sangrar, R., Docherty-Skippen, S. M., & Beattie, K. (2019). Blended face-to-face and online/computer-based education approaches in chronic disease self-management: A critical interpretive synthesis. *Patient Education and Counseling*, 102(10), 1822--1832. <https://doi.org/10.1016/j.pec.2019.05.009>
- Saxby, N., Beggs, S., Battersby, M., & Lawn, S. (2019). What are the components of effective chronic condition self-management education interventions for children with asthma, cystic fibrosis, and diabetes? A systematic review. *Patient Education and Counseling*, 102(4), 607–622. <https://doi.org/10.1016/j.pec.2018.11.001>
- Sheele, J. M., Bhangu, J., Wilson, A., & Mandac, E. (2019). Patient preference for medical information in the emergency department: Post-test survey of a random allocation intervention. *Journal of Emergency Nursing*, 45(5), 517-522.e6.
<https://doi.org/10.1016/j.jen.2019.05.009>

- Singh, C., Crawford, K., Willey, S., Hall, H., Harder, K., Plummer, V., & Williams, A. (2020). Medication adherence among people of Indian ethnicity living with chronic disease following migration to Australia. *Collegian*, 27(2), 179–184.
<https://doi.org/10.1016/j.colegn.2019.06.002>
- Sletvold, H., Sagmo, L. A. B., & Torheim, E. A. (2020). Impact of pictograms on medication adherence: A systematic literature review. *Patient Education and Counseling*, 103(6), 1095–1103. <https://doi.org/10.1016/j.pec.2019.12.018>
- Sonney, J., Duffy, M., Hoogerheyde, L. X., Langhauser, E., & Teska, D. (2019). Applying human-centered design to the development of an asthma essentials kit for school-aged children and their parents. *Journal of Pediatric Health Care*, 33(2), 169–177.
<https://doi.org/10.1016/j.pedhc.2018.07.008>
- Sonney, J., Segrin, C., & Kolstad, T. (2019). Parent- and child-reported asthma responsibility in school-age children: Examining agreement, disagreement, and family functioning. *Journal of Pediatric Health Care*, 33(4), 386–393.
<https://doi.org/10.1016/j.pedhc.2018.11.005>
- Sorensen, K., & Okan, O. (2020). *Health literacy: Health literacy of children and adolescents in school settings*. doi:10.4119/unibi/2942282.
- Springer, K., & Ruckel, J. (1992). Early beliefs about the cause of illness: Evidence against immanent justice. *Cognitive Development*, 7(4), 429–443.
[https://doi.org/10.1016/0885-2014\(92\)80002-W](https://doi.org/10.1016/0885-2014(92)80002-W)
- Suwannakeeree, P., Deerojanawong, J., & Prapphal, N. (2016). School-based educational interventions can significantly improve health outcomes in children with asthma. *J Med Assoc Thai*, 99(2). <http://www.jmatonline.com>

- Svavarsdottir, E. K., McCubbin, M. A., & Kane, J. H. (2000). Well-being of parents of young children with asthma. *Research in Nursing and Health*, 23(5), 346–358.
[https://doi.org/10.1002/1098-240X\(200010\)23:5<346::AID-NUR2>3.0.CO;2-W](https://doi.org/10.1002/1098-240X(200010)23:5<346::AID-NUR2>3.0.CO;2-W)
- Szeffler, S. J., Cloutier, M. M., Villarreal, M., Hollenbach, J. P., Gleason, M., Haas-Howard, C., Vinick, C., Calatroni, A., Cicutto, L., White, M., Williams, S., McGinn, M., Langton, C., Shocks, D., Mitchell, H., & Stempel, D. A. (2019). Building bridges for asthma care: Reducing school absence for inner-city children with health disparities. *Journal of Allergy and Clinical Immunology*, 143(2), 746–754.e2. <https://doi.org/10.1016/j.jaci.2018.05.041>
- Thapa, G., Nair, S., & Oetjen, C. (2019). Implementing an evidence-based, asthma decision support tool for children younger than 5 years old. *Journal of Pediatric Health Care*, 33(3), 296–308. <https://doi.org/10.1016/j.pedhc.2018.10.003>
- The Global Asthma Network. (2018). *The Global Asthma Report 2018*.
<http://www.globalasthmanetwork.org>
- Thomas, M. (2015). Why aren't we doing better in asthma: Time for personalised medicine? *Primary Care Respiratory Medicine*, 25. <https://doi.org/10.1038/npjpcrm.2015.4>
- Toelle, B., Peat, J., Mellis, C., & Woolcock, A. J. (1995). The cost of childhood asthma to Australian families. *Pediatric Pulmonology*, 19(6), 330–335.
- Türkeli, A., Yılmaz, Ö., & Yüksel, H. (2016). Metered dose inhaler-spacer use education effects on achieve asthma control in children. *Tuberkuloz ve Toraks*, 64(2), 105–111.
<https://doi.org/10.5578/tt.9142>.
- Uchima, O., Sentell, T., Dela Cruz, M. R., & Braun, K. L. (2019). Community health workers in pediatric asthma education programs in the United States: A systematic literature review. *Children's Health Care*, 48(2), 215–243.
<https://doi.org/10.1080/02739615.2018.1520107>

- Udtha, M., Nomie, K., Yu, E., & Sanner, J. (2015). Novel and emerging strategies for longitudinal data collection. *Journal of Nursing Scholarship*, 47(2), 152–160.
<https://doi.org/10.1111/jnu.12116>
- Urrutia-Pereira, M., To, T., Cruz, A., & Solé, D. (2017). The school as a health promoter for children with asthma: The purpose of an education programme. In *Allergologia et Immunopathologia* (Vol. 45, Issue 1, pp. 93–98). Elsevier Doyma.
<https://doi.org/10.1016/j.aller.2016.04.002>
- Valery, P. C., Whop, L. J., Morseu-Diop, N., Garvey, G., Masters, I. B., & Chang, A. B. (2016). Carers’ perspectives on an effective Indigenous health model for childhood asthma in the Torres Strait. *Australian Journal of Rural Health*, 24(3), 170–175.
<https://doi.org/10.1111/ajr.12257>
- Van Asperen, P. (2015). Deaths from childhood asthma, 2004–2013: What lessons can we learn? In *Medical Journal of Australia* (Vol. 202, Issue 3, pp. 125–127). Australasian Medical Publishing Co. Ltd. <https://doi.org/10.5694/mja14.01645>
- Vernon, M. K., Wiklund, I., Bell, J. A., Dale, P., & Chapman, K. R. (2012). What do we know about asthma triggers? A review of the literature. In *Journal of Asthma* (Vol. 49, Issue 10, pp. 991–998). <https://doi.org/10.3109/02770903.2012.738268>
- Vos, T., Abajobir, A. A., Abate, K. H., Abbafati, C., Abbas, K. M., Abd-Allah, F., Abdulkader, R. S., Abdulle, A. M., Abebo, T. A., Abera, S. F., Aboyans, V., Abu-Raddad, L. J., Ackerman, I. N., Adamu, A. A., Adetokunboh, O., Afarideh, M., Afshin, A., Agarwal, S. K., Aggarwal, R., ... Murray, C. J. L. (2017). Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990–2016: A systematic analysis for the Global Burden of Disease Study 2016. *The Lancet*, 390(10100), 1211–1259.
[https://doi.org/10.1016/S0140-6736\(17\)32154-2](https://doi.org/10.1016/S0140-6736(17)32154-2)

- Waldecker, A., Malpass, A., King, A., & Ridd, M. J. (2018). Written action plans for children with long-term conditions: A systematic review and synthesis of qualitative data. In *Health Expectations* (Vol. 21, Issue 3, pp. 585–596). Blackwell Publishing Ltd.
<https://doi.org/10.1111/hex.12643>
- Wang, A. L., Datta, S., Weiss, S. T., & Tantisira, K. G. (2019). Remission of persistent childhood asthma: Early predictors of adult outcomes. *Journal of Allergy and Clinical Immunology*, 143(5), 1752–1759.e6. <https://doi.org/10.1016/j.jaci.2018.09.038>
- Wang, L., Timmer, S., & Rosenman, K. (2020). Assessment of a university-based outpatient asthma education program for children. *Journal of Pediatric Health Care*, 34(2), 128–135. <https://doi.org/10.1016/j.pedhc.2019.09.004>
- Wang, M., Beal, D. J., Chan, D., Newman, D. A., Vancouver, J. B., & Vandenberg, R. J. (2017). Longitudinal research: A panel discussion on conceptual issues, research design, and statistical techniques. *Work, Aging and Retirement*, 3(1), 1–24.
<https://doi.org/10.1093/workar/waw033>
- Wei, L., & Feeny, D. (2019). The dynamics of the gradient between child's health and family income: Evidence from Canada. *Social Science and Medicine*, 226, 182–189.
<https://doi.org/10.1016/j.socscimed.2019.02.033>
- Wilson, S. R., Latini, D., Starr, N. J., Fish, L., Loes, L. M., Page, A., & Kubic, P. (1996). Education of parents of infants and very young children with asthma: A developmental evaluation of the Wee Wheezers program. *Journal of Asthma*, 33(4), 239–254. <https://doi.org/10.3109/02770909609055365>
- Wood, B. L., Miller, B. D., & Lehman, H. K. (2015). Review of family relational stress and pediatric asthma: The value of biopsychosocial systemic models. *Family Process*, 54(2), 376–389. <https://doi.org/10.1111/famp.12139>

- Woolcock, A. J., Bastiampillai, S. A., Marks, G. B., & Keena, V. A. (2001). The burden of asthma in Australia. *Medical Journal of Australia*, 175(3), 141–145.
<https://doi.org/10.5694/j.1326-5377.2001.tb143062.x>
- World Health Organisation. (1986). Ottawa charter for health promotion. *First International Conference on Health Promotion*.
http://www.healthpromotion.org.au/images/ottawa_charter_hp.pdf
- World Health Organisation. (2016). 9th Global Conference on Health Promotion. *Health Literacy: The Mandate for Health Literacy*.
<https://www.who.int/healthpromotion/conferences/9gchp/health-literacy/en/>
- Yang, C. L., Gaffin, J. M., & Radhakrishnan, D. (2019). Question 3: Can we diagnose asthma in children under the age of 5 years? In *Paediatric Respiratory Reviews* (Vol. 29, pp. 25–30). W.B. Saunders Ltd. <https://doi.org/10.1016/j.prrv.2018.10.003>
- Yilmaz, Ö., Türkeli, A., Karaca, Ö., & Yüksel, H. (2017). Does having an asthmatic sibling affect the quality of life in children? *Turkish Journal of Pediatrics*, 59(3), 274–280.
<https://doi.org/10.24953/turkjpmed.2017.03.007>
- Zacaron, D., Roncada, C., Dal Molin, R. S., Jones, M. H., & Pitrez, P. C. (2020). Prevalence and impact of asthma in schoolchildren in the city of Caxias do Sul-RS. *Jornal de Pediatria*, 96(4), 479–486. <https://doi.org/10.1016/j.jpmed.2019.01.001>
- Zahradnik, A. (2011). Asthma education information source preferences and their relationship to asthma knowledge. *Journal of Health and Human Services Administration*, 34(3), 325–351. <http://www.ncbi.nlm.nih.gov/pubmed/22359845>
- Zejda, J. E., Beridze, V., Bakhtadze, T., Beridze, S., Abuladze, L., Partenadze, N., & Lawson, J. (2020). Prevalence of and factors associated with underdiagnosis of pediatric asthma in Batumi, Georgia. *Allergologia et Immunopathologia*, 48(1), 73–77. <https://doi.org/10.1016/j.aller.2019.05.006>

Zhang, L., Lasmar, L. B., & Castro-Rodriguez, J. A. (2019). The impact of asthma and its treatment on growth: An evidence-based review. In *Jornal de Pediatria* (Vol. 95, pp. 10–22). Elsevier Editora Ltda. <https://doi.org/10.1016/j.jped.2018.10.005>

Appendix A

Ethics Approval



University Research Ethics Committee

Ms L Holzheimer and Assoc Prof H Mohay
School of Early Childhood
Centre for Applied Studies in Early Childhood
QUT Kelvin Grove

29 November 1994

Dear Ms Holzheimer and Professor Mohay

At its meeting on 22 November 1994, the University Research Ethics Committee considered the additional information/revisions supplied by you concerning your project "Evaluation of an asthma education program for young children in two community settings" (Ref No QUT UREC 821).

The Committee is satisfied that the information provided addresses its concerns.

Yours sincerely

Signature redacted

Kimberley Douglas
Secretary, University Research Ethics Committee
QUT Secretariat
Telephone: 864 2902

UrecDec14\Setainf.Doc

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PLEASE REPLY TO THE GARDENS POINT ADDRESS

Appendix B

Transcript of the Adventures of Kooky the Kookaburra and Cassie the Koala

The following is a transcript of the first video recording (Mohay & Masters, 1991) which is a component of the CAERP. This recording features actors dressed as the main characters and conveys the message regarding the symptoms of asthma, its effects on the lungs and the impact of asthma medication.

The video recording begins with the title screen and message, “The Adventures of Kooky the Kookaburra and Cassie the Koala. Today they learn about asthma.”

Legend

- N = Narrator
- K = Kooky the Kookaburra
- C = Cassie the Koala
- D = Daddy
- BF = Bush Fairy
- K&C = Kooky and Cassie

N: Once, long ago in the Australian bush, lived a kookaburra and a koala. Their names were Kooky and Cassie. Cassie made wonderful magic, but her best magic of all was the kind she made with her magic gum leaf. When she blew on it, it would make a loud whistling sound that made all of her friends in the bush feel happy. Kooky would feel so happy that sometimes he’d laugh so much he’d nearly fall out of his tree.

K: (Laughs) Whoops-a-daisy.

N: Then, one day, as they were playing, they saw a little boy and his daddy fishing at the creek.

C: Kooky, I wonder if my magic gum leaf will make them laugh too? (Gum leaf whistle)

N: And Cassie blew so loudly that the sound could be heard a long way away. The little boy and his daddy began to laugh and sing. Then, suddenly, the little boy began to gasp for breath.

C: Oh dear, what have I done?

D: We'd better get you to take your asthma medicine, Ben.

N: That night, Cassie couldn't stop thinking about Ben.

K: Don't worry Cassie, I'm sure Ben will be alright.

N: But you see, Cassie had never heard of asthma before. So she decided that in the morning, she'd go and ask the Bush Fairy all about it. (Musical interlude) The next day, they set off early, and soon, in the distance, they saw a house made of golden wattle flowers.

BF: Hello Kooky. Hello Cassie. What brings you to this part of the bush?

C: Hello Bush Fairy. We've come to ask you about asthma.

BF: Well, that's something the magic picture book can help us with. Why don't we look inside it?

N: The Bush Fairy sprinkled some sparkling bush dust all around, and in her hands appeared the magic picture book.

K: (Laughs) Oh, that's big. Oh look, I can see right inside his chest.

BF: Yes, Kooky, that's because inside Ben's chest are his lungs. They're the things that help him breathe.

C: Lungs look like two big sponges, don't they?

BF: Yes, they do. You see, when Ben breaths in, air goes through his nose, down a pipe and into other tiny pipes inside his lungs. When he breathes out, the air goes back out again. Put one hand on your chest and breathe in deeply. (Breathing in sound) The boys and girls can try this one too. Can you feel it moving?

C: Yes.

BF: Now breathe out. (Breathing out sound)

BF: What happens?

K: Oh, it feels flatter.

BF: That's because all the air has emptied out of your lungs, like a flat balloon. Sometimes, in little boys and girls, the pipes inside their lungs fill up with sticky stuff which makes them cough. Other times, the inside of the pipes swell, or go all twitchy, making the hole in the middle a lot smaller, and when this happens, the air can't get in and out so easily, and it makes it harder to breathe. This is what the doctors call asthma.

K: Oh, what can boys and girls do to make them feel better?

BF: Well, they can take their special medicine which fits into what's called a spacer. It looks a bit like a rocket ship, and it's very important that boys and girls learn to take their medicine properly.

C: Well, what does the medicine do?

BF: It makes the breathing tubes wider so that the air can get in and out more easily.

K: That means they'll be able to breathe better too, doesn't it?

BF: That's right.

C: Thank you, Bush Fairy. Now we understand.

N: So Kooky and Cassie waved goodbye to the Bush Fairy and strolled off down the bush path.

K&C: When you want to stop a cough, when you want to stop a wheeze, just take a little puff, then you breathe (laughs) with ease (laughs).

C: Can we do it again?

K: Okay, okay.

K&C: When you want to stop a cough when you want to stop a wheeze

N: Later that day, Cassie and Kooky visited the creek again to see if Ben and his daddy were back there fishing. Sure enough, there they were because Ben had taken his medicine. He was feeling much, much better, and that made Cassie and Kooky very happy.

K&C: Kookaburra sitting in the big gum tree, laughing merrily, merrily, koala eating leaves for tea, munching, munching gleefully (laughter).

C: Come on Kooky.

(Music)

Appendix C

Transcript of the Agro Asthma Show

The following is a transcript of the second video recording (Mohay & Masters, 1992) which is a component of the CAERP. This recording features the puppet Agro, a popular children's television character and two young children. Agro engages the children in conversation about the skill of using a spacer and a puffer. The children model the assembly of the spacer and puffer and then demonstrate the correct use of both.

Legend

- A = Agro
- B = Ben
- C = Courtney

Children: Agro! [clapping]

A: Hi there, and welcome to Agro's Asthma Show. Yes, I know all there is to know about asthma, and what you got to use and stuff like that, like, this stuff here, its, um, it's very important this stuff here, it's um, asthma stuff, yea, um, you put this, in there and then, that, that you got this thing here. (Laughs) Perhaps I need a little help. Is there someone in the audience who can give me a hand, please? Oh beauty, that boy and that little girl can you come on down, please. Come on down. Welcome to the Agro Asthma Show. Your name is?

C: Courtney.

A: A kiss please Courtney. (Kisses him) And your name is?

B: Ben.

A: Please to meet you, Ben. Shake on it, yea, shake my rubber hand. Put it back where you got it from, please Ben. You can put it on the desk. Now we're putting together, um, these things here which is to help you take your medicine, and and ...

B: Spacer, and two spacers, and that's a puffer.

A: And that's a what?

B: Puffer, spacer. We've got, this is a spacer, that's a spacer, and this is a puffer.

A: Well, I knew that, of course. Uh, I just want you guys to give me a little bit of a hand. Uh, now, could you put your spacer together, please? That's the way. I see. It's got a little arrow there on top.

B: Courtney, shake it.

A: Oh, good point, good point.

C: Like that.

A: Uh-huh, so you got to shake your medicine, uh?

C: Yea.

A: Ah good one, Ben, you knew that one eh, and ah, let me see, this is called a spacer, and the other thing's called the ...

C: Puffer.

A: The puffer! The puffer! And it's to help you breathe easier, isn't it?

C: Yes.

B: Agro.

A: Oh, right. I'm with you. I'm with you, Ben. Now listen. Uh, uh, I'd better put mine together, hadn't I, so we can all do this together.

B: Do you know how to do it?

A: Yea, course I do. I saw. It's got an arrow on top, and you just click it together, and then you put the ...

B: No cheating.

A: No, no, no, I don't cheat, I bet you, I bet you. Okay, um, I'll, you put yours together, and I'll put mine together. Okay? Ready, go.

B: There.

A: Good boy, Ben. I've finished mine, now look, see? Yea, but I, I did, but I did because ...

B: Courtney did all the work.

A: Yea, but it's easy to put together. Um now, um, let me see. Have you got your puffer? Oh, shake your medicine. Yea, that's right, yea.

B: Courtney, you forgot to shake Agro's.

C: Oh, sorry Agro.

A: That's alright, I didn't feel a thing. Alright now, that goes back in there. Okay, now Courtney, will you show me? That's to help you take your medicine, right?

C: Yes.

A: Okay. Now, um, how do I know if I'm doing it properly? What, what are we supposed to do?

C: Cause this thing rattles.

A: That rattles.

B: Why don't you give it a rattle?

A: Oh, yeah, okay. Um, how do you put the medicine in there?

C: You go like this. I'll do it to mine.

A: Okay.

C: You go like this.

A: Show me again. Show me again.

B: In the light, Courtney. Hold it up in the light.

C: Just like that.

A: Yeah, I'm watching; I'm watching. I saw it. I saw it. I saw it go in. Um, the medicine's still in there even though you can't see it. Right?

C: Uh-huh.

A: Because you can probably taste it, heh?

C: Yes.

B: Okay, so do you want to have a taste, Agro?

A: Pardon me.

B: Want to have a taste?

A: Yea, I want Courtney to show me first. Now you have one puff and how many breaths?

C: Five.

A: Okay, well show me the puff, and then show me the breath. Right. Can you just show me once more, please Courtney, now show me the puff. Okay, now show me the breath.

B: One, two, three, four, five.

A: Uh-huhhhhhh.

A: One, two, three, four, five, like that (laughs). And, and that'll help me breathe easier and stop coughing. That right?

B: Agro.

A: Yeah, it's easy to do, isn't it?

C: Yes.

A: Even I, even I could do it.

B: No, 'cause you only have these hands.

A: Material ones? Uh, well, boy I've got a surprise for you guys. There's another 200 of these backstage, and you've got to make them up for me (laughs).

B: Oh no.

A: (Laughs) Oh yeah. Got you. (Laughs) Thanks, Courtney. Thanks, Ben, and we'll catch you next time on Agro's Asthma Show.

Appendix D

Transcript of Young Children Managing Asthma

The following is a transcript of the third video recording (Mohay & Masters, 1993) which is a component of the CAERP. This recording features Benita Collins, a television host of Play School, a popular daily children's television program. Benita engages the children in conversation about how they manage their asthma. The children model the assembly of the spacer and puffer and demonstrate the correct use of both the spacer and puffer, and a nebuliser. The conversation emphasises the importance of taking daily medication to manage asthma, asthma triggers, and activities that children can complete while using a nebuliser. The initial setting shows children playing on playground equipment. The children come from their outdoor activities into a playroom where Benita is seated.

Legend

- B = Benita
- G = Grace
- M = Mark

B: Today I'm going to be talking to two young children who have asthma and see how they look after themselves because I know a lot of you younger children have asthma too.

G: Hello, Benita.

B: Hello, Grace.

M: Hi, Benita.

B: Hi, Mark.

G: We've come to take our medicine.

B: Mmmm hmm.

M: Yep.

B: What sort of medicine?

G: Oh, just for our asthma.

B: Your asthma?

M: Yeah.

B: Okay. Well, show me how you do it.

M: Well, okay.

G: Well ... okay. You get ... there's holes here.

B: Mmm-hmm.

M: Yep.

G: There's a little hump here.

B: Mmm. Right.

G: And you ...

M: And you place it in.

G: Put the humps in the holes.

B: Okay. Do you want to sit down and do that?

M: Push it.

B: Right.

M: You take this ...

G: You take this ... and shake it up.

M: You shake it really hard.

B: Mmm-hmm.

M: And you put this ...

B: Mmm.

M: This part in ... in the hole like that.

B: Okay. Yes.

G: And you put that ... this part in the ... in the hole like that.

B: Okay. Yes.

G: And then you just give it one tiny squirt.

M: Just a little one like this.

B: Yes, and then what?

M: And then you go five times ... you've got to go (pants five times) five.

B: Five.

M: Yep.

B: Terrific. And what's this called, do you know?

G: It's called a space bar.

B: Not a space bar.

G: No.

B: Close. It's like a space ship, isn't it?

M: Yeah.

B: It's called a spacer.

G: Spacer.

M: Spacer. That's it. And, umm ... after that we've always got to clean your teeth or gargle because it gets very yucky being in your mouth for too long.

B: Uh-ha.

M: Once you've had it, it's not very nice.

B: So you have to clean ... clean it of what ... clean it off your teeth, and it's already in your mouth by then, isn't it?

M: Yeah.

B: So you've taken your medicine.

M: Yeah.

B: Yes ... alright. And if you take this, what does that mean? That you're okay for the day or what?

M: Yeah. You're ... oh, no. You take it once in the morning; you're okay up until about half-past twelve.

B: Mmm-hmm.

M: You take it once, then you're okay up till night time, and you take it once at night time, and you go the whole way through the night.

B: Do some children have to take it less than that, maybe?

G:} Oh.

M:} Oh.

B: What about Gracie, do you know?

G: Once in the morning and once in the night time.

B: Mmm-hmm. What happens if you've got a cold or something like that?

M: If you've got ...

B: Sort of hard or ...

M: Really bad breathing or something slow, you use this, and this is called ...

G: This is ...

M:} ... a nebuliser.

G:} ... a nebuliser.

B: Ah-ha ...

M: And she'll show you how to use it.

G: You push this button.
B: Uh-ha.
G: And you just breathe normally.
B: Mmm-hmm.
M: Yep.
B: And would you keep that on for what?
M: About fifteen minutes.
B: Yes.
G: Yep, fifteen minutes.
B: That's quite a long time, isn't it?
M:} Yeah.
G:} Yes.
B: Oh.
G: But you can just read a book and ...
B: Mmm.
M: Yeah.
G: It doesn't ... and it's not scary.
B: Not scary. What? The noise? The noise is not scary.
G: No, it doesn't hurt you.
M: No, it doesn't hurt ya.
B: Mmm-hmm.
M: Some people when they're just starting to have it, they think it's a little bit scary for the ...
B: So you really only need that, what ... when you're really sick.
M: Yeah.
B: Yeah. When you perhaps have to have that on, and it's a long time, what else could you do apart from reading?
M: Yeah. Mmm.
B: What about drawing? Do you like drawing? Could you do ...
G: Yeah, I like drawing.
M: Yeah, I like drawing. Sewing.
B: Yes.
M: Handwork.
B: Yes, you could do that.

M: Yeah.

B: Yes, do you sometimes imagine?

M: Yeah, I imagine.

B: Ah, different things? Like where's your favourite place. Where would ... Where would ... If you could go anywhere, where would you like to go?

M: Mmm. Underwater World again.

B: Underwater World.

G: I want to go ... Newmarket Pool.

B: What's ... Where's that?

G: Newmarket Pool? Yeah.

B: Ah-ha.

G: It's at Newmarket.

B: Ah-ha. And is that really lovely?

G: Yeah. It's got this really big water slide that you slide down.

B: Uh-ha.

G: Like ... And it really like just ... It's, it's deep in the middle ...

B: Right.

G: And it's shallow in the deep end and shallow in the shallow end.

B: And is that, is that a nice, would that be a nice calm place to go?

G: Yes.

M: Yeah.

B: And if you're out somewhere and, ah, maybe you have an attack, do you know what might bring that on?

G: Mmm.

M: Mmm ... smoking.

B: Or, well, yes, that could be in the home or somewhere, couldn't it?

M: Yeah.

B: Yeah.

M: Or dusty stuff.

B: Up your nose and ...

G: Or lots of pollen.

B: Mmm-hmm.

G: And stuff.

B: So if you take this, umm, it keeps the asthma away.

M: Yeah.

G: Yeah. And you can run away for as ... um ... as well as you like.

B: Yeah.

G: And you can run and play.

M: Fastest or ...

B: Just like everyone.

G: And skip.

M: Some people at sports day, they had to. There were about five people, and they had to go back to their classrooms and take it, and they had to come back for their running races.

B: And they were okay?

M: Yep, they were fine.

B: Good. Alright, well, do you two want to go and play?

M: Yep, now that we've had that.

G: Yep.

B: Good. Alright then. Bye-bye Grace.

M: Bye.

B: Bye Mark.

The recording concludes with the children shown running into pond, splashing and playing.

Appendix E

Redacted content

Redacted content

Redacted content

Redacted content

Appendix F

Children's Asthma Knowledge Test Illustrated by Diane Brims

Introduction: We're going to play a game today. I'm going to ask you some questions, and I want you to give me your best answer. Let's try this one to start.

Practice item

1. Which one of these is Agro?

- ~ Agro
- ~ Bush Fairy
- ~ Kooky

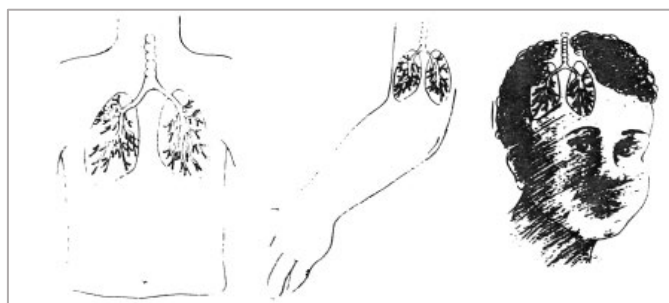
The possible responses to each question were presented as three coloured illustrations measuring 8cm × 11cm each, on a 23cm × 39cm background. For example:



Lung physiology

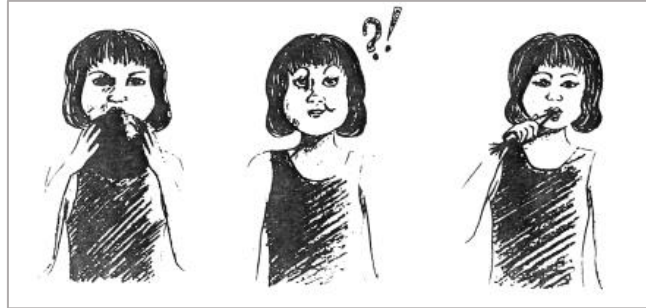
2. Where are your lungs?

- ~ chest
- ~ arm
- ~ head



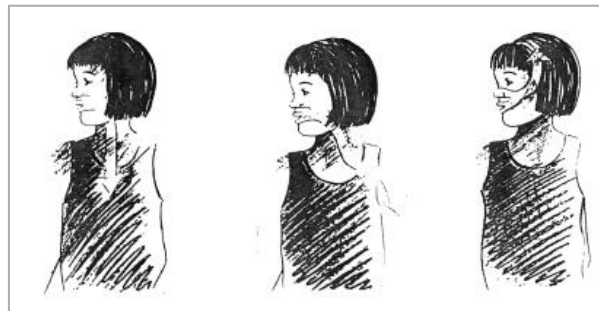
3. Do your lungs help you to

- ~ breath?
- ~ think?
- ~ eat your food?



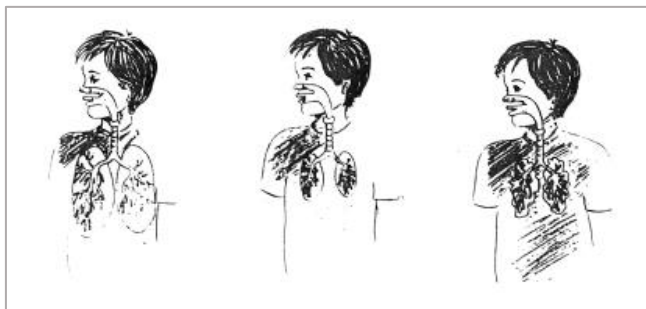
4. Where does the air go when you breathe in?

- ~ chest
- ~ arm
- ~ head



5. This is what your lungs look like before you breathe in (illustration). How do they look after you take a breath in?

- ~ bigger
- ~ smaller
- ~ unusual (funny) shape but same size



Scenario: Now I'm going to tell you about this boy that I know. His name is Thomas, and this is a picture of him here (show illustration). He is about the same age as you and he has asthma. But he doesn't know about asthma or how to look after his asthma. He needs you to help him and tell him about asthma and how he should take care of himself.

Asthma pathogenesis

6. What happens to Thomas when he gets asthma? Does he:

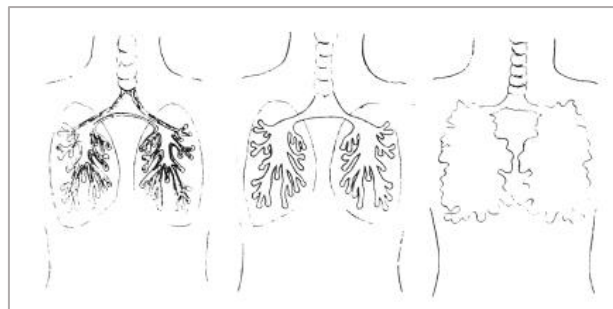
- ~ cough and wheeze
- ~ get a sore toe
- ~ get spots on his body



7. What happens to the breathing pipes in Thomas' lungs when he has asthma?

Do his breathing pipes:

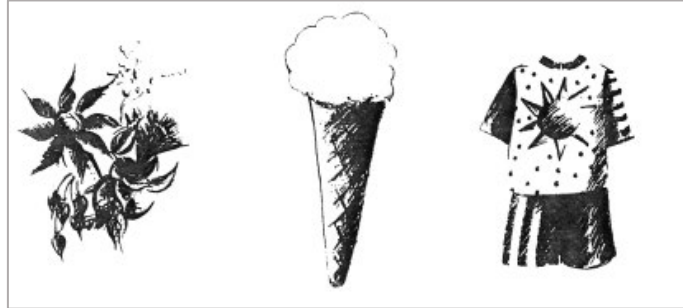
- ~ get smaller
- ~ get bigger
- ~ disappear



Triggers

8. What things could make Thomas cough and wheeze?

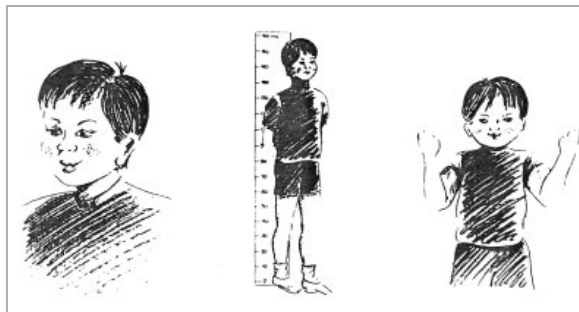
- ~ picking flowers
- ~ eating ice-cream
- ~ wearing bright clothes



Function of medication

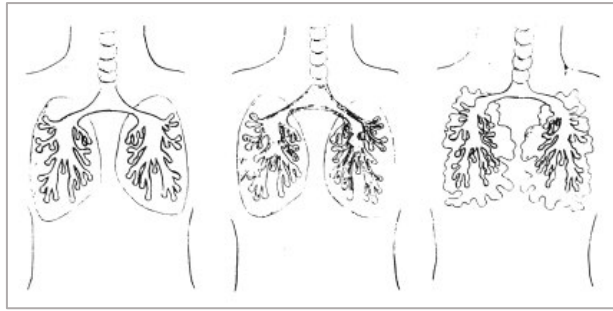
9. Why does Thomas take his asthma medicine? Does he take it to help him to:

- ~ breathe easier
- ~ grow taller
- ~ get bigger muscles



10. What happens to the pipes in Thomas' lungs when he takes his special asthma medicine? Do the breathing pipes:

- ~ get bigger
- ~ get smaller
- ~ change into a funny shape



Nebuliser - term, technique, feel comfortable about use

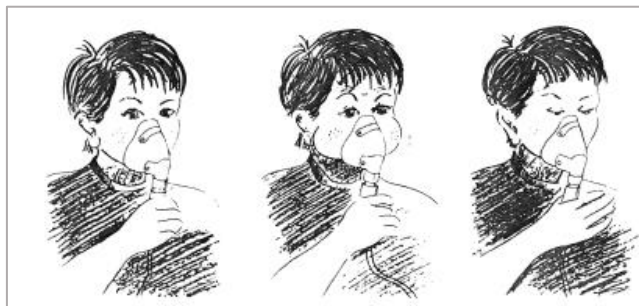
11. Which one of these is the nebuliser that Thomas could use to help him take his special asthma medicine?

- ~ nebuliser
- ~ oral medication (medicine glass)
- ~ puffer and spacer



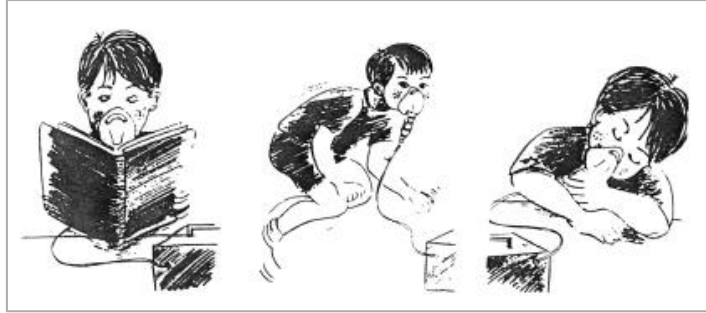
12. When Thomas uses his nebuliser does he have to breathe:

- ~ just the same as usual/normal (demonstrate)
- ~ very, very quickly like this (demonstrate)
- ~ very, very slowly like this (demonstrate)



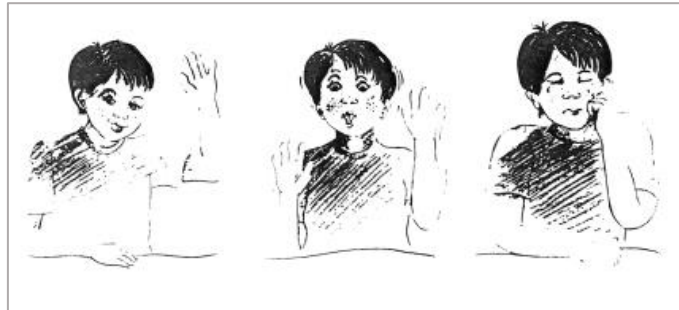
13. What can Thomas do while he is using his nebuliser to take his asthma medicine?

- ~ look at a book
- ~ jump up and down
- ~ sleep



14. How should Thomas feel about using the nebuliser to take his asthma medicine?

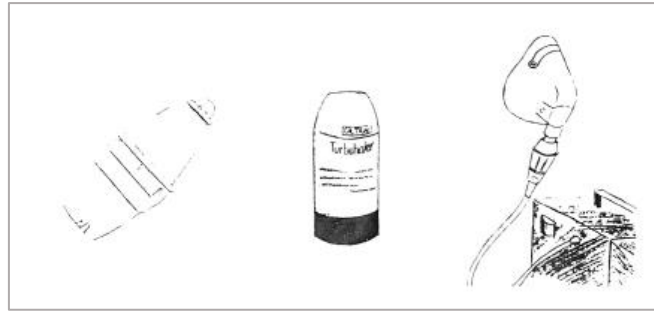
- ~ okay
- ~ scared and frightened
- ~ very sad



Spacer – term and technique

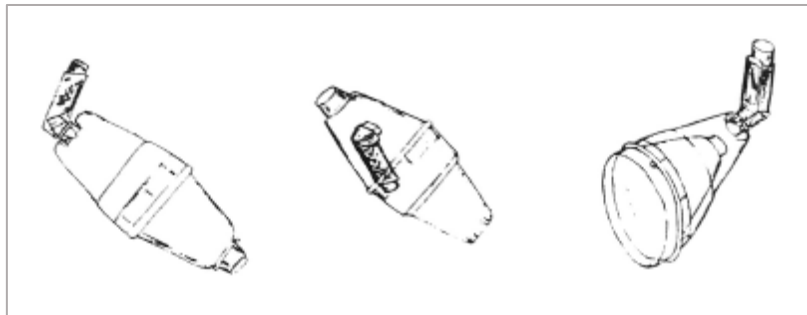
15. Which one of these is the spacer that Thomas could use to help him take his asthma medicine?

- ~ spacer
- ~ turbuhaler
- ~ nebuliser



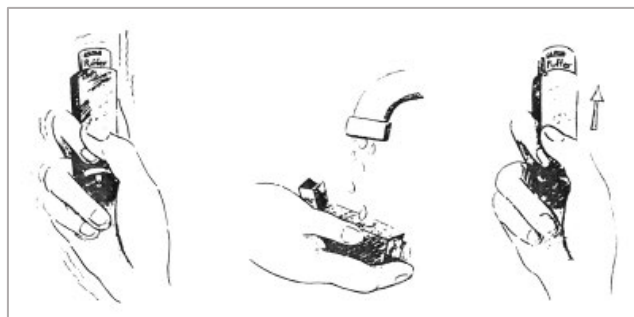
16. Which way should Thomas' spacer go together?

- ~ correct
- ~ incorrect
- ~ incorrect



17. Before Thomas puts the medicine into his spacer does he need to:

- ~ shake his puffer
- ~ wash his puffer
- ~ turn his puffer upside down



Spacer and nebuliser technique

18. What does Thomas have to do after he takes his asthma medicine? Does he have to:

- ~ brush his teeth

~ change his clothes

~ comb his hair



Quality of life

19. What should Thomas do if he takes his medicine every day?

~ play with all the other kids

~ stay in bed

~ only play quiet games inside



Appendix G

Children's Asthma Knowledge Test Score Sheet

ID No: Name: Age:

Centre:

Question	Pre Test 1	Code	Post Test 1	Code	Post Test 2	Code
	Date		Date		Date	
1	A B C		A B C		A B C	
2	A B C		A B C		A B C	
3	A B C		A B C		A B C	
4	A B C		A B C		A B C	
5	A B C		A B C		A B C	
6	A B C		A B C		A B C	
7	A B C		A B C		A B C	
8	A B C		A B C		A B C	
9	A B C		A B C		A B C	
10	A B C		A B C		A B C	
11	A B C		A B C		A B C	
12	A B C		A B C		A B C	
13	A B C		A B C		A B C	
14	A B C		A B C		A B C	
15	A B C		A B C		A B C	
16	A B C		A B C		A B C	
17	A B C		A B C		A B C	
18	A B C		A B C		A B C	
19	A B C		A B C		A B C	

Appendix H

General Information Parent Questionnaire

1. Parent's name
.....
2. Child's name
.....
3. Postal address
.....
.....
.....
4. Postcode
.....
5. Telephone number
Home ()
Work ()
6. Name of your child's preschool/kindergarten/child care centre
.....
7. Child's date of birth
.....
8. Child's current age
..... years months
9. Child's sex
(a) male
(b) female
10. Has your child ever experienced
(a) cough yes/no
(b) wheeze yes/no
(c) shortness of breath yes/no
11. Has your child experienced the symptoms of asthma in the past 12 months?

- (a) yes
(b) no
12. Does your child have asthma?
(a) yes
(b) no (go to question 14)
13. Has your child been diagnosed with asthma by a doctor?
(a) yes
(b) no
14. Does the child have siblings?
(a) yes
(b) no (go to question 16)
15. Please give the age and sex of the child's siblings (brothers and sisters) and indicate whether they experience asthma symptoms or have been diagnosed with asthma.

	Sex	Age in years	Has the child experienced asthma symptoms?	If the child has experienced asthma symptoms, have they experienced asthma symptoms in the past 12 months?	If the child has experienced asthma symptoms, have they been diagnosed with asthma by a doctor?
Sibling 1	M/F		Yes/No	Yes/No	Yes/No
Sibling 2	M/F		Yes/No	Yes/No	Yes/No
Sibling 3	M/F		Yes/No	Yes/No	Yes/No
Sibling 4	M/F		Yes/No	Yes/No	Yes/No

16. Do you or any of the adults living in your household have asthma?
(a) yes
(b) no (go to question 20)
17. If yes, how many adults have asthma?
.....
18. How many of the adults who have asthma have experienced symptoms in the past 12 months?
.....

19. How many of the adults living in your household take medication regularly to control the symptoms of asthma?

.....

Finally, a few questions about your household, which will be used for statistical purposes only. Of course, your responses will be treated in the strictest of confidence.

20. Which of the following best describes your living situation?
- (a) yourself, spouse and child/children
 - (b) yourself and child/children
 - (c) yourself, spouse, child/children and other family members
 - (d) yourself, child/children and other family members
 - (e) yourself, child/children and other non - family members
 - (f) other living situation
20. For each of the adults living in your household, please give details of highest academic achievement, occupation, work status and adult's relationship to the child named at question 2.

	Highest academic achievement (e.g. junior/senior certificate, trade qualifications, diploma, degree)	Occupation	Current work status (e.g. home duties, unemployed, pensioner)	Relationship to Child
Adult 1				
Adult 2				
Adult 3				
Adult 4				

Thank you for taking the time to complete this questionnaire.

Your contribution is greatly appreciated.

Appendix I

Children's Health Status and Asthma-Related Knowledge

Questionnaire for Parents of Children with Asthma

Child's name:

Parent's name:

1. Which asthma symptoms does your child experience?
 - (a) cough
 - (b) wheeze
 - (c) shortness of breath/difficulty in breathing
 - (d) chest tightness
 - (e) other, please specify
.....
2. How often does your child have asthma symptoms?
 - (a) most days
 - (b) weekly
 - (c) monthly
 - (d) every 3-5 months
 - (e) every 6-11 months
 - (f) once a year
 - (g) less than once a year
3. On average, how often does your child have an asthma attack?
 - (a) more than once a week
 - (b) once a week
 - (c) once a month
 - (d) once every three months
 - (e) once every six months
 - (f) once a year
 - (g) less than once a year
4. Has your child been diagnosed with asthma by a medical practitioner?
 - (a) yes
 - (b) no (go to question 8)

5. At what age was your child diagnosed with asthma by a medical practitioner?
..... years
6. Have you been told by a medical practitioner whether your child's asthma is mild, moderate or severe?
- (a) yes
 - (b) no
7. If yes, is it:
- (a) infrequent
 - (b) frequent
 - (c) persistent (chronic)
 - (d) don't know
8. Who does your child see about his/her asthma?
- (a) general practitioner only
 - (b) asthma (respiratory) specialist only
 - (c) paediatrician only
 - (d) general practitioner and specialist
 - (e) general practitioner and paediatrician
 - (f) other (e.g. naturopath)
9. On average, how often does your child see his/her doctor about his/her asthma?
- (a) once a week
 - (b) once a month
 - (c) once every three months
 - (d) once every six months
 - (e) once a year
 - (f) less than once a year
10. Which medications have been prescribed for your child's asthma and how often are each of them used?

Name of medication	How often is it used (e.g. daily, once a day, twice a day, as required)?

11. How is your child's medication administered?
- (a) nebuliser only
 - (b) puffer only
 - (c) puffer and spacer/volumatic/nebuhaler/aerochamber only
 - (d) puffer and spacer with nebuliser for acute attacks
 - (e) turbuhaler only
 - (f) other, please specify
.....
12. Have you and your child been shown the correct technique for taking medication via a spacer/volumatic/nebuhaler/aerochamber only?
- (a) yes
 - (b) no (go to question 15)
13. If yes, who showed you?
- (a) general practitioner
 - (b) paediatrician
 - (c) nurse
 - (d) asthma educator
 - (e) other, please specify
.....
 - (f) don't know
14. Did that person check that your child's technique for taking the medication via the spacer was correct?
- (a) yes
 - (b) no

15. In the past 12 months, how many times has your child attended the casualty or emergency ward in a hospital for his/her asthma?
.....
16. In the past 12 months, how many times has your child been admitted to the hospital for his/her asthma?
.....
17. During the past year, how many days was your child absent from preschool, kindergarten or child care because of his/her asthma?
.....

The following questions relate to asthma and its management. Please circle the correct response. You may circle more than one correct response.

18. What is asthma?
- (a) a spasm of the muscle in the wall of the airways
 - (b) inflammation and swelling of the lining in the airways
 - (c) excessive mucus secretion in the airways
 - (d) sensitive/reactive airways
 - (e) all of the above
 - (f) none of the above
19. What are the most obvious features associated with asthma?
- (a) bouts of coughing
 - (b) wheezing
 - (c) breathlessness
 - (d) gasping for air
 - (e) all of the above
 - (f) none of the above
20. Which of the following is likely to trigger an asthma attack in asthmatic children?
- (a) sudden changes in temperature
 - (b) too much medication
 - (c) dust and pollen
 - (d) parental anxiety about child's health
 - (e) all of the above

(f) none of the above

21. Are you aware of what triggers your child's asthma attacks?

(a) yes

(b) no (go to question 22)

Please list your child's asthma triggers:

.....

.....

22. When children with asthma use a nebuliser, do they need to breathe?

(a) quickly

(b) very quickly

(c) normally

(d) slowly

(e) very slowly

23. Which of the following can children do when they use a nebuliser?

(a) look at a book

(b) only sit quietly

(c) draw

(d) sleep

(e) jump up and down

24. Which of the following would describe how you would feel if you needed to use a nebuliser to take asthma medication?

(a) frightened

(b) okay

(c) sad

(d) stressed

(e) other

.....

25. Which of the following needs to be completed before dispensing medication from a puffer into a spacer?

(a) shake puffer

(b) wash puffer

(c) turn puffer upside down

- (d) none of the above
 - (e) all of the above
26. What do children with asthma need to do after taking asthma medication?
- (a) go to sleep
 - (b) eat lunch
 - (c) brush their teeth
 - (d) play
 - (e) all of the above
 - (f) none of the above

Please circle a number along the scale to indicate how you feel about the following statements.

27. On each scale:
- 1 means you **STRONGLY AGREE**
- 3 means you are **UNCERTAIN**
- 5 means you **STRONGLY DISAGREE**
- (a) Asthma attacks can be prevented:
1 2 3 4 5
 - (b) Asthma medications should be used regularly for the best results:
1 2 3 4 5
 - (c) Asthma medications are addictive if they are used all the time:
1 2 3 4 5
 - (d) The use of asthma medications every day should be discouraged if the child with asthma does not have any symptoms:
1 2 3 4 5
 - (e) Children who get asthma when running should be encouraged to play quiet games:
1 2 3 4 5
 - (f) It is easy to give an overdose of medication with asthma nebulisers:
1 2 3 4 5

(g) Asthma medications stop being effective if they are taken regularly for long periods of time:

1 2 3 4 5

(h) I feel that my knowledge of asthma and its management is satisfactory:

1 2 3 4 5

(i) Parents of children with asthma are usually over-anxious about their child's asthma:

1 2 3 4 5

(j) Children with asthma symptoms should be kept at home:

1 2 3 4 5

(k) Inhalers (puffers) are safer than nebulisers:

1 2 3 4 5

(l) Asthma attacks are often triggered by emotional responses:

1 2 3 4 5

(m) Young children should be encouraged to accept responsibility for the management of their asthma, under adult supervision and guidance:

1 2 3 4 5

(n) Children with asthma can participate in all normal childhood activities if their asthma is well managed:

1 2 3 4 5

28. Have you attended any asthma seminars/lectures, etc., in the past 12 months?

(a) Yes

Please describe

.....

Who ran the course?

(b) No

29. Would you like to know more about asthma and its management with children?

(a) Yes

(b) No

30. If yes, what specific aspects are you interested in (please tick):

- (a) asthma and its symptoms
- (b) asthma medications and treatment
- (c) trigger factors of asthma
- (d) asthma management plans
- (e) dealing with an attack
- (f) administering medications
- (g) peak flow meters
- (h) asthma and exercise
- (i) any other areas

Please specify:

.....
.....

Thank you for taking the time to complete this questionnaire.

Your assistance is greatly appreciated.

Appendix J

Teacher Questionnaire One

Name:.....

Centre name:

Current position:.....

1. Do you work in:
 - (a) a child care centre
 - (b) private kindergarten/preschool
 - (c) State preschool
 - (d) other, please specify
.....
2. How many children, on average, are in your care each day?
.....
3. What is the age of the group of children in your care?
.....
4. How many of these children are known to have asthma?
.....
5. How many other children in your care do you think may have asthma?
.....
6. Have you ever used a nebuliser with a child in your care?
 - (a) Yes
 - (b) No (go to question 8)
7. How many times on average have you done this in the last month?
.....
8. Has anyone ever showed you how to use the nebuliser?
 - (a) Yes Who?
 - (b) No (go to question 10)

9. Has anyone ever checked that you know how to use a nebuliser correctly?
 - (a) Yes Who?
 - (b) No
10. Have you ever used a spacer (e.g. volumatic, nebulhaler, aerochamber) with a child in your care?
 - (a) Yes
 - (b) No (go to question 12)
11. How many times on average have you done this in the last month?

.....
12. Has anyone ever showed you how to use a spacer?
 - (a) Yes Who?
 - (b) No (go to question 14)
13. Has anyone ever checked that you know how to use the spacer correctly?
 - (a) Yes Who?
 - (b) No
14. Does looking after children with asthma create any difficulties at your workplace?
 - (a) Yes
 - (b) No (go to question 16)
15. If yes, please comment on the types of difficulties which arise:

.....

.....

.....

.....

The following questions relate to asthma and its management. Please circle the correct response. You may circle more than one correct response.

16. What is asthma?
 - (a) a spasm of the muscle in the wall of the airways
 - (b) inflammation and swelling of the lining in the airways
 - (c) excessive mucus secretion in the airways
 - (d) sensitive/reactive airways

- (e) all of the above
 - (f) none of the above
17. What are the most obvious features associated with asthma?
- (a) bouts of coughing
 - (b) wheezing
 - (c) breathlessness
 - (d) gasping for air
 - (e) all of the above
 - (f) none of the above
18. Which of the following is likely to trigger an asthma attack in asthmatic children?
- (a) sudden changes in temperature
 - (b) too much medication
 - (c) dust and pollen
 - (d) parental anxiety about child's health
 - (e) all of the above
 - (f) none of the above
19. When children with asthma use a nebuliser, do they need to breathe?
- (a) quickly
 - (b) very quickly
 - (c) normally
 - (d) slowly
 - (e) very slowly
20. Which of the following can children do when they use a nebuliser?
- (a) look at a book
 - (b) only sit quietly
 - (c) draw
 - (d) sleep
 - (e) jump up and down
21. Which of the following would describe how you would feel if you needed to use a nebuliser to take asthma medication?
- (a) frightened
 - (b) okay
 - (c) sad

- (d) stressed
 - (e) other
22. Which of the following needs to be completed before dispensing medication from a puffer into a spacer?
- (a) shake puffer
 - (b) wash puffer
 - (c) turn puffer upside down
 - (d) none of the above
 - (e) all of the above
23. What do children with asthma need to do after taking asthma medication?
- (a) go to sleep
 - (b) eat their lunch
 - (c) brush their teeth
 - (d) play
 - (e) all of the above
 - (f) none of the above

Please circle a number along the scale to indicate how you feel about the following statements.

24. On each scale:
- 1 means you **STRONGLY AGREE**
- 3 means you **ARE UNCERTAIN**
- 5 means you **STRONGLY DISAGREE**
- (a) Asthma attacks can be prevented:
1 2 3 4 5
 - (b) Asthma medications should be used regularly for the best results:
1 2 3 4 5
 - (c) Asthma medications are addictive if they are used all the time:
1 2 3 4 5
 - (d) The use of asthma medications every day should be discouraged if the child with asthma does not have any symptoms:
1 2 3 4 5

- (e) Children who get asthma when running should be encouraged to play quiet games:
1 2 3 4 5
- (f) It is easy to give an overdose of medication with asthma nebulisers:
1 2 3 4 5
- (g) Asthma medications stop being effective if they are taken regularly for long periods of time:
1 2 3 4 5
- (h) It is extremely difficult for a childcare worker/teacher to assume responsibility for the management of a child's asthma:
1 2 3 4 5
- (i) Childcare workers/teachers should always consult parents before adjusting a child's asthma medication regime:
1 2 3 4 5
- (j) I feel that my knowledge of asthma and its management is satisfactory:
1 2 3 4 5
- (k) Parents of children with asthma are usually over-anxious about their child's asthma:
1 2 3 4 5
- (l) Children with asthma symptoms should be kept at home:
1 2 3 4 5
- (m) Childcare workers/teachers should not have to take responsibility for giving asthma medications:
1 2 3 4 5
- (n) Inhalers (puffers) are safer than nebulisers:
1 2 3 4 5
- (o) Asthma attacks are often triggered by emotional responses:
1 2 3 4 5

- (p) Young children should be encouraged to accept responsibility for the management of their asthma under adult supervision and guidance:

1 2 3 4 5

- (q) Children with asthma can participate in all normal childhood activities if their asthma is well managed

1 2 3 4 5

25. Do you have asthma?

(a) Yes

(b) No

26. Does anyone in your immediate family have asthma?

(a) Yes

(b) No

27. Have you attended any asthma seminars/lectures, etc in the past 12 months?

(a) Yes

Please describe

.....

Who ran the course?

(b) No

28. Would you like to know more about asthma and its management with children?

(a) Yes

(b) No

29. If yes, what specific aspects are you interested in: (please tick)

(a) asthma and its symptoms

(b) asthma medications and treatment

(c) trigger factors of asthma

(d) asthma management plans

(e) dealing with an attack

(f) administering medications

(g) peak flow meters

(h) asthma and exercise

(i) any other areas

Please specify:

.....

30. Please list your professional qualifications:

.....

.....

31. How many years have you been working in the childcare/teaching field?

.....

Thank you for taking the time to complete this questionnaire.

Your assistance is greatly appreciated.

Appendix K

Teacher Questionnaire Two

Name:.....

School/Centre:.....

1. What is asthma?
 - (a) a spasm of the muscle in the wall of the airways
 - (b) inflammation and swelling of the lining in the airways
 - (c) excessive mucus secretion in the airways
 - (d) sensitive/reactive airways
 - (e) all of the above
 - (f) none of the above
2. What are the most obvious features associated with asthma?
 - (a) bouts of coughing
 - (b) wheezing
 - (c) breathlessness
 - (d) gasping for air
 - (e) all of the above
 - (f) none of the above
3. Which of the following are likely to trigger an asthma attack in asthmatic children?
 - (a) sudden changes in temperature
 - (b) too much medication
 - (c) dust and pollen
 - (d) parental anxiety about child's health
 - (e) all of the above
 - (f) none of the above
4. When children with asthma use a nebuliser, how do they need to breathe?
 - (a) quickly
 - (b) very quickly
 - (c) normally
 - (d) slowly
 - (e) very slowly

5. Which of the following can children do when they use a nebuliser?
 - (a) look at a book
 - (b) only sit quietly
 - (c) draw
 - (d) sleep
 - (e) jump up and down
6. Which of the following would describe how you would feel if you needed to use a nebuliser to take asthma medication?
 - (a) frightened
 - (b) okay
 - (c) sad
 - (d) stressed
 - (e) other
7. Which of the following needs to be completed before dispensing medication from a puffer into a spacer?
 - (a) shake puffer
 - (b) wash puffer
 - (c) turn puffer upside down
 - (d) none of the above
 - (e) all of the above
8. What do children with asthma need to do after taking asthma medication?
 - (a) go to sleep
 - (b) eat lunch
 - (c) brush their teeth
 - (d) play
 - (e) all of the above
 - (f) none of the above
9. On each scale:

1 means you **STRONGLY AGREE**

3 means you are **UNCERTAIN**

5 means you **STRONGLY DISAGREE**

 - (a) Asthma attacks can be prevented:

1	2	3	4	5
---	---	---	---	---

- (b) Asthma medications should be used regularly for the best results:
1 2 3 4 5
- (c) Asthma medications are addictive if they are used all the time:
1 2 3 4 5
- (d) The use of asthma medications every day should be discouraged if the child with asthma does not have any symptoms:
1 2 3 4 5
- (e) Children who get asthma when running should be encouraged to play quiet games:
1 2 3 4 5
- (f) It is easy to give an overdose of medication with asthma nebulisers:
1 2 3 4 5
- (g) Asthma medications stop being effective if they are taken regularly for long periods of time:
1 2 3 4 5
- (h) I feel that my knowledge of asthma and its management is satisfactory:
1 2 3 4 5
- (i) Parents of children with asthma are usually over-anxious about their child's asthma:
1 2 3 4 5
- (j) Children with asthma symptoms should be kept at home:
1 2 3 4 5
- (k) Inhalers (puffers) are safer than nebulisers:
1 2 3 4 5
- (l) Asthma attacks are often triggered by emotional responses:
1 2 3 4 5
- (m) Young children should be encouraged to accept responsibility for the management of their asthma, under adult supervision and guidance:
1 2 3 4 5

- (n) Children with asthma can participate in all normal childhood activities if their asthma is well managed:

1 2 3 4 5

10. How many times did the group as a whole view the following materials:

- (a) The Adventures of Kookie and Cassie (video)
- (b) The Agro Asthma Show (video)
- (c) Young Children Managing Asthma (video)
- (d) What's That Noise? (picture book)

11. Were the materials also made available to individuals and small groups?

- (a) Yes
- (b) No

12. Please indicate the number of children who used the materials individually or in a small group.

.....

13. For what length of time on average were these children exposed to the materials either individually or in a small group situation?

.....

14. Please describe in as much detail as possible your use of the asthma education materials with the children.

.....

.....

.....

.....

15. Please rate the usefulness of the asthma education materials in increasing your own knowledge of the following aspects of asthma and management on the scale:

1 means NOT USEFUL

2 means SOME USE

3 means VERY USEFUL

- (a) Structure and function of the lungs
1 2 3
- (b) Asthma as a health condition
1 2 3
- (c) Asthma triggers
1 2 3
- (d) Purpose and function of asthma medications
1 2 3
- (e) Use of nebulisers and spacers
1 2 3

16. Please rate the usefulness of the asthma education materials in increasing children's knowledge of the following aspects of asthma and management on the scale:

1 means NOT USEFUL

2 means SOME USE

3 means VERY USEFUL

- (a) Structure and function of the lungs
1 2 3
- (b) Asthma as a health condition
1 2 3
- (c) Asthma triggers
1 2 3
- (d) Purpose and function of asthma medications
1 2 3
- (e) Use of nebulisers and spacers
1 2 3

17. Are there any other comments you wish to make about these materials or their use with children?

.....

.....

.....

18. If the asthma education resource was to be introduced into childcare centres and preschools, how do you feel this would be best achieved?
- (a) made available on loan through the local Community Health Services
 - (b) made available on loan through the local Asthma Foundation
 - (c) be purchased by the centre for use
 - (d) a representative delivers the materials to your centre on loan for use and provides educational support if requested
19. What amount would your centre be willing to pay if the materials were purchased?
- (a) \$10
 - (b) \$15
 - (c) \$20
 - (d) \$25
 - (e) \$30
20. What amount would your centre be willing to pay if the materials were loaned for use from a community-based centre?
- (a) \$5
 - (b) \$10
 - (c) \$15

Thank you for taking the time to complete this questionnaire.

Your assistance is greatly appreciated.

Appendix L

Teacher Questionnaire Three

Name:.....

School/Centre:.....

1. What is asthma?
 - (a) a spasm of the muscle in the wall of the airways
 - (b) inflammation and swelling of the lining in the airways
 - (c) excessive mucus secretion in the airways
 - (d) sensitive/reactive airways
 - (e) all of the above
 - (f) none of the above
2. What are the most obvious features associated with asthma?
 - (a) bouts of coughing
 - (b) wheezing
 - (c) breathlessness
 - (d) gasping for air
 - (e) all of the above
 - (f) none of the above
3. Which of the following are likely to trigger an asthma attack in asthmatic children?
 - (a) sudden changes in temperature
 - (b) too much medication
 - (c) dust and pollen
 - (d) parental anxiety about child's health
 - (e) all of the above
 - (f) none of the above
4. When children with asthma use a nebuliser, do they need to breathe?
 - (a) quickly
 - (b) very quickly
 - (c) normally
 - (d) slowly
 - (e) very slowly

5. Which of the following can children do when they use a nebuliser?
 - (a) look at a book
 - (b) only sit quietly
 - (c) draw
 - (d) sleep
 - (e) jump up and down
6. Which of the following would describe how you would feel if you needed to use a nebuliser to take asthma medication?
 - (a)
 - (b) okay
 - (c) sad
 - (d) stressed
 - (e) other
7. Which of the following needs to be completed before dispensing medication from a puffer into a spacer?
 - (a) puffer
 - (b) wash puffer
 - (c) turn puffer upside down
 - (d) none of the above
 - (e) all of the above
8. What do children with asthma need to do after taking asthma medication?
 - (a) to sleep
 - (b) lunch
 - (c) brush their teeth
 - (d) play
 - (e) all of the above
 - (f) none of the above
9. On each scale:

1 means you **STRONGLY AGREE**

3 means you are **UNCERTAIN**

5 means you **STRONGLY DISAGREE**

 - (a) Asthma attacks can be prevented:

1	2	3	4	5
---	---	---	---	---

- (b) Asthma medications should be used regularly for the best results:
1 2 3 4 5
- (c) Asthma medications are addictive if they are used all the time:
1 2 3 4 5
- (d) The use of asthma medications every day should be discouraged if the child with asthma does not have any symptoms:
1 2 3 4 5
- (e) Children who get asthma when running should be encouraged to play quiet games:
1 2 3 4 5
- (f) It is easy to give an overdose of medication with asthma nebulisers:
1 2 3 4 5
- (g) Asthma medications stop being effective if they are taken regularly for long periods of time:
1 2 3 4 5
- (h) I feel that my knowledge of asthma and its management is satisfactory:
1 2 3 4 5
- (i) Parents of children with asthma are usually over-anxious about their child's asthma:
1 2 3 4 5
- (j) Children with asthma symptoms should be kept at home:
1 2 3 4 5
- (k) Inhalers (puffers) are safer than nebulisers:
1 2 3 4 5
- (l) Asthma attacks are often triggered by emotional responses:
1 2 3 4 5
- (m) Young children should be encouraged to accept responsibility for the management of their asthma, under adult supervision and guidance:
1 2 3 4 5

(n) Children with asthma can participate in all normal childhood activities if their asthma is well managed:

1 2 3 4 5

Thank you for taking the time to complete this questionnaire.

Your assistance is greatly appreciated.

Appendix M

Children's Health Status and Asthma-Related Knowledge Questionnaire for Parents of

Children with Asthma

1. Parent's name
.....
2. Child's name
.....
3. Postal address
.....
.....
.....
4. Postcode
.....
5. Telephone number
Home ()
Work ()
6. Name of your general medical practitioner
.....
7. Child's date of birth
.....
8. Child's current age
..... years months
9. Child's sex
(a) male
(b) female
10. Which asthma symptoms does your child experience?
(a) cough
(b) wheeze
(c) shortness of breath/difficulty in breathing

- (d) chest tightness
 - (e) other, please specify
11. How often does your child have asthma symptoms?
- (a) most days
 - (b) weekly
 - (c) monthly
 - (d) every 3-5 months
 - (e) every 6-11 months
 - (f) once a year
 - (g) less than once a year
12. On average, how often does your child have an asthma attack?
- (a) more than once a week
 - (b) once a week
 - (c) once a month
 - (d) once every three months
 - (e) once every six months
 - (f) once a year
 - (g) less than once a year
13. At what age was your child diagnosed with asthma by a medical practitioner?
..... years.
14. Have you been told by a medical practitioner whether your child's asthma is mild, moderate or severe?
- (a) yes
 - (b) no
15. If yes, is it:
- (a) infrequent
 - (b) frequent
 - (c) persistent (chronic)
 - (d) don't know
16. Who does your child see about his/her asthma?
- (a) general practitioner only
 - (b) asthma (respiratory) specialist only
 - (c) paediatrician only

- (d) general practitioner and specialist
 - (e) general practitioner and paediatrician
 - (f) other (e.g. naturopath)
17. On average, how often does your child see his/her doctor about his/her asthma?
- (a) once a week
 - (b) once a month
 - (c) once every three months
 - (d) once every six months
 - (e) once a year
 - (f) less than once a year
18. Which medications have been prescribed for your child's asthma and how often are each of them used?

Name of medication	How often is it used (e.g. daily, once a day, twice a day, as required)?

19. How is your child's medication administered?
- (a) nebuliser only
 - (b) puffer only
 - (c) puffer and spacer/volumatic/nebuhaler/aerochamber only
 - (d) puffer and spacer with nebuliser for acute attacks
 - (e) turbuhaler only
 - (f) other, please specify

20. Have you and your child been shown the correct technique for taking medication via a spacer/volumatic/nebuhaler/aerochamber only?
 - (a) yes
 - (b) no (go to question 15)
21. If yes, who showed you?
 - (a) general practitioner
 - (b) paediatrician
 - (c) nurse
 - (d) asthma educator
 - (e) other, please specify
 - (f) don't know
22. Did that person check that your child's technique for taking the medication via the spacer was correct?
 - (a) yes
 - (b) no
23. In the past 12 months, how many times has your child attended the casualty or emergency ward in a hospital for his/her asthma?
.....
24. In the past 12 months, how many times has your child been admitted to the hospital for his/her asthma?
.....
25. During the past year, how many days was your child absent from preschool, kindergarten or child care because of his/her asthma?
.....

The following questions relate to asthma and its management. Please circle the correct response. You may circle more than one correct response.

26. What is asthma?
 - (a) a spasm of the muscle in the wall of the airways
 - (b) inflammation and swelling of the lining in the airways
 - (c) excessive mucus secretion in the airways
 - (d) sensitive/reactive airways
 - (e) all of the above
 - (f) none of the above

27. What are the most obvious features associated with asthma?
- (a) bouts of coughing
 - (b) wheezing
 - (c) breathlessness
 - (d) gasping for air
 - (e) all of the above
 - (f) none of the above
28. Which of the following is likely to trigger an asthma attack in asthmatic children?
- (a) sudden changes in temperature
 - (b) too much medication
 - (c) dust and pollen
 - (d) parental anxiety about the child's health
 - (e) all of the above
 - (f) none of the above
29. Are you aware of what triggers your child's asthma attacks?
- (a) yes
 - (b) no (go to question 22)

Please list your child's asthma triggers:

.....

.....

.....

.....

30. When children with asthma use a nebuliser, do they need to breathe?
- (a) quickly
 - (b) very quickly
 - (c) normally
 - (d) slowly
 - (e) very slowly
31. Which of the following can children do when they use a nebuliser?
- (a) look at a book
 - (b) only sit quietly

- (c) draw
 - (d) sleep
 - (e) jump up and down
32. Which of the following would describe how you would feel if you needed to use a nebuliser to take asthma medication?
- (a) frightened
 - (b) okay
 - (c) sad
 - (d) stressed
 - (e) other
33. Which of the following needs to be completed before dispensing medication from a puffer into a spacer?
- (a) shake puffer
 - (b) wash puffer
 - (c) turn puffer upside down
 - (d) none of the above
 - (e) all of the above
34. What do children with asthma need to do after taking asthma medication?
- (a) go to sleep
 - (b) eat lunch
 - (c) brush their teeth
 - (d) play
 - (e) all of the above
 - (f) none of the above

Please circle a number along the scale to indicate how you feel about the following statements.

35. On each scale:
- 1 means you **STRONGLY AGREE**
- 3 means you are **UNCERTAIN**
- 5 means you **STRONGLY DISAGREE**
- (a) Asthma attacks can be prevented:
- 1 2 3 4 5

- (b) Asthma medications should be used regularly for the best results:
1 2 3 4 5
- (c) Asthma medications are addictive if they are used all the time:
1 2 3 4 5
- (d) The use of asthma medications every day should be discouraged if the child with asthma does not have any symptoms:
1 2 3 4 5
- (e) Children who get asthma when running should be encouraged to play quiet games:
1 2 3 4 5
- (f) It is easy to give an overdose of medication with asthma nebulisers:
1 2 3 4 5
- (g) Asthma medications stop being effective if they are taken regularly for long periods of time:
1 2 3 4 5
- (h) I feel that my knowledge of asthma and its management is satisfactory:
1 2 3 4 5
- (i) Parents of children with asthma are usually over-anxious about their child's asthma:
1 2 3 4 5
- (j) Children with asthma symptoms should be kept at home:
1 2 3 4 5
- (k) Inhalers (puffers) are safer than nebulisers:
1 2 3 4 5
- (l) Asthma attacks are often triggered by emotional responses:
1 2 3 4 5
- (m) Young children should be encouraged to accept responsibility for the management of their asthma, under adult supervision and guidance:
1 2 3 4 5

- (n) Children with asthma can participate in all normal childhood activities if their asthma is well managed:

1 2 3 4 5

36. Have you attended any asthma seminars/lectures, etc., in the past 12 months?

(a) Yes

Please describe

Who ran the course?

(b) No

37. Would you like to know more about asthma and its management with children?

(a) Yes

(b) No

38. If yes, what specific aspects are you interested in? (please tick)

(a) asthma and its symptoms

(b) asthma medications and treatment

(c) trigger factors of asthma

(d) asthma management plans

(e) dealing with an attack

(f) administering medications

(g) peak flow meters

(h) asthma and exercise

(i) Any other areas

Please specify:

Finally, a few questions about your household, which will be used for statistical purposes only. Of course, your responses will be treated in the strictest of confidence.

39. Which of the following best describes your living situation?

(a) yourself, spouse and child/children

(b) yourself and child/children

(c) yourself, spouse, child/children and other family members

(d) yourself, child/children and other family members

(e) yourself, child/children and other non - family members

(f) other living situation

40. For each of the adults living in your household, please give details of highest academic achievement, occupation, work status and adult's relationship to the child named at question 2.

	Highest academic achievement (e.g. junior/senior certificate, trade qualifications, diploma, degree)	Occupation	Current work status (e.g. home duties, unemployed, pensioner)	Relationship to Child
Adult 1				
Adult 2				
Adult 3				
Adult 4				

Thank you for taking the time to complete this questionnaire.

Your assistance is greatly appreciated.

Appendix N

Children's Asthma Management and Health Status Diary

Name:

Date of birth:

Current medication:

WEEK 1	SUN	MON	TUE	WED	THUR	FRI	SAT
Wheezes/coughs	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
Change in medication type or dosage. If yes, list change	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
Refused to take medication on one or more occasion	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
Phone calls to doctor related to asthma	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
Visits to doctor related to asthma	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
Emergency visit to hospital for asthma	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
Admission to hospital for asthma	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
Level of activity restriction due to asthma Rate as 1 2 3 4 5 with 1 being no restriction and 5 being confined to bed							

Comments:

.....

Medication change (please date) and provide dosage details:

.....

.....

Appendix O

Parental Asthma-Related Knowledge Questionnaire

Child's name:

Parent's name:

The following questions relate to asthma and its management. Please circle the correct response. You may circle more than one correct response.

1. What is asthma?
 - (a) a spasm of the muscle in the wall of the airways
 - (b) inflammation and swelling of the lining in the airways
 - (c) excessive mucus secretion in the airways
 - (d) sensitive/reactive airways
 - (e) all of the above
 - (f) none of the above
2. What are the most obvious features associated with asthma?
 - (a) bouts of coughing
 - (b) wheezing
 - (c) breathlessness
 - (d) gasping for air
 - (e) all of the above
 - (f) none of the above
3. Which of the following is likely to trigger an asthma attack in asthmatic children?
 - (a) sudden changes in temperature
 - (b) too much medication
 - (c) dust and pollen
 - (d) parental anxiety about the child's health
 - (e) all of the above
 - (f) none of the above

4. Are you aware of what triggers your child's asthma attacks?
 - (a) yes
 - (b) no (go to question 22)Please list your child's asthma triggers:
.....
.....
.....
5. When children with asthma use a nebuliser, do they need to breathe?
 - (a) quickly
 - (b) very quickly
 - (c) normally
 - (d) slowly
 - (e) very slowly
6. Which of the following can children do when they use a nebuliser?
 - (a) look at a book
 - (b) only sit quietly
 - (c) draw
 - (d) sleep
 - (e) jump up and down
7. Which of the following would describe how you would feel if you needed to use a nebuliser to take asthma medication?
 - (a) frightened
 - (b) okay
 - (c) sad
 - (d) stressed
 - (e) other
8. Which of the following needs to be completed before dispensing medication from a puffer into a spacer?
 - (a) shake puffer
 - (b) wash puffer
 - (c) turn puffer upside down
 - (d) none of the above
 - (e) all of the above

9. What do children with asthma need to do after taking asthma medication?
- (a) go to sleep
 - (b) eat lunch
 - (c) brush their teeth
 - (d) play
 - (e) all of the above
 - (f) none of the above

Please circle a number along the scale to indicate how you feel about the following statements.

10. On each scale:

1 means you **STRONGLY AGREE**

3 means you are **UNCERTAIN**

5 means you **STRONGLY DISAGREE**

- (a) Asthma attacks can be prevented:

1 2 3 4 5

- (b) Asthma medications should be used regularly for the best results:

1 2 3 4 5

- (c) Asthma medications are addictive if they are used all the time:

1 2 3 4 5

- (d) The use of asthma medications every day should be discouraged if the child with asthma does not have any symptoms:

1 2 3 4 5

- (e) Children who get asthma when running should be encouraged to play quiet games:

1 2 3 4 5

- (f) It is easy to give an overdose of medication with asthma nebulisers:

1 2 3 4 5

- (g) Asthma medications stop being effective if they are taken regularly for long periods of time:

1 2 3 4 5

- (h) I feel that my knowledge of asthma and its management is satisfactory:
1 2 3 4 5
- (i) Parents of children with asthma are usually over-anxious about their child's asthma:
1 2 3 4 5
- (j) Children with asthma symptoms should be kept at home:
1 2 3 4 5
- (k) Inhalers (puffers) as safer than nebulisers:
1 2 3 4 5
- (l) Asthma attacks are often triggered by emotional responses:
1 2 3 4 5
- (m) Young children should be encouraged to accept responsibility for the management of their asthma, under adult supervision and guidance:
1 2 3 4 5
- (n) Children with asthma can participate in all normal childhood activities if their asthma is well managed:
1 2 3 4 5

11. Have you attended any asthma seminars/lectures, etc., in the past 12 months?

(a) Yes

Please describe

Who ran the course?

(b) No

Thank you for taking the time to complete this questionnaire.

Your assistance is greatly appreciated.

Appendix P

Children's Asthma Education Resource Use Questionnaire

Child's name:

Parent's name:

The following questions relate to asthma and its management. Please circle the correct response. You may circle more than one correct response.

1. What is asthma?
 - (c) a spasm of the muscle in the wall of the airways
 - (d) inflammation and swelling of the lining in the airways
 - (e) excessive mucus secretion in the airways
 - (f) sensitive/reactive airways
 - (g) all of the above
 - (h) none of the above
12. What are the most obvious features associated with asthma?
 - (a) bouts of coughing
 - (b) wheezing
 - (c) breathlessness
 - (d) gasping for air
 - (e) all of the above
 - (f) none of the above
13. Which of the following is likely to trigger an asthma attack in asthmatic children?
 - (a) sudden changes in temperature
 - (b) too much medication
 - (c) dust and pollen
 - (d) parental anxiety about child's health
 - (e) all of the above
 - (f) none of the above

14. Are you aware of what triggers your child's asthma attacks?
- (a) yes
 - (b) no (go to question 22)
- Please list your child's asthma triggers:
-
-
-
15. When children with asthma use a nebuliser, do they need to breathe?
- (a) quickly
 - (b) very quickly
 - (c) normally
 - (d) slowly
 - (e) very slowly
16. Which of the following can children do when they use a nebuliser?
- (a) look at a book
 - (b) only sit quietly
 - (c) draw
 - (d) sleep
 - (e) jump up and down
17. Which of the following would describe how you would feel if you needed to use a nebuliser to take asthma medication?
- (a) frightened
 - (b) okay
 - (c) sad
 - (d) stressed
 - (e) other
18. Which of the following needs to be completed before dispensing medication from a puffer into a spacer?
- (a) shake puffer
 - (b) wash puffer
 - (c) turn puffer upside down
 - (d) none of the above
 - (e) all of the above

19. What do children with asthma need to do after taking asthma medication?

- (a) go to sleep
- (b) eat lunch
- (c) brush their teeth
- (d) play
- (e) all of the above
- (f) none of the above

Please circle a number along the scale to indicate how you feel about the following statements.

20. On each scale:

1 means you **STRONGLY AGREE**

3 means you are **UNCERTAIN**

5 means you **STRONGLY DISAGREE**

(a) Asthma attacks can be prevented:

1 2 3 4 5

(b) Asthma medications should be used regularly for the best results:

1 2 3 4 5

(c) Asthma medications are addictive if they are used all the time:

1 2 3 4 5

(d) The use of asthma medications every day should be discouraged if the child with asthma does not have any symptoms:

1 2 3 4 5

(e) Children who get asthma when running should be encouraged to play quiet games:

1 2 3 4 5

(f) It is easy to give an overdose of medication with asthma nebulisers:

1 2 3 4 5

(g) Asthma medications stop being effective if they are taken regularly for long periods of time:

1 2 3 4 5

- (h) I feel that my knowledge of asthma and its management is satisfactory:
1 2 3 4 5
- (i) Parents of children with asthma are usually over-anxious about their child's asthma:
1 2 3 4 5
- (j) Children with asthma symptoms should be kept at home:
1 2 3 4
- (k) Inhalers (puffers) are safer than nebulisers:
1 2 3 4 5
- (l) Asthma attacks are often triggered by emotional responses:
1 2 3 4 5
- (m) Young children should be encouraged to accept responsibility for the management of their asthma, under adult supervision and guidance:
1 2 3 4 5
- (n) Children with asthma can participate in all normal childhood activities if their asthma is well managed:
1 2 3 4 5

21. Have you attended any asthma seminars/lectures, etc., in the past 12 months?

(a) Yes

Please describe

Who ran the course?

(b) No

The following questions relate to the use of the Children's Asthma Education

Resources in your family.

22. Approximately how many times did your child view the following materials during the past three months:

- (a) The Adventures of Kookie and Cassie (video)
- (b) The Agro Asthma Show (video)
- (c) Young Children Managing Asthma (video)
- (d) What's That Noise? (picture book)

23. Please describe in as much detail as possible how the videos and picture book were used in your home.

.....

.....

.....

.....

24. Please rate the usefulness of the asthma education materials in increasing your own knowledge of the following aspects of asthma and management on the scale:

1 means NOT USEFUL

2 means SOME USE

3 means VERY USEFUL

- (a) Structure and function of the lungs

1 2 3

- (b) Asthma as a health condition

1 2 3

- (c) Asthma triggers

1 2 3

- (d) Purpose and function of asthma medications

1 2 3

- (e) Use of nebulisers and spacers

1 2 3

25. Please rate the usefulness of the education materials in increasing your child's knowledge of the following aspects of asthma and management on the scale:

1 means NOT USEFUL

2 means SOME USE

3 means VERY USEFUL

- (a) Structure and function of the lungs

1 2 3

(b) Asthma as a health condition

1 2 3

(c) Asthma triggers

1 2 3

(d) Purpose and function of asthma medications

1 2 3

(e) Use of nebulisers and spacers

1 2 3

26. Are there any comments you wish to make about these materials or their use with children?

.....

.....

.....

.....

Thank you for taking the time to complete this questionnaire.

Your assistance is greatly appreciated.