Telehealth Education for Pediatric Asthma Management

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She has no known conflict of interest to disclose.

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Abstract

Objectives: Asthma education is essential for every pediatric asthma management plan. This Doctor of Nursing Practice (DNP) Quality Improvement (QI) project, guided by the Social Cognitive Theory, aims to explore effective and innovative interventions for asthma management and determine if telehealth is an effective way to deliver asthma education to parents.

Methods: Parents (n = 5) of children with asthma at an urban pediatric primary care clinic were recruited to attend four weekly, 60-minute asthma education sessions over Zoom®. Participants were recruited with flyers and clinic referrals. Participants answered pre- and post-intervention online questionnaires following informed consent, including the Parental Asthma Management Self-Efficacy Scale (PAMSES), the Asthma Control Test (ACT), and a parent program evaluation. Paired sample t-tests were conducted to analyze data and measure mean differences in pre-and post-parent self-efficacy and asthma control in their child.

Results: The results include a statistically significant change in pre-intervention and post-intervention mean PAMSES scores. There was no significant difference between pre-intervention and post-intervention ACT scores; however, there was an increase in mean ACT scores from baseline.

Conclusions: Telehealth is a practical and cost-effective way to address gaps in asthma education and improve patient outcomes. The use of telehealth may be an effective way to address gaps in parent/patient education regarding the prevention of and management of asthma symptoms. Ongoing assessment is needed to evaluate if asthma telehealth education can be effective in other settings, languages, and age groups.

Keywords: pediatric asthma, telehealth education, asthma management

Telehealth Interventions for Pediatric Asthma Management

Asthma is a chronic disease of the airways involving airway inflammation and remodeling. It includes genetic and environmental elements as causative factors and affects both adults and children. Symptoms vary from person to person, and there is no cure. Shortness of breath, chest tightness, cough, and wheezing are common asthma symptoms. Asthma exacerbations are related to increased acute symptoms, decreased quality of life, and asthma fatalities (Papi et al., 2018). One strategy for reducing exacerbations and improving asthma management is through education.

Background and Significance

Problem Statement

According to the World Health Organization (WHO) (2020), more than 339 million individuals live with asthma globally. In the United States (U.S.), an estimated 6 million children are affected by asthma (Centers for Disease Control and Prevention [CDC], 2020). In Arizona, 10.9% of children under 17 years of age have asthma (American Lung Association in Arizona [ALAA], 2016). The CDC (2019) reports that 50.3% of children with asthma have uncontrolled symptoms.

While medication adherence is an effective way to prevent asthma exacerbations, the CDC (2018) reports that more than one-half of children with asthma do not regularly take their prescribed controller medication. Furthermore, asthma is the leading cause of student school absenteeism and school calls to Emergency Medical Services in Arizona (ALAA, 2016). National asthma healthcare costs are estimated to be 50.1 billion dollars (ALAA, 2016). These statistics show a high burden of disease and the high cost of poorly managed asthma globally, nationally, and in Arizona.

Purpose and Rationale

To address the asthma burden nationally, the Department of Health and Human Services (HHS) lists reducing asthma attacks, emergency department visits, hospitalizations, and asthma deaths as objectives in Healthy People 2030; Strategies for reaching these objectives include patient and caregiver education on asthma management and medications (Office of Disease Prevention and Health Promotion [ODPHP], 2020). Similarly, the CDC's National Asthma Control Program (NACP) includes asthma self-management as one of six strategies recommended for decreasing the national asthma burden (CDC, 2020). The Arizona Health Improvement Plan drafted by The Arizona Department of Health Services (AZDHS) includes improving disease self-management as a strategy for improving the health of those living with respiratory conditions (ALAA, 2016). These national and state objectives underscore the importance of asthma management, which is reached through effective asthma education. This QI DNP project aims to explore using telehealth as an innovative intervention for asthma management in a primary care setting by evaluating the integration of telehealth to provide effective asthma education to parents at the project site.

Pediatric Asthma

Children with asthma miss 2.48 more days of school each year compared to their peers without asthma (ALAA, 2016). Furthermore, exacerbations can lead to airway remodeling and long-term poor health outcomes with poorly controlled asthma (Papi et al., 2018). Comprehensive asthma management aims to improve quality of life by reducing asthma symptoms (National Heart, Lung, and Blood Institute [NHLBI], 2007). This evidence suggests that pediatric asthma be managed holistically because asthma can impact various aspects of patients’ and families' lives.

Asthma Education and Telehealth Asthma Education

Telehealth interventions can improve disease management in pediatric patients with asthma. For example, in a randomized control trial, Kosse et al. (2019) tested a mobile health (mHealth) asthma intervention to increase medication adherence in adolescents with poor adherence. The researchers found the intervention improved participant medication adherence (Kosse et al., 2019). In a separate school-based study, inner-city youth improved asthma management after participating in an asthma telehealth education program (Lin et al., 2020). Just as important, studies such as these demonstrate the potential for reaching underserved communities and impacting health inequities through telehealth technology (Blakey et al., 2018).

Standard Education

Patients and caregivers are managing asthma based on guidelines and recommendations shared with them by healthcare providers. The Global Initiative for Asthma (GINA) and the National Asthma Education and Prevention Program (NAEPP) provides expert and evidence-based asthma management guidelines. The NAEPP guidelines are widely used in primary and specialty care to manage asthma. The successful implementation of these guidelines is influenced by patient/caregiver teaching and provider recommendations (Papi et al., 2018). The NAEPP guidelines have recently been updated to reflect the most current recommendations (Cloutier et al., 2020). Both expert groups recommend effective patient and caregiver teaching for optimal health outcomes (Cloutier et al., 2020; GINA, 2020; NHLBI, 2007).

Improved Asthma Management and Medication Adherence

A systematic review found that knowledge gaps regarding asthma management are related to poor medication adherence in pediatric patients (Gray et al., 2018). A randomized control trial by Koumpagioti et al. (2019) found similar results as participants demonstrated increased medication adherence after participating in an asthma education program. A systematic review evaluating pediatric inhaler techniques found that medication delivery improved with education interventions (Gillette et al., 2016). Of note, Gillette et al. (2016) found the education's effectiveness was not changed by mode of delivery, setting, or facilitator, even when delivered online. Exploring effective and innovative ways to provide asthma education can improve asthma management and medication adherence and reduce the asthma burden in pediatric patients with asthma.

Internal Evidence and PICOT Question

In a large pediatric primary care clinic in urban Phoenix, AZ, pediatric patients with asthma are seen and managed by the primary care provider. Only patients with difficult to control asthma are referred to a pediatric pulmonologist for care. The primary care provider delivers asthma education during the scheduled clinic visit. No formal, uniform, or telehealth asthma education is provided.

This inquiry has led to the relevant PICOT question, In pediatric patients with asthma receiving care in an urban primary care practice (P), how does telehealth asthma education (I) compared to standard care (C) impact asthma management and medication adherence (O) over six months (T)?

Evidence Synthesis

Search Strategy

To answer the PICOT question, PsycINFO, PubMed, Cumulative Index of Nursing and Allied Health Literature (CINAHL), and The Cochrane Library were extensively searched. These databases were chosen based on their relevance to the medical field, research focus, and peer-reviewed content.

Keywords

Based on the PICOT question, combinations of the following keywords were included in the database searches: *pediatric asthma, child, children or adolescent, asthma education, telehealth, telemedicine, telehealthcare, virtual health, eHealth, asthma management, asthma medication adherence*.

Inclusion Criteria, Exclusion Criteria, and Limitations

Inclusion criteria included grey literature and studies published in the last five years, from multiple countries, in English, and relevant to pediatric asthma. MeSH and Boolean terms were used to broaden the search. Opinion articles, articles not published in English, studies greater than five years old, and studies that were not primary research were excluded.

The initial PubMed search included key terms *pediatric asthma, children with asthma, telehealth, eHealth, virtual health, telemedicine, asthma education, asthma management*, and *asthma medication adherence* yielded 2,944 results. Search limit key terms included *pediatric, asthma education, telehealth*, OR *telemedicine, and asthma management,* which produced 39 results.

The PyscINFO initial search included key terms *pediatric asthma, telehealth, telemedicine, asthma management,* and *asthma education*, yielding one result. The search terms were broadened to *pediatric asthma, asthma education, asthma management, and asthma medication adherence,* which produced 17 results.

The initial CINAHL search included key terms of *pediatric, child or children or adolescent, telehealth,* OR *telemedicine*, and *asthma education* and yielded 16 results. A second search included key terms *pediatric*, or *child* or *children* or *adolescent*, *asthma management, medication adherence*, and *telehealth* OR *telemedicine,* which yielded seven results.

The initial Cochrane Library search terms included *pediatric asthma, telehealth, medication adherence*, and *asthma management*, which yielded 3,933 results. Limiting search terms included *pediatric asthma, asthma education, medication adherence, telehealth, telehealthcare* OR *telemedicine* and yielded 18 results.

Critical Appraisal & Synthesis

The exhaustive search of all four databases yielded a total of 81 results. Rapid critical appraisal checklists were used to narrow the article pool to the most relevant articles, which are included in evaluation and synthesis tables (see Appendix A, Table A1). The synthesis table illustrates the differences and commonalities between the selected studies (see Appendix A, Table A2). Following the rapid critical appraisal process, ten studies were selected to be included in the review. All the studies provide level II quantitative data. All the studies included were randomized controlled trials selected for their higher level of evidence and relevance to the PICOT question. Most of the studies were completed in the U.S. and explicitly described randomization, although not all studies were double-blinded.

Regarding study demographics, a high degree of homogeneity is present among the studies chosen for critical appraisal. Specifically, 3,435 participants were included in the studies, with a mean age of 13.5 years (Bender et al., 2015; Halterman et al., 2018; Johnson et al., 2015; Kolmodin MacDonell et al., 2016; Kosse et al., 2019; Koufopoulos et al., 2016; Koumpagioti et al., 2019; Lin et al., 2020; Lv et al., 2019; Perry et al., 2018). Outlier studies include one study with 1756 participants and a small study with a sample size of 21 (Bender et al., 2015; Lin et al., 2020). Almost all the studies included a cell phone application or texting system component (Bender et al., 2015; Johnson et al., 2015; Kolmodin MacDonell et al., 2016; Kosse et al., 2019; Koufopoulos et al., 2016; Lv et al., 2019). The most common outcomes measured were medication adherence and asthma control (Bender et al., 2015; Johnson et al., 2015; Kolmodin MacDonell et al., 2016; Kosse et al., 2019; Koufopoulos et al., 2016; Koumpagioti et al., 2019; Lin et al., 2020; Lv et al., 2019; Perry et al., 2018). Outcomes were most commonly measured with validated questionnaires before and after the interventions. The most common interventions included telehealth education programs in the school or outpatient setting (Koufopoulos et al., 2016; Koumpagioti et al., 2019; Perry et al., 2018), or cell phone applications, and texting (Bender et al., 2015; Johnson et al., 2015; Kolmodin MacDonell et al., 2016; Kosse et al., 2019; Koufopoulos et al., 2016; Lv et al., 2019). All ten studies used heterogenous validated measurement instruments to measure outcomes. These instruments included questionnaires, interviews, and pharmacy and medical records.

Evidence Synthesis

The synthesis of the study findings illustrates the ease of implementing telehealth interventions because most patients and caregivers have access to cell phones. Multiple studies reported improved access to patients with asthma that might not otherwise access care. Some challenges exist; set-up, technology literacy, and technological difficulties were cited as barriers to using telehealth. The evidence underscores the importance of including a multifaceted approach to asthma management. One-time, brief virtual interactions that lacked patient interaction were not enough to impact outcomes. Multiple, interactive contacts were the most successful in eliciting a behavioral change in participants. Providers and staff can facilitate these positive outcomes by integrating a formalized telehealth education program in the clinic setting.

Implementation Framework

The Rosswurm and Larrabee (1999) A Model for Change to Evidence-Based Practice includes six steps that have guided the implementation of this project and plans for long-term sustainability (see Appendix B, Figure B1). The steps of this model include assessing the need for change, linking problems with interventions and outcomes, synthesizing the evidence, designing practice change, implementing and evaluating, and lastly, integrating and maintaining the change. This model is instrumental in guiding the application of the DNP project and was chosen as the steps of the model are congruent with the intended sequence of the evidence-based practice change.

The first step is assessing the need for change in asthma management. A systematic review found that knowledge gaps regarding asthma management are related to poor medication adherence in pediatric patients (Gray et al., 2018). Another systematic review evaluating inhaler techniques found that medication delivery improved with education interventions (Gillette et al., 2016). The second step of the model, linking problems to support a practice change, was completed through the initial literature review.

The pandemic increasingly forced providers to quickly consider virtual means of healthcare delivery. Synthesizing the best evidence relevant to telehealth and chronic disease management fulfilled the third step of the model addressed through this DNP project. This step, synthesizing the best evidence, is essential to improving and ensuring the effectiveness of telehealth interventions. The current literature review supports effective and innovative ways to deliver asthma education.

The available evidence influenced step four, designing the intervention to reflect the evidence. Step five includes the implementation and evaluation of the intervention. Implementation took place through the project site. Pre- and post-data was collected, and in-depth statistical analysis was used to evaluate the project. Finally, integration and sustainability of the practice change is the final step. Integration and sustainability were achieved by creating a culture that supports patient education.

Theoretical Framework

Social Cognitive Theory describes transforming knowledge into optimal health promotion and practices (Bandura, 1986) (See Appendix B, Figure B2). Albert Bandura's theory explains the interrelationship between personal, environmental, and behavioral factors to impact individual health outcomes. Personal factors are further described as knowledge, goals, and self-efficacy (Bandura, 1986). When the dynamics between personal, environmental, and behavioral factors interact, better health is achieved as health goals align with increased self-efficacy and health knowledge (Bandura, 2004).

Social Cognitive Theory appropriately frames this telehealth asthma education intervention. The personal domain is influenced by increasing parent knowledge about health promotion benefits and perceived self-efficacy. The environment domain includes the project site and the project facilitator as positive influences on parent intrapersonal perceptions about reaching health goals. Finally, consistent with the framework, the behavior domain is affected as increased parent knowledge, and self-efficacy can result in behavior changes that improve their child's asthma control. Improved asthma control motivates healthcare providers to continue this positive interchange with parents leading to improved health outcomes.

Project Methods

Ethical Considerations

Ethical principles are incorporated into this project by ensuring an ethical study design. This includes obtaining Arizona State University (ASU) Institutional Review Board (IRB) approval (See Appendix C) and facilitator completion of the Collaborative Institutional Training

Initiative (CITI) training. Also, permission to implement the DNP project has been granted by the project site (See Appendix D). The study design includes full disclosure of the rights and risks of participation and full written disclosure regarding the voluntary nature of participation. Written disclosures and informed consent were disseminated and collected, and unique participant identifications were assigned to protect participant privacy.

Population and Setting

This project was implemented in a primary care clinic in Phoenix, AZ. The clinic serves patients throughout their lifespan, with several locations throughout the city specializing in pediatrics. Currently, primary care providers at the DNP project site give brief asthma education to patients and their parents during scheduled appointments. However, no formal, uniform, or telehealth asthma education is provided at the clinics. Parents of pediatric clinic patients with asthma were invited to participate in the project.

Participants and Recruitment

The parent recruitment process included flyers and clinic referrals by Ms. Josefina Castelo, FNP, to recruit parents of pediatric patients with asthma. The flyer was posted in the clinic for families to see and potentially self-recruit. Recruitment flyers were also given to potential families during clinic visits when staff or providers identified a family who may be eligible for the program. Eligible families were also contacted by telephone by the project facilitator.

Potential participants were directed to the project facilitator to communicate interest after seeing the email on the flyer. After answering inclusion/exclusion criteria questions, potential participants received an email from the project facilitator directing them to a Survey Monkey questionnaire. Project details were again provided through the same Survey Monkey questionnaire. The project risks and benefits were detailed, and those interested in participating provided consent by continuing with the Survey Monkey questionnaire. This same tool collected demographic information and asthma management history.

As this was a pediatric telehealth intervention, the following inclusion and exclusion criteria were applied. Inclusion criteria included parents of pediatric patients with asthma, an asthma diagnosis in a child or adolescent, being a clinic patient, and the ability to access the internet and speak English or Spanish. If a potential parent participant is under 18 years, consent can be given by a guardian. Exclusion criteria included: patients outside of the intended child's age range, parents of children who do not have asthma, do not speak English or Spanish, do not have access to the internet, and cannot give consent.

Project Description

The selection of the NHLBI's *A Breath of Life* education materials was chosen for this DNP project due to their effectiveness, delivery type, target audience, cost, and the availability in English and Spanish. The target audience for *A Breath of Life* are parents of children with asthma or community health workers interested in teaching asthma education to parents in their community (NHLBI, 2014). The educational materials are available in English and Spanish and are free of cost when requested through the NHLBI. Consistent with the evidence synthesis, this asthma education curriculum engages the parent and includes multiple interactive sessions that can be adapted to telehealth technology.

Parents participated in four 60-minute asthma education sessions. All sessions took place between Fall 2021 and Spring 2022. The sessions reviewed general asthma pathophysiology and common asthma triggers, typical asthma medications, the importance of the asthma action plan, responding to asthma exacerbations, and how to control asthma. All sessions were delivered live over Zoom®, allowing for dialogue between the facilitator and participant. The NHLBI educational materials were made available to participants by the project facilitator. All telehealth Zoom® visits were scheduled by email or phone call between facilitator and participant. This project sequence allowed for pre-and post-intervention data collection, program facilitation, and ample time for parent engagement.

Data Collection and Analysis

The goal of the telehealth asthma education intervention was to increase parent self-efficacy to manage asthma and improve their child's asthma control. Measurable outcomes were evaluated using pre- and post- surveys scored on a 5-point Likert scale. Each participant chose a unique identification number when completing the surveys. Identifying and personal information was not requested, used, or stored. Participants were invited to answer pre- and post-education surveys before and after the intervention. The data was then stored on an Excel file on the project facilitator's personal password-protected computer and imported to Intellectus® for data analysis.

Instrumentation

Outcome measurements include pre-and post-intervention parent self-efficacy, child asthma control, and a post-project evaluation. The Parental Asthma Management Self-Efficacy Scale (PAMSES) has been found to be valid and reliable. This scale was used to measure parental self-efficacy before and after the asthma education intervention (See Appendix E, Figure E1). The PAMSES has a Cronbach's alpha of 0.87 in past research, indicating strong internal consistency and reliability (Bursch et al., 1999). The Asthma Control Test (ACT) is a questionnaire assessing asthma control (See Appendix E, Figure E2). The validity and reliability of the ACT are substantiated and has a reported Cronbach's alpha of 0.84 in past research; this test is widely used to assess asthma control in patients with asthma (Nathan et al., 2004). The project facilitator administered the ACT and PAMSES before the first and after the last telehealth visit. Paired sample t-tests were conducted to measure the mean differences between pre-and post-intervention scores. The post-project evaluation was administered by the project facilitator after the last telehealth session with parents.

Budget

The budget for the DNP project is $410. The economic analysis related to telehealth asthma education must factor in the overall benefit versus the cost of running the proposed DNP project (Reavy, 2016). The project site has eight clinic locations, and the budget cost (See Appendix F) can be split between the clinic locations utilizing the service. Based on a cost-utility analysis, the telehealth asthma education program represents a much lower overall cost when considering the increased quality of life and improved health associated with the positive effects of the intervention. In addition, the savings to the healthcare system would be positively impacted (Reavy, 2016).

Results

Demographics

A total of 8 parents were enrolled in the program. Five parents (n=5) completed the program and provided PAMSES and ACT scores (62%). The average age of their children with asthma was 9.20 years of age (SD = 2.95) and ranged from 4 to 11 years. The summary statistics can be found in Table 1.

Of the five parents completing the program, the most frequently observed gender in the participants' children with asthma was female (n= 3, 60%), followed by male (n= 2, 40%). The summary statistics are found in Table 2.

Table 1

Summary Statistics Table for ACT Age Variables

Variable	*M*	*SD*	*n*	SE_M	Min	Max	Skewness	Kurtosis
Age	9.20	2.95	5	1.32	4.00	11.00	-1.39	0.11

Note. '-' indicates the statistic is undefined due to constant data or an insufficient sample size.

Table 2

Frequency Table for ACT Gender Variables

Variable	*n*	%
Gender		
Male	2	40.00
Female	3	60.00
Missing	0	0.00

Note. Due to rounding errors, percentages may not equal 100%.

The telehealth educational sessions were offered in English and Spanish. The most frequently observed language spoken during the educational sessions was English, 40% (n=2), followed by Bilingual, 40% (n=2), and Spanish, 20% (n=1). The summary statistics for language frequency are found in Table 3.

Table 3

Frequency Table for Language Used During Intervention

Variable	*n*	%
Language		
English	2	40.00
Bilingual	2	40.00
Spanish	1	20.00
Missing	0	0.00

Note. Due to rounding errors, percentages may not equal 100%.

PAMSES

A paired *t*-test was calculated to examine PAMSES scores before and after the intervention. There were mean improvements in pre- and post-intervention PAMSES mean scores for parents, 45.20 (SD = 11.86) and 61.60 (SD = 4.45) respectively. The result of the two-tailed paired samples *t*-test was significant, *t*(4) = -2.90, *p* = .044. The summary statistics are found in Table 4.

Table 4

Two-Tailed Paired Samples t-Test for the Difference Between Pre- and Post-intervention PAMSES Variables in Parent Participants

Pretest		Post test				
M	*SD*	*M*	*SD*	*t*	*p*	*d*
45.20	11.86	61.60	4.45	-2.90	.044	1.30

Note. N = 5. Degrees of Freedom for the *t*-statistic = 4. *d* represents Cohen's *d.*

ACT

A paired t-test was calculated to examine ACT scores before and after the intervention. There were mean improvements in pre-and post ACT mean scores for the children of parent participants, 20.40 (SD = 1.67) and 22.20 (SD = 1.64), respectively. The change was not statistically significant *t*(4) = -2.45, *p* = .070; however, the positive mean change on this variable and the Cohen's effect size value (*d* = 1.10) suggests a large clinical significance. The summary statistics are found in Table 5.

Table 5

Two-Tailed Paired Samples t-Test for the Difference Between Pre- and Post-Intervention ACT Variables in Participants' Children

Pre-ACT		Post-ACT				
M	*SD*	*M*	*SD*	*t*	*p*	*d*
20.40	1.67	22.20	1.64	-2.45	.070	1.10

Note. N = 5. Degrees of Freedom for the *t*-statistic = 4. *d* represents Cohen's *d.*

Program Evaluation

Of the 5 participants who completed the program evaluation, 4 (80%) indicated that the education sessions, handouts, and picture cards/slides were excellent, 2 (40%) participants indicated learning something new about asthma and about asthma medications, and 1(20%) participant indicated enjoying the program online but would prefer to meet in person instead of through telehealth.

Project Impact

The outcomes from the DNP project will impact patients, parents, providers, and systems. Parents will have the knowledge and improved self-efficacy to manage their child's asthma. This increased self-efficacy can improve asthma control in their child, reflected in improved ACT scores. The clinically significant PAMSES mean scores and the positive impact on the ACT scores can help garner support from providers at the clinic level and provide the data necessary to justify the implementation and sustainability of this intervention at the systems level.

This DNP project can contribute to the ongoing evaluation of effective asthma management interventions at the policy level. Collectively, the clinical significance of these interventions can lead to increased health policy advocacy making telehealth asthma education a standard, fully reimbursable service for pediatric patients with asthma. A longer project duration can help collect data regarding hospitalizations, school absenteeism, and calls to EMS from schools, further supporting the need for additional resources and staff specializing in patient education.

Sustainability

Motivation to sustain an asthma education program can be encouraged by providing staff and provider training to discuss the connection between improved health outcomes and patient education. Informational sessions can be integrated into staff meetings by the project facilitator or site champion. Provider feedback will help draft a clinic protocol for referring all asthma patients to an asthma educator after completing an asthma action plan with them. Documenting this referral in the electronic health record will be essential to sustainability as this can also help cover the cost of patient education.

Discussion

Strengths and Limitations

The telehealth provider/patient encounter format facilitated meetings with parents. Parents found the sessions easy to attend as they were not required to travel or make complicated family arrangements to attend. Having the sessions over Zoom® also allowed for more scheduling options to meet the needs of the families. Early, late or weekend appointments were easy to accommodate using the telehealth office visit format. The live sessions also provided the opportunity for families to build a rapport with the project facilitator as opposed to simply watching a prerecorded video. Providing the sessions in English and Spanish helped make the program available to some families who might not have participated.

Challenges included participant time constraints. Despite the observed change in PAMSES mean scores and the ease of using telehealth, participants' busy lives made it difficult for some parents to participate. Also, the short duration of the DNP project limited long-term data collection. Evidence demonstrates health outcomes are improved when knowledge gaps are addressed with effective asthma education (Gillette et al., 2016; Gray et al., 2018; Koumpagioti et al., 2019). While the intervention positively impacted the ACT scores, a longer project duration could help inform the efficacy of other outcomes, such as hospitalizations and school absences, as asthma is the leading cause of school absences and EMS calls (ALAA, 2016).

Recommendations

Asthma is a chronic disease requiring a multifaceted approach to symptom management. Various factors contribute to the success and challenges related to effective asthma control. Asthma education has shown to be an essential component of disease management (Papi et al., 2018). Implementing innovative asthma education interventions in the primary care setting will help support effective asthma management. Formalized asthma education can be easily facilitated over telehealth. The need for effective asthma management education is compelling researchers to continue evaluating if telehealth can be an effective intervention for asthma education, specifically in their population and setting. Telehealth interventions are versatile, and providers can easily adapt interventions to meet the needs of the target population. Future recommendations include longer project duration, inclusions of larger sample sizes, and further implementation evaluation using the Spanish language materials from NHLBI.

Conclusion

Telehealth asthma education can effectively improve parents' self-efficacy to manage asthma and improve their child's asthma control. Multiple, interactive contacts are the most successful in eliciting a behavioral change in participants. A telehealth asthma education intervention was implemented in a primary care setting to explore the impact of telehealth asthma education at the project site. Results indicate increased parent self-efficacy to manage their child's asthma and improved pediatric asthma control. Addressing asthma education requires innovative interventions from providers and healthcare systems. The implementation of this QI DNP project shows telehealth is an effective and sustainable way to provide asthma education in this primary care setting. Telehealth is an innovative intervention for pediatric asthma management and provides a new, effective, and sustainable opportunity for addressing gaps in patient education and access to care.

References

American Lung Association in Arizona. (2016). *The 2016 Arizona asthma burden report* [PDF]. https://www.azdhs.gov/documents/prevention/tobacco-chronic-disease/az-asthma-burden-report.pdf

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory* (1st ed.). Prentice Hall.

Bandura, A. (2004). Health promotion by social cognitive means. *Health Education & Behavior*, *31*(2), 143–164. https://doi.org/10.1177/1090198104263660

Bender, B. G., Cvietusa, P. J., Goodrich, G. K., Lowe, R., Nuanes, H. A., Rand, C., Shetterly, S., Tacinas, C., Vollmer, W. M., Wagner, N., Wamboldt, F. S., Xu, S., & Magid, D. J. (2015). Pragmatic trial of health care technologies to improve adherence to pediatric asthma treatment. *JAMA Pediatrics*, *169*(4), 317. https://doi.org/10.1001/jamapediatrics.2014.3280

Blakey, J. D., Bender, B. G., Dima, A. L., Weinman, J., Safioti, G., & Costello, R. W. (2018). Digital technologies and adherence in respiratory diseases: The road ahead. *European Respiratory Journal*, *52*(5), 1801147. https://doi.org/10.1183/13993003.01147-2018

Bursch, B., Schwankovsky, L., Gilbert, J., & Zeiger, R. (1999). Construction and validation of four childhood asthma self-management scales: Parent barriers, child and parent self-efficacy, and parent belief in treatment efficacy. *Journal of Asthma*, *36*(1), 115–128. https://doi.org/10.3109/02770909909065155

Centers for Disease Control and Prevention. (2018, November 13). *Asthma in children*. Centers for Disease Control and Prevention, Vital Signs. Retrieved February 11, 2021, from https://www.cdc.gov/vitalsigns/childhood-asthma/index.html

Centers for Disease Control and Prevention. (2019, July 3). *Asthma stats: Uncontrolled asthma among children, 2012–2014*. AsthmaStats. https://www.cdc.gov/asthma/asthma_stats/uncontrolled-asthma-children.htm

Centers for Disease Control and Prevention. (2020a, October 28). *Most recent national asthma data*. Retrieved February 8, 2021, from https://www.cdc.gov/asthma/most_recent_national_asthma_data.htm

Centers for Disease Control and Prevention. (2020b, December 2). *Exhale*. National Asthma Control Program. Retrieved February 10, 2021, from https://www.cdc.gov/asthma/exhale/index.htm

Cloutier, M. M., Baptist, A. P., Blake, K. V., Brooks, E. G., Bryant-Stephens, T., DiMango, E., Dixon, A. E., Elward, K. S., Hartert, T., Krishnan, J. A., Lemanske, R. F., Ouellette, D. R., Pace, W. D., Schatz, M., Skolnik, N. S., Stout, J. W., Teach, S. J., Umscheid, C. A., & Walsh, C. G. (2020). 2020 focused updates to the asthma management guidelines: A report from the national asthma education and prevention program coordinating committee expert panel working group. *Journal of Allergy and Clinical Immunology*, *146*(6), 1217–1270. https://doi.org/10.1016/j.jaci.2020.10.003

Gillette, C., Rockich-Winston, N., Kuhn, J. A., Flesher, S., & Shepherd, M. (2016). Inhaler technique in children with asthma: A systematic review. *Academic Pediatrics*, *16*(7), 605–615. https://doi.org/10.1016/j.acap.2016.04.006

Global Initiative for Asthma. (2020). *Global strategy for asthma management and prevention, 2020* [Report]. www.ginasthma.org

Gray, W. N., Netz, M., McConville, A., Fedele, D., Wagoner, S. T., & Schaefer, M. R. (2018). Medication adherence in pediatric asthma: A systematic review of the literature. *Pediatric Pulmonology*, *53*(5), 668–684. https://doi.org/10.1002/ppul.23966

Halterman, J. S., Fagnano, M., Tajon, R. S., Tremblay, P., Wang, H., Butz, A., Perry, T. T., & McConnochie, K. M. (2018). Effect of the school-based telemedicine enhanced asthma management (sb-team) program on asthma morbidity. *JAMA Pediatrics*, *172*(3), e174938. https://doi.org/10.1001/jamapediatrics.2017.4938

Johnson, K. B., Patterson, B. L., Ho, Y.-X., Chen, Q., Nian, H., Davison, C. L., Slagle, J., & Mulvaney, S. A. (2015). The feasibility of text reminders to improve medication adherence in adolescents with asthma. *Journal of the American Medical Informatics Association*, *23*(3), 449–455. https://doi.org/10.1093/jamia/ocv158

Kolmodin MacDonell, K., Naar, S., Gibson-Scipio, W., Lam, P., & Secord, E. (2016). The Detroit young adult asthma project: Pilot of a technology-based medication adherence intervention for African-American emerging adults. *Journal of Adolescent Health*, *59*(4), 465–471. https://doi.org/10.1016/j.jadohealth.2016.05.016

Kosse, R. C., Bouvy, M. L., de Vries, T. W., & Koster, E. S. (2019). Effect of a mhealth intervention on adherence in adolescents with asthma: A randomized controlled trial. *Respiratory Medicine*, *149*, 45–51. https://doi.org/10.1016/j.rmed.2019.02.009

Koufopoulos, J. T., Conner, M. T., Gardner, P. H., & Kellar, I. (2016). A web-based and mobile health social support intervention to promote adherence to inhaled asthma medications: Randomized controlled trial. *Journal of Medical Internet Research*, *18*(6), e122. https://doi.org/10.2196/jmir.4963

Koumpagioti, D., Boutopoulou, B., Priftis, K. N., & Douros, K. (2019). Effectiveness of an educational program for children and their families on asthma control treatment adherence. *Journal of Asthma*, *57*(5), 567–573. https://doi.org/10.1080/02770903.2019.1585873

Larrabee, J. H. (2008). *Nurse to nurse evidence-based practice* (1st ed.). McGraw-Hill Professional. https://doi.org/10.1036/0071493727

Leas, B. F., Tipton, K., Bryant-Stephens, T., Jackson-Ware, M., Mull, N., & Tsou, A. Y. (2020, April). *Characteristics of existing asthma self-management education packages. Technical Brief No. 35*. ECRI Institute- Penn Medicine Evidence-based Practice Center. https://effectivehealthcare.ahrq.gov/products/asthma-education/technical-brief

Lin, N. Y., Ramsey, R. R., Miller, J. L., McDowell, K. M., Zhang, N., Hommel, K., & Guilbert, T. W. (2020). Telehealth delivery of adherence and medication management system improves outcomes in inner-city children with asthma. *Pediatric Pulmonology*, *55*(4), 858–865. https://doi.org/10.1002/ppul.24623

Lv, S., Ye, X., Wang, Z., Xia, W., Qi, Y., Wang, W., Chen, Y., Cai, X., & Qian, X. (2019). A randomized controlled trial of a mobile application-assisted nurse-led model used to improve treatment outcomes in children with asthma. *Journal of Advanced Nursing*, *75*(11), 3058–3067. https://doi.org/10.1111/jan.14143

Nathan, R. A., Sorkness, C. A., Kosinski, M., Schatz, M., Li, J. T., Marcus, P., Murray, J. J., & Pendergraft, T. B. (2004). Development of the asthma control test. A survey for assessing asthma control. *Journal of Allergy and Clinical Immunology*, *113*(1), 59–65. https://doi.org/10.1016/j.jaci.2003.09.008

National Heart, Lung, and Blood Institute. (2007). *National asthma education and prevention program. Expert panel report 3: Guidelines for the diagnosis and management of asthma. Summary report 2007* [Report]. www.nhlbi.nih.gov/health-topics/guidelines-for-diagnosis-management-of-asthma

Office of Disease Prevention and Health Promotion. (2020). *Respiratory disease. Healthy people 2030*. Department of Health and Human Services. https://health.gov/healthypeople/objectives-and-data/browse-objectives/respiratory-disease

Papi, A., Brightling, C., Pedersen, S. E., & Reddel, H. K. (2018). Asthma. *The Lancet*, *391*(10122), 783–800. https://doi.org/10.1016/s0140-6736(17)33311-1

Perry, T. T., Halterman, J. S., Brown, R. H., Luo, C., Randle, S. M., Hunter, C. R., & Rettiganti, M. (2018). Results of an asthma education program delivered via telemedicine in rural schools. *Annals of Allergy, Asthma & Immunology*, *120*(4), 401–408. https://doi.org/10.1016/j.anai.2018.02.013

QualityMetric Incorporated. (2017, January). *Asthma control test*. www.asthma.com

Reavy, K. (2016). *Inquiry and leadership: A resource for the DNP project* (1st ed.). F.A. Davis Company.

Rosswurm, M. A. & Larrabee, J. H. (1999). A model for change to evidence-based practice. *Journal of Nursing Scholarship*, 31(4), 317-322.

Tosca, M., Del Barba, P., Licari, A., & Ciprandi, G. (2020). The measurement of asthma and allergic rhinitis control in children and adolescents. *Children*, *7*(5), 43. https://doi.org/10.3390/children7050043

World Health Organization. (2020, May 20). *Asthma Key Facts*. Retrieved February 8, 2021, from https://www.who.int/news-room/fact-sheets/detail/asthma

Appendix A

Evaluation and Synthesis Tables

Table A1

Quantitative Evaluation Table

Citation	Theory/ Conceptual Framework	Design/ Method	Sample/ Setting	Major Variables & Definitions	Measurement/ Instrumentation	Data Analysis	Findings/ Results	Level of Evidence Application to practice
Bender et al. (2015) Pragmatic trial of health care technologies to improve adherence to pediatric asthma treatment. **Country:** USA **Funding:** National Institutes of Health **Bias:** No biases reported.	Self-regulation Model	**Design:** Quantitative, Pragmatic Randomized Clinical Trial **Purpose:** To assess the efficacy of an SR intervention on controller medication adherence.	**n:** 1756 **CG**: 447 **IG**: 452 **Mean age**: 8.1 **Demographics:** 3-12 y.o.,55.9% White, 24.8%, Hispanic, 14.3% African American, 38.9% female, 61.1% male. **EC:** comorbid dx, outside pharm **Setting:** phone **Attrition:** 10% **Definitions:** adherence, PDC, asthma control.	**IV:** 24 months of SR phone call reminders and options for asthma info, asthma nurse or pharmacist. **DV:** Medication adherence. **Definitions:** Medication adherence, controller medication, ICS, EHR	**Tools:** Calculations of PDC per pharmacy records. **Validity:** unreported validity.	**Statistical Tests:** Intention-to-treat analysis generalized linear model, sensitivity analysis.	IG experienced improved ICS medication adherence, 25.4% higher than CG, P<.001.	**Level of Evidence:** Pragmatic randomized clinical trial, Level II **Strengths:** low cost, long study period (24 months), low attrition. **Weakness**: Measurement based on ICS refills from pharmacy. **Feasibility:** High feasibility. **Utility to PICOT**: Support for the use of text messages.

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Halterman et al. (2018) Effect of the school-based telemedicine enhanced asthma management (sb-team) program on asthma morbidity. **Country:** United States **Funding:** Grant funded by the National Heart, Lung, and Blood Institute **Bias:** Potential CG bias. No other conflicts reported.	Garrity's Communication Theory	**Design:** Quantitative, RCT **Purpose:** Evaluate SB-TEAM program on asthma morbidity in urban children with persistent asthma.	**n:** 400 **CG**: 200 **IG**: 200 **Mean age**: 7.8 **Demographics**: Urban children with persistent asthma. Age 3-10 years 61.8% male 57.5% African American 76.3% public ins. **EC**: must speak English, have a telephone. Excluded those w/ significant medical conditions. **Setting:** School sites in Rochester City School District **Attrition:** 7 **Definitions:** ICS, persistent asthma.	**IV**: SB-TEAM program participation. **DV**: Mean number of SFD per 2 weeks. **Definitions:** SFD, SB-TEAM, Persistent asthma, Telemedicine	**Tools**: Bimonthly blinded interviews and review of medical and school records. Symptom diaries. **Validity:** Valid for study population and study design.	**Statistical tests:** Multivariable modified intention-to-treat analyses. GEE models. Binomial error & logitlink function were specified for binary outcomes. 2-sample t tests for comparison P < .05.	**CI:** 11.6 vs 10.97 SFD; difference, 0.69; 95% CI, 0.15-1.22; P= .01 **% Change**: IV group had fewer ED visits 7% vs 15%, odds ratio, 0.52: 95% CI, 0.32-0.84.	**Level of evidence**: RCT Level II **Strengths:** Low attrition, feasible in setting. **Weakness:** unable to blind participant and caregivers. Participants in the CG may have created bias as they likely received improved care through the study. **Feasibility:** Feasible & sustainable. **Utility to PICOT**: Access to care is enhanced through telemedicine.

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Johnson et al. (2015) The feasibility of text reminders to improve medication adherence in adolescents with asthma. **Country:** USA **Funding:** Agency for Healthcare Research and Quality **Bias:** no bias reported	Self-regulation Model	**Design:** Quantitative, Block- RCT **Purpose:** To assess the effectiveness of MMH- and SMS- texting service on medication adherence and self-efficacy.	**n:** 98 **CG**: 45 **IG**: 53 **Mean age**: 13.93/14.17 **Demographics:** 12-17 y.o., White 47%, African American 47%. Male 53%, female 47%. **EC:** Must be English speaking, taking asthma medications, must have internet and cell phone. **Setting:** pediatric outpatient setting, cell phone **Attrition:** 9 **Definitions:** SMS, MMH, C-PAM, A-PAM	**IV:** Established MMH and received SMS medication reminders **DV1:** Medication Adherence **DV2:** Asthma control **DV3**: Self-efficacy **DV4**: Quality of life **Definitions:** SMS, MMH, ACT, C-PAM, A-PAM, PAQLQ	**Tools:** ACT, C-PAM, A-PAM, PAQLQ, CASES **Validity:** Validated instruments	**Statistical Tests:** Intention-to-treat approach. Wilcox test. Pearson's chi-squared test. Proportional odds model.	MMH is associated with improved medication adherence, perceived quality of life, and self-efficacy. **DV1**: Med adherence (P= .011), **DV2**: no change **DV3**: Self-efficacy (P= .016) **DV4**: Quality of life (P=.037)	**Level of Evidence:** Level II RCT **Strengths:** Ease of implementation, low attrition. **Weakness**: small sample size, disproportionately African American. **Feasibility:** High feasibility since most adolescents have texting capabilities. **Utility to PICOT**: Text message reminders are effective among adolescents.

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Citation	Theory/ Conceptual Framework	Design/ Method	Sample/ Setting	Major Variables & Definitions	Measurement/ Instrumentation	Data Analysis	Findings/ Results	Level of Evidence Application to practice
Kolmodin MacDonell et al. (2016) The Detroit young adult asthma project: Pilot of a technology-based medication adherence intervention for African American emerging adults. **Country:** United States **Funding**: National Institutes of Health **Bias:** No biases reported	Self-regulation Model	**Design:** Quantitative, RCT **Purpose:** To develop and test the feasibility and efficacy of technology delivered sessions w/ text messages on medication adherence and asthma control.	**n:** 50 **CG**: 24 **IG**: 25 **Mean age**: 22.4 **Demographics:** 18-29 y.o. African-Americans with poorly controlled asthma, w/controller med. 36 females, 12 males, most w/ HS degree. **EC: c**ontroller, texting, pregnant, serious condition, psych disorder and must speak English. **Setting:** Cell **Attrition:** 1 **Definitions:** Poor adherence, rescue medication, minority youth.	**IV:** 30 days of text message reminders to take asthma medication. **DV1:** Medication Adherence **DV2:** Asthma control **Definitions** Asthma control, medication adherence, MI ACT, spirometer.	**Tools:** Medication adherence: Self-reported questionnaire at baseline, 1 and 3 months. Asthma control: ACT Lung function: spirometer Satisfaction: Client satisfaction questionnaire **Validity:** ACT, and spirometer known valid measurement tools.	**Statistical Tests:** Cohen's d test.	Intervention is effective in increasing medication adherence and asthma control. **DV1**: Med adherence: total doses missed t (44) = 1.06 (d=.35), IG had improved med adherence. **DV2**: Asthma control, total symptoms t (42) = 2.22, p<.05 (d=.071), both groups improved in asthma control.	**Level of Evidence:** Level II RCT **Strengths**: >80% high client satisfaction. **Weakness**: Pilot status, needs to be replicated w/larger sample. Self-reported questionnaires. Needs stronger statistical analysis. **Feasibility:** A technology-based intervention with a behavioral component is feasible and effective. **PICOT** Utility: A useful tool for youth with texting capabilities.

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Kosse et al. (2019) mHealth intervention employed to improve self-management, medication adherence, disease control and quality of life in adolescents with asthma. **Country:** Netherlands **Funding:** Netherlands Organization for Health Research and Development and from Umenz Benelux BV **Bias:** None. Passible bias from participants.	Dorothea E. Orem's Self-Care Theory	**Design**: Quantitative, Cluster RCT **Purpose**: To evaluate the effectiveness of the Adolescent Adherence Patient Tool (ADAPT) in improved self-management and medication adherence, disease control and quality of life in adolescents with asthma	**n:** 253 **CG**: 147 **IG**: 87 **Mean age**: 15.1 **Demographics:** Male and female, ages 12-18. Half were female. Mostly Dutch. **EC:** min. 2 ICS or ICS/LABA Rx during past 12 months, must have a smart phone, must understand Dutch, cannot be dependent on others for meds. **Setting:** phone **Attrition:** 19 **Definitions:** Smartphone Med adherence ICS & LABA	**IV: 6-month** access to ADAPT **DV1:** Self-reported management and medication adherence **DV2:** Disease control and quality of life. **Definitions** mHealth, Medication adherence, Disease Control.	**Tools:** MARS, CARAT and PAQLQ questionnaires. **Validity**: Valid and reliable in Dutch population	**Statistical Tests:** Baseline, a mixed-effects model, chi square test or fisher's exact test, depending on type of variable.	**DV1**: Increased medication adherence p= 0.04, 1.07, CI 0.54; 2.20. **DV2**: No effect on asthma control p >0.05	**Level of Evidence**: RCT Level II **Strengths**: Large number of participants, low attrition. **Weakness**: Not blinded, pharmacist as provider, baseline adherence not considered. Possible response and desirability bias. **Feasibility:** Feasible in the clinic setting, tailor interventions to patients with low adherence. **Utility to PICOT**: Feasible to use cell phone.

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Koufopoulos et al. (2016) A web-based and mobile health social support intervention to promote adherence to inhaled asthma medications: Randomized controlled trial. **Country:** United Kingdom **Funding:** Grant from the University of Leeds School of Psychology and a Fulbright Scholarship for the first author. **Bias:** None reported. Participants were paid to participate.	Social Cognitive Theory, and the Theory of Planned Behavior	**Design:** Quantitative, 2-arm RCT **Purpose:** Evaluate effectiveness of online community for improving asthma medication adherence.	**n**: 216 **CG**: 117 **IG**: 99 **Mean age**: 28.1 **Demographics:** Male and female university students. Participants were mostly female. **EC:** failure to fill questionnaire, did not have asthma, were not on an ICS, failure to give consent, or already participated. **Setting:** web-based **Attrition:** 113 participants **Definitions**: ICS, web-based	**IV**: Online community "Asthma Village" **DV**: Increased medication adherence. **Definitions:** ICS, SMAQ, SMAQ-T2	**Tools:** Self-reported 6-item Simplified Medication Adherence Questionnaire (SMAQ) and SMAQ-T2 taken 9 weeks postbaseline. **Validity**: Validated measure.	**Statistical tests:** Descriptive statistics were calculated for all variables. Effect was examined with Multivariate analysis of variance, covariance (MANOVA) and (MANCOVA). Chi-square test indicated attrition was higher in IG.	Study found increased short-term adherence while monitoring, no other improvements found. MANCOVA indicates no condition effects (Wilks' lambada = 0.998; F196= 0.176, P=.68)	**Level of evidence**: Level II RCT. **Strengths:** Fostered interaction among participants. Not time intensive. Broad inclusion criteria. **Weakness:** Self-reported measures. **Feasibility**: High, however must add a behavioral component.

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Koumpagioti et al. (2019) Effectiveness of an educational program for children and their families on asthma control treatment adherence. **Country:** Greece **Funding:** Grant from GlaxoSmithKline. **Bias:** possible patient bias as study was performed in outpatient setting where patients may be more adherent.	Health Belief Model	**Design:** Quantitative, RCT **Purpose:** Evaluate effect of pediatric asthma care education on medication adherence.	**n**: 96 **CG:**48 **IG:**48 **Mean age**: 8.4 **Demographics:** age 4-16 years, Greek, male and female participants, similar demographics. **EC:** Newly diagnosed with asthma, excluded severe preexisting medical conditions, must understand Greek. **Setting:** outpatient clinic by a specialist nurse **Attrition:** 12% or 18 participants **Definitions:** ICS, LABA.	**IV**: Asthma educational program. **DV**: improved medication adherence and associated clinical values **Definitions**: Smartinhalers, FeNO, ACT, spirometer	**Tools:** Smartinhalers electronic monitoring devices to measure adherence, Spirometry, exhaled nitric oxide fraction (FeNO) and pre and post Asthma Control Test (ACT) scores **Validity:** Smartinhalers, FeNO, Spirometry and ACT scores are all validated.	**Statistical tests:** Univariate analysis w/ independent or paired-t tests, Wilcoxon rank-sum test and chi-square test. Multivariate analysis done with linear regression models.	**% Change:** Total sample: 73% medication adherence. 80% for the IG, 68% for CG. ($p<0.001$). Suboptimal adherence 82% in CG vs 48.7% in IG.	**Level of evidence:** Level II RCT. **Strengths:** electronic devices avoid subjective reporting. Facilitated by a nurse. **Weakness:** high attrition, and/or participants need to charge devices. Limited period of the study (6 weeks). **Feasibility:** Highly feasible in an outpatient or school setting. **Utility to PICOT:** Support for asthma education.

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Lin et al. (2020) Telehealth delivery of adherence and medication management system improves outcomes in inner-city children with asthma. **Country**: United States **Funding:** Luther Foundation Gift and the Verizon Foundation Gift **Bias:** no biases reported	Physician-patient relationship Theory	**Design:** Quantitative, Quasi-experimental study **Purpose:** Assess the feasibility and efficacy of school-based telehealth care on medication adherence and asthma control.	**n:** 21 **CG**: NA **IG**: 21 **Mean age**: 13.7 **Demographics:** 10-17 y.o., inner-city youth, uncontrolled asthma. 74% African American. 57% males. **EC:** Serious chronic disease, no consent, plans to change schools. **Setting:** Schools in Cincinnati, OH **Attrition:** 0 **Definitions**: inner-city, healthcare utilization, medication adherence.	**IV:** 6 months, 7 medical visits, 5 self-management visits over VBT **DV1:** asthma control **DV2:** Medication adherence **Definitions:** technology-enhanced medical care, VBT, CASI, ACT, TreatSmart electronic inhaler monitor, telehealth, healthcare access barriers.	**Tools:** CASI, ACT, TreatSmart**,** Propeller Health System electronic inhaler monitor. **Validity:** ACT and CASI are both validated tools. Propeller Health System monitor is FDA approved.	**Statistical Tests:** Linear mixed-effects models w/ random effect. Paired t-test used to compare controller and rescue meds.	**Results:** Improved symptoms and medication adherence. **DV1**: ACT scores (p=.0003), **DV2**: medication adherence from baseline to intervention (t=1.93, p= .03).	**Level of Evidence:** Quasi-experimental Level II S **Strengths:** Delivered by asthma specialists, included a behavioral component. **Weakness**: Small sample size, no control group. **Feasibility:** Feasible and effective, can reach youth with limited access to care. **PICOT Utility**: Telehealth in school setting with a self-management component. Participant may benefit from booster sessions.

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Citation	Theory/ Conceptual Framework	Design/ Method	Sample/ Setting	Major Variables & Definitions	Measurement/ Instrumentation	Data Analysis	Findings/ Results	Level of Evidence Application to practice
Lv et al. (2019) A randomized controlled trial of a mobile application-assisted nurse-led model used to improve treatment outcomes in children with asthma. **Country:** China **Funding:** Science and Technology Research Project of Jinhua **Bias:** Possible recall bias. Possible selection bias as software only works on Android.	Communication Theory	**Design:** Quantitative, RCT **Purpose:** To assess the effectiveness of a mobile application management model in childhood asthma.	**n:** 152 **CG**: 75 **IG**: 77 **Mean age**: 7.95 **Demographics:** Han Chinese, 6-12 y.o.,53.2% male, all have a smart phone. **EC:** asthma exacerbation at enrollment, current rhinosinusitis, OSA, serious co-morbidities, immunodeficient. **Setting:** cell phone, Jinhua City, China **Attrition:** 9 **Definitions:** ICS, asthma exacerbations, mobile application.	**IV:** Mobile application to help manage asthma plus usual care. **DV1:** Frequency of asthma exacerbations. **DV2:** Medication adherence **Definitions:** asthma exacerbations, mobile application, medication adherence.	**Tools:** C-ACT, nurse telephone call. **Validity:** C-ACT is valid and reliable.	**Statistical Tests:** Mann-Whitney u-test, Chi square analysis, Fishers exact test, Student's t-test.	IG experienced higher medication adherence, and C-ACT scores. **DV1**: Exacerbations 7-10 versus 3, Z=10.361, $p<0.001$, **DV2**: C-ACT scores 22.44, $p<0.05$.	**Level of Evidence:** Level II, RCT **Strengths:** Low attrition rate, managed by nurses and physicians. **Weakness**: Small sample size. Those w/o smartphones could not participate. **Feasibility:** high feasibility if usable on more software. **Utility to PICOT**: Technology, plus nurse-led interventions increase medication adherence.

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Citation	Theory/ Conceptual Framework	Design/ Method	Sample/ Setting	Major Variables & Definitions	Measurement/ Instrumentation	Data Analysis	Findings/ Results	Level of Evidence Application to practice
Perry et al. (2018) Results of an asthma education program delivered via telemedicine in rural schools. **Country:** USA **Funding:** National Institutes of Health **Bias:** No bias reported	Health belief Model	**Design:** Quantitative, Cluster Randomized Trial **Purpose**: To evaluate the efficacy of asthma education via telehealth on symptom-free days, medication adherence.	**n:** 393 **CG**: 199 **IG**: 194 **Mean age**: 9.6 **Demographics:** 7-14 y.o., 81% African-American, 53 White, 161 low-income, male 205. **EC:** Significant respiratory disease, English, no telephone access, must have exercise induced asthma only. **Setting:** Schools in Delta region of Arkansas. **Attrition:** 30 **Definitions:** low-income, rural US, school based.	**IV:** Telemedicine School based asthma education plus usual care and education delivered to caregivers. **DV1:** SFD at 3 and 6 months **DV2:** Medication adherence **Definitions:** Low-income, rural, school-based, medication adherence, SFD	**Tools:** Follow-up survey, PedsQL, CHSA, PAQLQ **Validity:** Tools are valid and reliable	**Statistical Tests:** Wilcoxon rank sum test and x2test.	Increased medication adherence, no difference in symptom free days. **DV1**: no difference 7.2 versus 8 SFD (P=.51) **DV2**: Medication adherence reported as "most of" or "all of" the time IG 78% vs 63%, P=.03).	**Level of Evidence:** Level II, Cluster Randomized Trial **Strengths:** Low attrition **Weakness**: only 61% of caregivers finished sessions. **Feasibility:** Feasible, needs to address caregiver engagement. **Utility to PICOT**: School-based interventions are effective, must be multifaceted, engage caregivers.

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Table A2

Synthesis Table

Studies		Bender et al.	Halterman et al.	Johnson et al.	Kolmodin MacDonell et al.	Kosse et al.	Koufopoulos et al.	Koumpagioti et al.	Lin et al.	Lv et al.	Perry et al.
Basics	Year	2015	2018	2015	2016	2019	2016	2019	2020	2019	2018
	LOE	II	II	II	II	II	II	II	II	II	II
	Design	RCT	RCT	RCT	RCT	RCT	RCT	RCT	QE	RCT	CRT
	Mean Age	8.1	7.8	13.93	22.4	15.1	28.1	8.4	13.7	7.95	9.6
	Attrition	10%	<1%	<1%	<1%	<1%	52%	12%	0	<1%	<1%
	Country	USA	USA	USA	USA	NL	UK	Greece	USA	China	USA
	n participants	1756	400	98	50	253	216	96	21	152	393
	Valid Tools	x	x	x	x	x	x	x	x	x	x
Interventions	Phone calls	x									
	SB program		x						x		
	Texting			x	x						
	Phone App					x				x	
	Online community						x				
	ED Program							x			x
Major findings	Med Adherence	↑		↑	↑	↑	↑	↑	↑		↑
	SFD		↑								NC
	ER visits		↓								
	Asthma Control			NC	↑	NC			↑	↑	
	Self-Efficacy			↑							
	Quality of Life			↑							
	Exacerbations									↓	

Key: **CRT**= cluster randomized trial, **ED**= education, **ER**=emergency room, **NC**= no change, **RCT**= randomized controlled trial, **SB-TEAM**= School-based telemedicine enhanced asthma management, **SFD**= Symptom free days, **QE**=quasi-experimental, ↑ = increase, ↓= decrease, x = applicable.

Appendix B

Implementation Framework and Model

Figure B1

A Model for Change to Evidence-Based Practice

(Rosswurm & Larrabee, 1999)

Figure B2

Social Cognitive Theory

(Bandura, 1986)

Appendix C

IRB Approval Letter

ASU Knowledge Enterprise Development

APPROVAL: EXPEDITED REVIEW

Diana Jacobson
EDSON: DNP
602/496-0863
DIANA.JACOBSON@asu.edu

Dear Diana Jacobson:

On 10/7/2021 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	Telehealth Education for Pediatric Asthma Management
Investigator:	Diana Jacobson
IRB ID:	STUDY00014675
Category of review:	
Funding:	None
Grant Title:	None
Grant ID:	None
Documents Reviewed:	• Flores Asthma Education IRB Protocol Final 10 15 2021.docx, Category: IRB Protocol; • Flores Email Request to Schedule and Method of Contact_Spanish_10 15 2021.pdf, Category: Translations; • Flores Participant Survey Consent Letter Final 10 15 2021.pdf, Category: Consent Form; • Flores Participant Survey Consent Letter_Spanish_10 15 2021.pdf, Category: Consent Form; • Flores Post Survey Spanish 10 15 21.pdf, Category: Translations; • Flores Recruitment Email Final 10 15 2021.pdf, Category: Recruitment Materials; • Flores Recruitment Email Spanish 10 15 21.pdf, Category: Recruitment Materials; • Flores Recruitment Phone Script Final 10 15 2021.pdf, Category: Recruitment Materials; • Flores Recruitment Phone Script_Spanish 10 15 21.pdf, Category: Recruitment Materials; • Flores Spanish CompanyCERTIFICATION OF ACCURACYP.2.pdf, Category: Other; • Flores_ Asthma Education Flyer 2_Spanish_10 15 21.pdf, Category: Recruitment Materials; • Flores_ NHLBI Participant Certificate_Spanish 10 15 2021.pdf,

	Category: Translations; • Flores_ Pre Survey _Spanish 10 15 21.pdf, Category: Translations; • Flores_Asthma Education Flyer 1_ Spanish_10 15 2021.pdf, Category: Recruitment Materials; • Flores_Asthma Education Flyer 2_10 15 2021.pdf, Category: Recruitment Materials; • Flores_ASU IRB_translation-certificate Spanish Translation 10 15 21.pdf, Category: Translations; • Flores_ASU IRB_translation-certificate_Spanish Back Translation_ 10 15 21.pdf, Category: Translations; • Flores_Happy Kids Pediatrics Support Letter, Category: Off-site authorizations (school permission, other IRB approvals, Tribal permission etc); • Flores_NHLBI Participant Handouts_Spanish 10 15 2021.pdf, Category: Translations;

The IRB approved the protocol from 10/7/2021 to 10/6/2022 inclusive. Three weeks before 10/6/2022 you are to submit a completed Continuing Review application and required attachments to request continuing approval or closure.

If continuing review approval is not granted before the expiration date of 10/6/2022 approval of this protocol expires on that date. When consent is appropriate, you must use final, watermarked versions available under the "Documents" tab in ERA-IRB.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

REMINDER - All in-person interactions with human subjects require the completion of the ASU Daily Health Check by the ASU members prior to the interaction and the use of face coverings by researchers, research teams and research participants during the interaction. These requirements will minimize risk, protect health and support a safe research environment. These requirements apply both on- and off-campus.

The above change is effective as of July 29th 2021 until further notice and replaces all previously published guidance. Thank you for your continued commitment to ensuring a healthy and productive ASU community.

Sincerely,

IRB Administrator

cc: Cynthia Flores

Appendix D

Site Approval Letter

happy kids pediatrics

6710 W Camelback Rd. Ste. A
Glendale, AZ 85303
Phone (623) 235-6901
Fax (623) 242-7236

Date: 09/16/2021

To Whom It May Concern,

On behalf of Happy Kids Pediatrics, I am pleased to support the quality improvement Doctor of Nursing Practice (DNP) project entitled "Telehealth Asthma Education for Pediatric Asthma Management." This DNP project is proposed by Cynthia Flores, BSN, RN, Arizona State University (ASU), Edson College of Nursing and Health Innovation DNP student and her ASU mentor, Dr Diana Jacobson.

Our organization agrees to serve as the quality improvement project site for the implementation of this DNP project which will inform and support asthma education for caregivers of children with asthma and their families. Thank you for providing the opportunity for Happy Kids Pediatrics to be part of this important DNP project.

Respectfully,

Josefina Castelo, FNP-C
Happy Kids Pediatrics

623-633-3467

Appendix E

Measurement Tools

Figure E1

Parental Asthma Management Self-Efficacy Scale

(Bursch et al., 1999)

Figure E2

Asthma Control Test

(Nathan et al., 2004)

Appendix F

Budget Proposal

Phase	Activities	Direct Cost	Indirect Cost	Total
Preparation	Proposed Full-time Patient Educator	$50,000.00 per year	**5,000**	**55,000**
	Support staff hours 36 hours @ 15/hr.	$540		**$540**
	Patient Educator training		**$500**	**500**
	Design, develop web materials		$500	**500**
	Professional webpage management		$1,000	**1,000**
	Hire Spanish translator Estimated 50 hours @ $12/hr. to translate materials		**$600**	**$600**
	Design evaluation tools		$300	**300**
Delivery	Patient Educator	salary or free if done by PI only		**0**
	Internet service for telehealth service		$1,200	**1,200**
	Laptop equipment, router, cell phone for program		$1,500	**1,500**
	Translators for Spanish-speaking audiences 10 hours @ $50		$500	**$500**
	Office supplies: software, copies, paper, incidentals		$200	**200**
	Participant materials		$500	**$500**
	Curriculum		Free	**0**
Evaluation	Postage		$50	$50
	Evaluator Review and analysis of results (10hrs@20/hr.)		$200	**$200**
Total cost				**62,590**
Total without full-time staff				**7,590**
Inputs or Potential Funding Sources	Insurance reimbursement for patient education 10 hours per patient @ $50/per hour, $500 per pt.			**$3,000 for 6 patients**
	Grants (CDC, NACP)	50,000		**50,000**
	Community Donations: private donors, fundraisers, company sponsorships	10,000		**10,000**
Total Inputs				**$63,000**
Cost/savings				**410**