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Implementation and evaluation of asthma education cell phone application: ASTHMAXcel, within an allergy and asthma specialty practice.

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Implementation and Evaluation of Asthma Education Cell Phone Application: ASTHMAXcel, Within an Allergy and Asthma Specialty Practice

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Abstract

Background: Asthma is the leading chronic illness among pediatric patients. One of the most significant obstacles facing asthma care is adherence to asthma management plans. In the pediatric population, adolescents (ages 12-17) traditionally have poor asthma management. Research shows that adolescents respond well to technology-based education and that improving adolescent healthcare literacy leads to better asthma control.

Environment: This project took place at an allergy and asthma specialists office. This private practice includes primary care allergy, asthma, and immunology services that follows roughly 120 adolescents with asthma.

Purpose: The purpose of this project was to provide the allergy and asthma office staff with an additional educational resource to give adolescent asthma patients. This technology-based, mobile device application was meant to help prevent unnecessary office calls and non-routine office visits by increasing patient healthcare literacy.

Procedures: The intervention was an in-service which instructed the office staff to educate patients within the demographic population during office visits on the use of the ASTHMAXcel applications. For eight weeks, the staff provided the education and resource to the inclusive population and documented the encounters on a data entry log. The staff was also instructed to document patients who received the education at a previous appointment on a separate data entry log. At the end of weeks 4 and 8, the staff participated in an open-ended question and feedback document.

Measures: The project was measured through two data entry logs and two open-ended questions. The first data entry log measured if the education was given, and if not, then why, the date and time the education was given, and the age of the patient receiving education. The

second data entry log was intended for patients who received the education and were returning for another appointment within the implementation dates. This log included date and time of the encounter, age of the patient, and if the patient downloaded and used the applications. The results of these logs were compared to a total number of patients within the inclusion criteria that were seen within the implementation dates, provided through an EMR review by the office manager. The open-ended question document contained the question: What factors are preventing the ASTHMAXcel discharge education? The document also had a section for constructive feedback.

Data Analysis: Analysis reported that 83.7% of the total number of patients seen were offered the education. Of that group, 86% agreed to participate in receiving the education. Major barriers to implementation mostly included cancellations due to illness or weather. Five patients (14%) refused the intervention for various reasons but mostly due to reason for office visit.

Discussion: The ASTHMAXcel application education intervention was delivered at an exceptionally high rate. The staff of the implementing office expressed interest in continuing to make the application available to their adolescent patients. Follow-up on the rate of application usage and a measurement of asthma-related healthcare literacy among patients receiving the application education would be beneficial to support further application implementation.

Conclusion: ASTHMAXcel is an easily accessible resource for primary care services to improve adolescent asthma patients' healthcare literacy. ASTHMAXcel is as efficacious as an in-person educational class and is more suited for the adolescent age group.

Implementation and Evaluation of Asthma Education Cell Phone Application: ASTHMAXcel, Within an Allergy and Asthma Specialty Practice

Asthma is the leading chronic illness among children (Office of Disease Prevention and Health Promotion, 2021). As many as 7 million children in the United States suffer from chronic asthma, with 60% of these patients reporting at least one acute asthma exacerbation and/or asthma attack per year (Arianna, et al, 2017). This long-term respiratory disease includes symptoms such as wheezing, chest tightness, shortness of air, and cough which results from a narrowing of the airways, increased mucus production, and thickening of airway walls (National Heart, Lung, and Blood Institute, 2020). Severity of asthmatic pediatric patients is on a broad spectrum from mild to very severe. In as many as 20% of exacerbations, patients are forced to go to the Emergency Department (ED) for symptom management (Arianna, et al, 2017). Attacks that result in ED visits are associated with missed school days, increased anxiety, and more frequent attacks (Cloutier, 2020). In many cases, exacerbations can be controlled with improved patient understanding of their own asthma, along with identification and elimination of asthma triggers (Center for Disease Control and Prevention, 2009).

Background

Perhaps the greatest obstacle facing asthma management is adequate adherence. Healthcare providers base much of asthma management planning on reported symptoms, with some emphasis also given to in-office pulmonary function tests (PFTs). Diagnosis of asthma severity is also largely dependent on patient self-reporting (Mammen, et al, 2019). Self-reporting can be limited according to the patient's asthma healthcare literacy level. Populations with low healthcare literacy tend to have poorer asthma control (Mammen, et al, 2019). Studying a population of interest, Mammen, et al, 2019, found that adolescents reported asthma

symptoms 69.1% of the days, with a third of these including severe symptoms. The patients also failed to correlate atypical symptoms, such as coughing and throat clearing, as asthma symptoms. This identifies adolescents as a major group at risk for low asthma healthcare literacy.

Teenagers and adolescents, usually considered ages 12 through 17, are at risk for poor asthma control and adherence due to new assumption of management and responsibility for their asthma. Adolescents have been shown to have higher incidences of asthma exacerbation, anxiety, depression, and decrease in physical activity as compared to asthmatics of both older and younger age groups (Mammen, et al, 2019). There are many layers to both decreased understanding of disease and non-adherence to asthma management plans which result in a complex problem for clinicians to address (Papparlado, et al, 2017).

Healthcare literacy is shown to have a direct effect on asthma control. As patients begin to grow into their adolescent years, parents are more likely to give more responsibility of managing their asthma. Research has shown that adolescents of parents with low healthcare literacy tend to have poor asthma control and low healthcare literacy as well (Papparlado, et al, 2017). Low healthcare literacy has also been linked to increased exacerbations and poor asthma care plan adherence (Papparlado, et al, 2017). In many cases, adolescents may not be ready to assume management of their asthma. Take-home survey questionnaires revealed only 35% of teens were classified as “ready” to be managing their disease on their own (Jones, et al, 2019).

Many interventions have been studied to improve adolescent management, with some success found in technology-based interventions. Education about asthma management begins at office visits, where providers, nurses, and medical assistants are tasked with preparing patients with the necessary resources to effectively manage their disease. Staff at a private asthma and

allergy practice agree that an interactive mobile device resource could improve adolescent asthma healthcare literacy.

Environment

This quality improvement (QI) project took place at an allergy and asthma outpatient specialty office. The office employs an allergy specialist physician and two nurse practitioners, as well as multiple nurses and medical assistants. There are also three secretaries to assist with admission, discharge, and scheduling. The office primarily services a rural area containing several counties across two states. According to the office manager, this office has seen 120 adolescent asthma patients regularly over the 2019-2021 calendar years. Adolescent asthma patients are seen in the office every 3-6 months. Those on controller medications, such as daily inhalers will perform PFTs. All asthma patients fill out the Asthma Control Test survey (ACT) at each visit.

Even with the addition of more providers, the owner and primary physician has expressed frustration over the continued decrease in provider time spent with each patient. Due to this change, education has developed into a tiered approach. At this time, education is split between the providers, nurses, and medical assistants. Even with the tiered approach, the sheer volume of patients has resulted in a desire for beneficial resources that patients can use without needing to call the office or come in for a visit outside of regularly scheduled check-ups.

Target Population

The intervention was implemented to the staff of the primary care asthma specialty practice, particularly the nurses and medical assistants. Nurses and medical assistants are tasked with admitting patients for appointments, performing initial assessments of both subjective and objective (PFTs), and discharge instructions. Discharge instructions contain the bulk of new

education and instructions. The intervention was initiated at the start of the visit by administering the handout resource with QR codes linking to two mobile device applications. Education on the applications was added during the discharge education portion of the visit. The intervention particularly focused on encounters of nurses and medical assistants with adolescents, ages 12 through 17, reporting for asthma-related office visits. The implemented educational resource was made available to all patients seen within this demographic category, regardless of whether the office visit was for an acute episode or a routine check-up. This project implementation focused solely on the staff as the goals of the project were to improve the discharge education given to adolescent asthma patients by adding an at-home resource that is educational and easily accessed.

Literature Synthesis

A comprehensive literature review found that asthma can be well controlled with adequate plan of care adherence. The review also highlighted adolescents as a group at high risk for poor asthma control, usually due to lower levels of healthcare literacy. Generally, adolescence is the stage where patients take over self-management of their disease. Finally, research showed that technology-based interventions improved asthma control in many age groups, particularly adolescents. A total of 38 articles were reviewed and synthesized for this project, in addition to information gathered from the National Heart, Lung and Blood Institute (NHLBI), the Office of Disease Prevention and Health Promotion (Healthy People 2030), the Center for Disease Control and Prevention (CDC), and The National Institute of Health (NIH)

As the world itself has gravitated toward technology, so have younger generations. A systematic review of 80 studies evaluating the effectiveness of eHealth interventions showed that these interventions proved to be beneficial in improving patient adherence to asthma medication:

inhaled corticosteroids (Jeminwa, et al, 2018). In another study, a randomized control trial, an asthma decision-making online support tool was implemented to children and adolescents with uncontrolled asthma. More than half the patients reported uncontrolled symptoms at screening whereas only 30-49% reported uncontrolled symptoms post-intervention (Kercsmar, et al, 2019). The intervention was associated with increased asthma control. A separate randomized control trial performed by Kosse, et al, 2019, used an mHealth intervention to improve adolescent adherence to asthma regimen. The trial implemented the Medication Adherence Report Scale (MARS) to 234 adolescents (12-18) who filled asthma-related medications at one or more of 66 pharmacies. The results showed that the MARS scores improved by 1.42 points for those with the intervention and decreased by 0.70 points in the control group (Kosse, et al, 2019). A barrier that can often inhibit asthma management adherence is unwillingness in adolescents to appropriately self-monitor their disease. A 2018 systematic review analyzed 14 studies which focused on eHealth interventions geared toward improving patient reporting (Lancaster, et al, 2018). Patients found that eHealth interventions helped improve communication with their provider, which led to better controlled symptoms (Lancaster, et al, 2018). Likewise, a three-phase randomized control trial in Glasgow, UK, implemented a website called Living Well with Asthma to 51 teenagers and adults. Results showed that phase three will be very promising due to the high rate of retention (Morrison, et al, 2016).

As technology becomes more integral in healthcare, providers are constantly attempting to implement technology-based interventions into patient education. A proposed multicomponent technology intervention seeks to increase adherence in African American youth. This study will include 192 enrolled patients with poor medication adherence and uncontrolled asthma symptoms. The authors hypothesize that the intervention will lead to improvement in

adherence through computer-delivered interviews revolving round medication adherence and individual text messaging to remind about medications (MacDonell et al, 2018). Results are not available yet as the study ran from September 1, 2016, to August 31, 2021, but this is another example of technology being utilized to improve patient healthcare literacy. In addition to interventions involving text-messaging, Pozadski, et al, 2016, performed a systematic review of automated telephone communication systems which included 132 trials that covered preventive asthma care, management of long-term asthma, and appointment reminders. The authors concluded that telephone communication systems helped change patient behavior and improved healthcare literacy and outcomes (Pozadski, et al, 2016).

Ramsey, et al, 2020, performed a systematic review of digital interventions for pediatric asthma management which included 264 reviewed articles with 15 articles selected. In this review, 87% of the digital interventions were found to improve adherence and 53% improved outcomes (Ramsey, et al, 2020). In a nine-week randomized control trial, the authors provided a web-based and mobile health social support intervention which included 216 participants who used an inhaled corticosteroid. The group was tasked with self-reporting of medication usage. Results found promising increase in adherence during the trial but unfortunately that number decreased after the trial ended, concluding that participants needed to remain engaged to continue to show improvements (Koufopoulus, et al, 2016).

As more technological interventions are explored, mobile device applications are showing promise. In a systematic review, Majeed-Ariss, et al, 2015, studied adolescent use of mobile and tablet applications that supported personal management of chronic disease. Though only four studies met inclusion criteria, results indicate that there is a magnitude of educational applications for patients to use with a barrier being that patients are not aware of this resource

(Majeed-Ariss, et al, 2015). A similar systematic review focused solely on asthma related self-management applications for adolescents. This review resulted in eight studies which indicate that smart phone application use can increase asthma control and adherence but lack of data limits conclusive evidence (Alquran, et al, 2018). A review of mHealth (mobile health) apps in the Google Play store and Apple App store resulted in 24 apps that helped with self-management of bronchial asthma in children and adolescents (Franmair, et al, 2021). These applications include AsthmaAustralia, Ask Me, AsthMe!, Kiss My Asthma, and ASTHMAXcel.

ASTHMAXcel

In a longitudinal assessment of the efficacy of mobile device application, ASTHMAXcel, Hsia, et al, 2020, found that the increase in asthma knowledge led to better outcomes for patients. The study found that there was a significant decrease in ED visits and rescue-inhaler use during the latter part of the study (Hsia, et al, 2020). Asthma Control Test scores also increased during the trial. In addition, Hsia et al, 2020, compared the ASTHMAXcel app to actual in-person education. Both ASTHMAXcel and in-person education yielded improvement in asthma knowledge and satisfaction (Hsia, et al, 2020). In a related study, the authors applied the ASTHMAXcel Asthma Adventures game app to 39 pediatric patients ranging from 7 to 17 years old. The study measured asthma control, asthma knowledge, healthcare utilization, and patient satisfaction at three visits. Results found that patients improved in these categories between each visit, with the largest jump between the first and second visits, although there was sustained improvement between visits two and three (Hsia, et al, 2020). The authors concluded that the ASTHMAXcel Asthma Adventures gaming application improved asthma knowledge, quality of life, and decreased ED visits and the use of steroids (Hsia, et al, 2020).

This quality improvement project is an educational resource addition to discharge teaching for adolescent asthma patients. The resource is the parent mobile device application ASTHMAXcel and the subsequent pediatric application, Asthma Adventures (AA). The ASTHMAXcel app was developed by a team of asthma specialist physicians, behavioral psychologists, and software engineers. The app was created to improve understanding of asthma disease process and eliminate environmental triggers of asthma (Hsia, et al, 2020).

ASTHMAXcel consists of eleven chapters of interactive videos. The chapters are 'How asthma effects your airways', 'Medications and how these work', 'Rescue versus controller medications', 'Spacer use and inhaler technique', 'Peak flow monitoring', 'Asthma action plan', 'Outdoor environmental triggers', 'Indoor environmental triggers', 'Tobacco smoke and asthma', 'Exercise-induced asthma', and 'Cleaning your inhaler, spacer, and nebulizer parts'. Each chapter consists of a short video and summary related to the chapter topic. The app also requires initial demographic and disease-related information before beginning, as well as a survey after the last chapter.

The AA application is a pediatric geared derivative of the parent ASTHMAXcel app. The AA app consists of interactive movies, games, and quizzes in the form of a quest and battle scenarios (Hsia, et al, 2020). The goal is to involve pediatric patients in their asthma care and improved asthma control through fun, engaging activities. The AA app is a playable mobile device game which features five levels.

Most levels consist of a video, like the videos of the parent app, and a monster for the main character to battle. During each battle, the player is periodically asked questions based on the previous video. If the question is answered correctly, the monster loses health points. After the level, the player is given a focused survey. The levels include 'How asthma affects your

airways', 'Medications and how these work' and 'Priming', 'How to use an inhaler and spacer' and 'How to use a peak flow meter' and 'Asthma action plan', 'Environmental control- Pets, roaches, and mice' and 'Environmental control- Molds and dust mites', and 'Secondhand smoke' and 'Exercise-induced asthma' and 'Cleaning parts'. The final level is set up as a virtual bedroom where the player is tasked with finding nine objects that are considered asthma triggers and four items that improve asthma control. After each item selected, the player is asked an asthma-related question. The game is won by completing the final level successfully. The player is then given a follow-up survey.

As the efficacy of the application has already been studied and shown to improve asthma education, this intervention was meant to measure the implementation of these applications within the specialty office's in-person education among their adolescent asthma patients, during office visits.

Purpose and Specific Aim

This quality improvement project evaluated the feasibility of introducing education on a mobile device application to adolescent asthma patients during the education portion of the visit. The specific aim was to determine the delivery rate for providing patients education regarding the mobile application and to assess for barriers and facilitators to providing the education.

Conceptual Framework

The Iowa model is a framework developed to assist in researching, developing, and implementing a quality improvement change. Last updated in 2017, the Iowa Model is a step-by-step evidenced-based practice pathway to identify opportunities for patient care improvement (Buckwalter et al., 2017). Changes to the model included making the framework more "linear" so it is easier to follow, and separating out different parts of the pathway, including the addition

of "conducting research" as a step (Buckwalter et al., 2017). The steps are identifying a trigger, determine if the problem is a priority, form a team, gather, and analyze research, critique, and synthesize research, decide if there is reason to implement a practice change, implement the change, and evaluate results (Buckwalter et al., 2017). The Iowa model is used by clinicians, nurses, and researchers to identify a practice problem, conduct research, introduce a change based on EBP, and disseminate results for further improvement.

The theoretical framework used for this project is Lewin's Change Theory. Discussed in depth under "Intervention" the change theory breaks down change implementation into three factors: drive, barriers, and equilibrium. To effectively implement change, there must be a driving force to create plans and implement action toward the change (Lewin, 2020). Factors that would slow or suspend progression toward change are called barriers and can take many different forms, such as lack of resources, leadership, and direction (Lewin, 2020). Finally, while all change will have some element of drive and barriers, those two factors cannot be equal, otherwise there is no progression. In other words, the drive must be stronger than the barriers can prevent.

Procedures

The implementation of this project began with an in-service conducted by the DNP project lead. This was conducted during a lunchtime presentation for the entire office staff which included physicians, advanced practice registered nurses, registered nurses, medical assistants, secretaries, and the office manager. The in-service included a PowerPoint presentation of the ASTHMAXcel and AA applications.

During the presentation, the staff was given instruction on what the intervention was, how to use the applications, and what was expected of them. The staff was also shown the

resources to give to patients, two data entry logs, and the open-ended questions to be used for result measures. The resource provided was a handout (Appendix B) created by the DNP project lead based on the ASTHMAXcel website. The staff was instructed to give the resource to all patients who meet the criteria for application implementation and then to fill out the first data entry log (APPENDIX C).

Patients who met inclusion criteria for this discharge education were adolescents between ages 12 and 17 who have a diagnosis of asthma. The participants were given the resource handout with QR codes at the beginning of their visit. During the discharge education and instructions portion of the visit, the discharging nurse gave education of the two applications. The staff member then documented the interaction on the appropriate data entry log. The staff was instructed to document all patients who meet inclusion criteria, if the patient did not receive discharge education, then the staff member documented the barriers. The log included the date and time of the interaction, the age of the patient, if the patient received the education, and if not, then what were the barriers to implementation.

A second data entry log (Appendix D) was given to the staff for returning patients. If a patient reports that they received the education at a previous appointment, then the staff refrained from repeating the education and documented the encounter on a separate data entry log. This log included date, time, age, and if the patient downloaded and used the ASTHMAXcel applications.

This intervention was implemented for eight full weeks at the asthma specialist office. At the end of week four and week eight, the DNP project lead returned to the office during a lunch meeting and provided each pertinent staff member with two open-ended questions. The questions began with a signed preamble obtained from the IRB. In this question document, the

staff listed any barriers to education implementation. There was also a section on the document for open-ended feedback (APPENDIX E). The DNP project lead attempted to address these barriers. The DNP project lead made short visits to the office weekly during implementation to remind and encourage staff about the implementation and to answer any questions.

At the conclusion of week eight, the office manager provided a query of the total number of patients seen within the inclusion criteria during the project implementation process. The data was pulled from the office EMR system to ensure accuracy. At the end of implementation, the DNP project lead collected the data entry logs, questions, and performed data analysis.

Measures

This quality improvement project was measured using two data entry logs and two open-ended questions. The first log was completed by staff members each time they had an encounter with patients within inclusion criteria. The log included descriptive data of the encounter such as date, time, patient age, acknowledgement of education or failure to educate, and barriers. After the intervention implementation was completed, results of this tool were compiled and reviewed. To determine the total number of patients seen within the inclusion criteria the office manager queried the EMR and provided results to the DNP project lead. Results included only the total number of patients seen within the inclusion criteria and did not include any patient identifiers. The second data entry log was used for patients who reported receiving the education at a prior appointment. This log documented date, time, age, and if the patient downloaded and used the apps.

Two open-ended questions were used at weeks four and eight. The participants were asked to respond to open-ended question: What factors are preventing the ASTHMAXcel discharge education? The staff was also asked to provide constructive feedback on the bottom

portion of the questionnaire. Using the responses, the DNP project lead addressed recurring barriers if possible. A preamble consent was used in the questionnaire. The questions document also had a section for open-ended feedback regarding the project implementation.

Evaluation

Results were evaluated to determine the rate (by percentage) of inclusive patients receiving the discharge education. Evaluation also included any patients that followed up and the rate that downloaded and used the apps. The responses to the open-ended questions were reviewed and analyzed for recurring themes. The feedback was meant to be used as anecdotal evidence to identify project limitations and areas of improvement.

Dissemination

This project's results were shared with the private practice office where the intervention was performed. The final manuscript was disseminated through poster presentations and submitted for publication.

Ethics

This project was submitted to the University of Louisville IRB as a quality improvement project. Approval by allergy and asthma specialty office was obtained via approval letter from office manager and owner/primary physician (Appendix A). Only patient age and date and time of appointment were logged during implementation and those data logs have been appropriately disposed of in order to maintain all staff and patient privacy. No other patient identifiers were recorded.

Data Analysis and Results

The allergy and asthma specialty office site scheduled 56 adolescent patients during the implementation period. Of the scheduled patients, 13 individuals canceled for unreported reasons. The office saw 43 adolescent asthma patients during the implementation period. The education was offered to 36 patients. Of the 36 patients, 31 accepted the education and 5 refused the education (Figure 1).43a

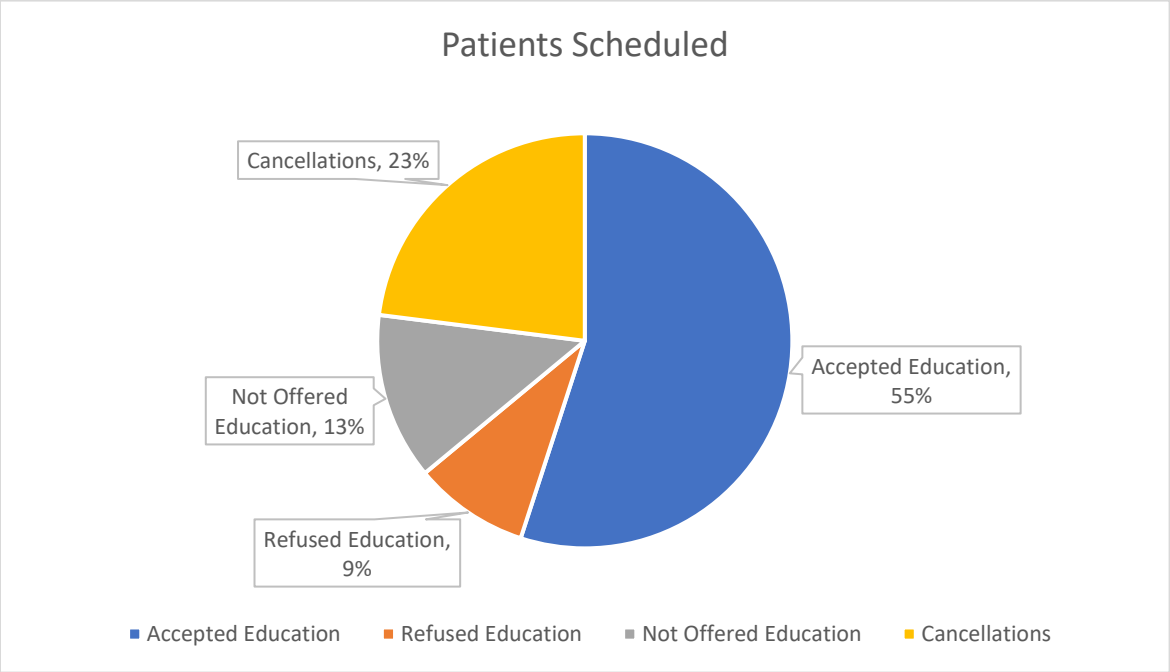

Fig 1

The results were analyzed by calculating the rate that the office staff implemented the education among the inclusive population. Due to cancellations, only 76.7% of the scheduled patients were seen. Within this group, 83.7% of the patients were offered the educational resource applications. Of the patients who were offered the intervention, 86% were receptive, while 14% refused the education. The five patients who refused the education were asked to give a reason for refusal. Three of the patients refused because they were in the office for sick

visits and did not feel well. One patient reported that they were there strictly to talk about allergy shots. One patient declined to give a reason for refusal.

Volume of patient ages seen, and implementation success rate were five 12-year-olds (67%), eight 13-year-olds (100%), nine 14-year-olds (88.9%), three 15-year-olds (100%), ten 16-year-olds (80%), and one 17-year-old (100%). The mean age seen was 14.2 years old (SD = 1.49, range 12–17 years of age) (Figure 2).

Of note, one 11-year-old patient saw the educational resources for the applications posted in the office and requested to receive the education as well. This patient is not included in any of the data analysis but the interest from a patient who was not originally approached by the staff is significant to the long-term usage of the applications by the office.

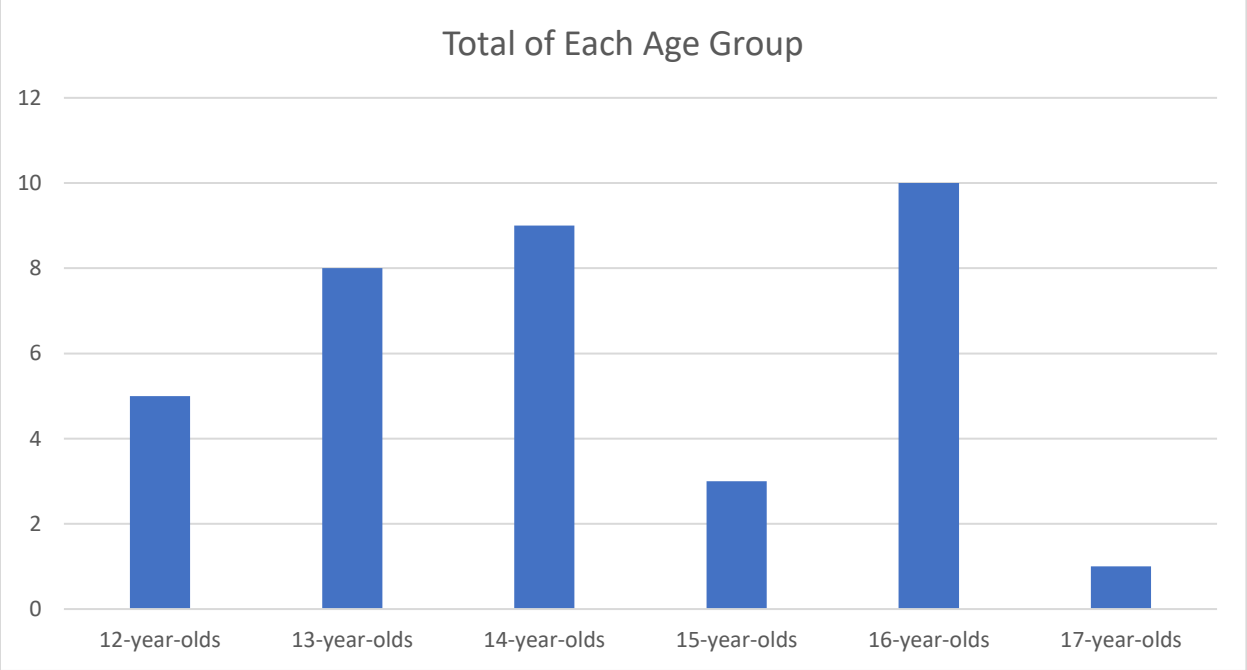

Fig 2

The office staff completed open-ended questions halfway through the implementation and at the end of the implementation. The first question asked about barriers to implementing the education. Apart from the few isolated, reported refusals, the staff responded that the major

barriers were things that prevented patients from making it into the office. Factors that interfered with office visits included illness, mostly related to the COVID-19 pandemic, and inclement weather. The staff did not provide constructive feedback on project implementation.

Discussion

As the most common chronic pediatric illness, asthma possess a great healthcare safety threat. As found in Kosse, et al, 2019, mobile device interventions improved asthma self-management and adherence. Measurements revealed that quality of care improved after the implementation of mobile device interventions (Kosse, et al, 2019). The findings in this study mirror Munteanu, et al, 2020's Romanian study which correlated smart phone applications with improved asthma control and self-management.

This study was performed to measure the rate at which an allergy specialist office would include a mobile device application in their discharge teachings for adolescent asthma patients. The application, ASTHMAXcel, was used as an additional resource for office staff to improve adolescent asthma healthcare literacy. The staff provided the education as directed and received high responses from the patients. With over 86% of the participating patients receiving education, the potential for increased healthcare literacy is much higher than without the intervention. Although this study does not follow the patients' progress, previous studies imply that the introduction of a smart phone application resource results in increased asthma quality of life and literacy. However, without follow-up, it is impossible to determine if the participants used the applications after they left the office. There seemed to be no discernible trend in implementation rates across individual age groups, with the lowest percentage being the 12-year-old group (67%) and the highest being the 13-year-old, 15-year-old, and 17-year-old age groups (100%). Only five participants declined the intervention. A common theme among these

patients was reason for the visit. Three of the five declining participants reported that they were at the office for sick visits. Another patient declined because they were there for an allergy shot consultation and the last patient did not provide a reason for declining. Reason for visit was the only trend established among the declining patients.

The high response by office staff is very encouraging for improving adolescent asthma management. Several studies support mobile device intervention over conventional resources or workshops in this age group. Studies about ASTHMAXcel in particular show that the applications can be as effective as in person class, while producing higher participation rates. Since the application is data supported, the implementation into discharge teaching should result in increased asthma understanding and improved asthma quality of life.

Upon review of the data results, it was reported that the office would be interested in integrating the applications into common practice discharge education. Due to the nature of both applications, the range is far broader than simply adolescents. Any patient with a smart phone has the capability to use one or both applications, from children to elderly.

Limitations

This QI project has several limitations. Since the participants were not notified beforehand the implementation was reliant on adherence to appointments. In many cases weather and illness caused scheduled appointment cancellations, decreasing the total overall patients seen during the implementation period. Another limitation is the need of the nurses to sacrifice their time to devote to the education. Due to the COVID-19 pandemic, the allergy office saw increases in patient loads, which effected staff time constraints with each patient. The pandemic also resulted in some staff absences. There were also a couple of staffing changes, which resulted in shifting of education responsibilities and required training of new staff.

Finally, this intervention is totally dependent on the patient's accessibility to a smart phone and applications, whether their own or their parent's.

Conclusion

Smart phone applications are shown to improve asthma management in the adolescent age group. ASTHMAXcel is a popular educational asthma related application which includes a game geared toward teenagers and children. As patient loads have increased, it has become difficult for providers to spend adequate time teaching patients and adolescents can be a difficult age group to reach with conventional educational tactics. Office staff at a private asthma specialty office used the provided ASTHMAXcel applications as an addition to their discharge education for adolescent asthma patients. The vast majority of inclusive patients were receptive to the education. The office staff agreed that the applications would be a good addition to their standard discharge process.

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APPENDIX A: Approval Letter

Allergy & .Asthma Specialists, P.S.C.

Lee S. Clore, Jr., MD - Board Certified Allergy/lmmunology

Sara J. Martin, APRN

3604 Wathens Crossing I Owensboro, KY 42301 | (270) 684-6144

www.owensboroallergy.com

November 9, 2021

To whom it may concern:

The purpose of this letter is to inform you that our team approves Stefan Swift's DNP project regarding Asthmaxcel application implementation.

Thank you,

Jean L. Owen, MBA
Practice Administrator

APPENDIX B: Sample Resource

ASTHMAXcel and Asthma Adventures

Available for IOS through the App store and for Android on Google Play

- Download both the ASTHMAXcel app and the Asthma Adventures
    - ASTHMAXcel has informational videos and reviews
    - Asthma Adventures has five levels to beat with monsters to battle and questions to answer
        - Each level starts with a short video with important information
        - The final level will require critical thinking to eliminate environmental asthma triggers and identify objects that improve asthma control
- Please complete each short survey after each level for the ASTHMAXcel database

If you have any questions, please contact Allergy & Asthma Specialists at (270) 684-6144

SCAN QR CODE BELOW TO PLAY NOW!

APPLE GOOGLE

APPENDIX C: Implementation Log

DNP Project Log

Adolescent Asthma Education Implementation

DATE	TIME	AGE	RECEIVED EDUCATION? Yes or No	BARRIERS

APPENDIX D: Follow Up Log

DNP Project Follow Up Log

DATE	TIME	AGE	Downloaded and Used Applications: Yes or No

APPENDIX E: Open-Ended Questions

Implementation and Evaluation of Asthma Education Cell Phone Application: ASTHMAXcel, Within an Allergy and Asthma Specialty Practice

Dear Participant:

You are being invited to participate in a quality improvement project about asthma mobile device resource implementation by answering questions in the attached survey. The purpose of this project is to include a mobile device application asthma education resource to adolescent asthma patients that is age-appropriate and easily accessible. This quality improvement project is conducted by Dr. Whitney Nash, Dr. Sara Robertson, and Michael Swift, BSN, RN, of the University of Louisville. There are no known risks for your participation in this quality improvement project. The information collected may not benefit you directly. The information learned in this project may be helpful to others. The information you provide will be collected and analyzed for barrier elimination and project enhancement. Your completed survey will be stored in a confidential file kept with the DNP primary investigator**.** The survey will take approximately ten minutes time to complete.

Individuals from the School of Nursing, the Institutional Review Board (IRB), the Human Subjects Protection Program Office (HSPPO), and other regulatory agencies may inspect these records. In all other respects, however, the data will be held in confidence to the extent permitted by law. Should the data be published, your identity will not be disclosed.

Taking part in this quality improvement project is voluntary. By answering survey questions, you agree to take part in this quality improvement project. You do not have to answer any questions that make you uncomfortable**.** You may choose not to take part at all. If you decide to be in this quality improvement project you may stop taking part at any time. If you decide not to be in this project or if you stop taking part at any time, you will not lose any benefits for which you may qualify.

If you have any questions about your rights as a participant in a quality improvement project, you may call the Human Subjects Protection Program Office at (502) 852-5188. You can discuss any questions about your rights as a participant in a quality improvement project, in private, with a member of the Institutional Review Board (IRB). The IRB is an independent committee made up of people from the University community, staff of the institutions, as well as people from the community not connected with these institutions. The IRB has reviewed this quality improvement project.

If you have any questions, concerns, or complaints about the quality improvement project, please contact: Michael Swift, BSN, RN, at (270) 315-3863

If you have concerns or complaints about the quality improvement project and you do not wish to give your name, you may call 1-877-852-1167. This is a 24-hour hot line answered by people who do not work at the University of Louisville.

Sincerely,

Michael S. Swift, BSN, RN

Barriers To ASTHMAXcel Implementation

What factors are preventing the ASTHMAXcel discharge education? Please list and explain below:

- _____
- _____
- _____
- _____
- _____
- _____
- _____

Below, please provide constructive feedback on DNP project implementation:

_____

_____

_____

_____

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