Title of Study: Phase 4: Improving Asthma Outcomes By Facilitating Patient-Centered Care At School (Asthma-Free School)

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1. ABSTRACT

This is a pilot study based on the community stakeholder-derived data from three previous Quality Improvement projects to improve the partnership between Cincinnati Children's Medical Center (CCHMC), Cincinnati Public Schools (CPS), and Cincinnati Health Department (CHD) to reduce the morbidity of childhood asthma in the inner city schools of Cincinnati and CCHMC. Through this work, we developed a preliminary understanding of school-based asthma care by defining barriers and identifying outcomes important to key stakeholders. These data were used to adapt and improve the 2008 to current Asthma Improvement Collaborative between CCHMC and CPS through the school health program of the CHD in order to test asthma outcomes in this pilot study. The CCHMC Asthma Center has an established working relationship with the CPS-CHD through the Asthma Improvement Collaborative. To address the concerning incidence of asthma in Greater Cincinnati, we are embarking on an innovative pilot to develop "asthma-free schools" in neighborhoods where the incidence of asthma is especially high. In partnership with CPS (Oyler, Roberts, Withrow, and School of Creative and Performing Arts schools), we intend to achieve asthma-free schools through school-based asthma care programs. High-risk asthmatic participants will be identified to participate. "High-risk" will be defined as poorly controlled asthma, frequent school absences, and/or need for daily controller asthma medications. A number of interventions will be incorporated into the pilot study of 30 participants including use of a commercially available inhaler cap monitoring sensor, a mobile software management platform that tracks adherence of all asthma medications, mobile based telehealth medical visits to assess asthma control, and mobile based telehealth adherence problem-solving interventions.

2. PURPOSE OF STUDY:
The purpose of this project is to adapt an existing CCHMC- CPS- CHD asthma infrastructure in order to address school-based asthma care barriers and then to test the efficacy of this program in a pilot study to improve asthma outcomes in 30 urban core youth.

The stakeholder feedback from Stages 1-3 (IRB 2014-6757, 2015-3056, 2015-4754) of our quality improvement (QI) project on barriers and outcomes for school-based asthma care was collected in order to determine the feasibility of a school-based asthma intervention. This work involved following stakeholder groups: school staff, school nurses, and primary care providers and the pooled anonymous data from these focus group has been used to design this asthma intervention. This project is a cross-over QI-research project which extends our current school-based QI work by the Pulmonary Medicine Asthma Center but tests the outcomes in a pilot study which will be used as part of a journal article submission and used as preliminary data for a NIH U01 grant application in 2016. A number of interventions will be incorporated into the pilot study of 30 participants including use of a commercially available inhaler cap monitoring sensor, a mobile software management platform that tracks adherence of all asthma medications, mobile based telehealth medical visits to assess asthma control, and mobile based telehealth adherence problem-solving interventions.

3. BACKGROUND:
Asthma is a common, complex and costly chronic condition in the U.S., resulting in nearly 2 million acute care visits and $56 billion in overall costs each year (Akinbami 2012). Of these patients, 5-20% have poorly controlled asthma accounting for nearly 50% of all asthma-related expenditures (Pakhale 2011).

Previous work done in this area: Greater Cincinnati's geography places it at the environmentally tricky confluence of low-lying smog-trapping hills, three heavily traveled interstate highways, and high rate of allergen exposure. This makes it an area ripe for asthma. The overall rate of pediatric asthma in Greater Cincinnati is more than twice the national average and, in some urban-core neighborhoods, as high as 10 times the national rate. At Cincinnati Children's, we see daily evidence of this in our Emergency Department, where as kids often arrive in asthma distress and in a high-rate of re-hospitalization in our Medicaid population. Poor asthma control across the nation and locally in Cincinnati is associated with an overrepresentation of children from minority groups, low-income families, and single parent households who have higher rates of financial hardship and familial strain compared those with well-controlled asthma (Moorman 2012, Beck 2014). Many of these high-risk children attend local Cincinnati Public Schools (CPS) and are cared for at Cincinnati Children's Hospital Medical Center (CCHMC). Barriers to asthma care in our population have previously been described (Mansour 2000) and ongoing quality improvement (QI) work at CCHMC which includes asthma education, written asthma action plans, post-hospitalization follow-up appointments, and medications in hand at discharge have reduced hospital readmissions. Yet, data from previous investigations and our internal data show that no more than 50% of patients keep appointments or fill prescriptions, leading to continued poor asthma control and risk for future exacerbation (Lozano 2003). A CCHMC-CPS-Cincinnati Health Department (CHD) asthma infrastructure has been developed (Mansour 2008) in order to address some of these barriers. However, many of these children still have poor asthma control and missed school days.

Successful management of a lifelong chronic medical condition is usually complex. Patients with persistent asthma typically require multiple medications, taken several times a day via different routes and use of complicated devices. Many of these children do not access preventative medical care for asthma and/or do not have adequate self-management skills to avoid or manage asthma exacerbations. These highest-risk asthma patients may need more intensive intervention rather than just traditional medical office clinic visits than those with intermittent or well-controlled asthma.

Previous studies indicate that a school-based asthma intervention with direct administration of asthma controller medication by a school nurse (Halterman 2011 and 2012) can improve asthma outcomes in children. Furthermore, the use of an innovative software sensor and interactive management platform, Propeller Health, in a community setting has also been shown to improve asthma outcomes in adults (Van Sickle 2013). However, the propeller platform has not been extensively tested in children or in the school setting. Up to 75% of adolescents 12-17 years and 85% of African-American children have access to a smartphone and over 80% of middle-schoolers have their own cell phone. Over 90 % of middle-schoolers and adolescents go online (ref: http://www.pewinternet.org/2015/04/09/teens-social-media-technology-2015/; http://cdn.theatlantic.com/static/mt/assets/science/Research%20Findings_%20MARC%202011%20Survey%20Grades%203-12.pdf). 71% of adolescents use at least one social media web-site with Facebook, Instagram, Snapchat, Twitter, Google+, Vine, and Tumblr being the most popular (ref: http://www.pewinternet.org/2015/04/09/teens-social-media-technology-2015/).

Current infrastructure for implementing this project: The CCHMC Asthma Center in partnership with the CCHMC Anderson Center for Community Health, the CHD and CPS have an in-school asthma improvement initiative in place called the Asthma Control Test (ACT) screening program. This program provides asthma screening in the fall to CPS participants in the school setting by CHD school nurses and consultation support through the CCHMC Asthma Center. This program is driven and has oversight through the CCHMC Population Health Community Committee, a multidisciplinary group representing the various stakeholders. For this project, we would identify potential focus group participants through the ACT screening program and through participant sick visits to the school nurses for asthma related problems. To address the concern of high rate of pediatric asthma hospitalizations in Greater Cincinnati, we are embarking on an innovative QI-research pilot to develop “asthma-free schools” in neighborhoods where the incidence of asthma is especially high.

4. STUDY DESIGN

This is an interventional pilot study based on the community stakeholder-derived data from three previous Quality Improvement projects to improve the partnership between CCHMC, CPS, and CHD to reduce the morbidity of childhood asthma in the inner city schools of Cincinnati and CCHMC. About 30 high-risk asthmatic participants will be identified to participate and a number of interventions will be incorporated including asthma specific questionnaires, use of a commercially available inhaler cap monitoring sensor, a mobile software management platform that tracks adherence of all asthma medications, mobile based telehealth medical visits to assess asthma control, and mobile based telehealth adherence problem-solving interventions.

This proposal is funded through a Luther Foundation and Verizon Foundation philanthropic gifts.

5. DURATION:

Duration for the participants will be 6 months. Participants will be enrolled in the study during the first year of the project. If necessary to complete enrollment the enrollment period will extend into the second school year. Data analysis will be performed 3 months after the last participant completes the project.

6. SELECTION & RECRUITMENT OF PARTICIPANTS:

A. Number of participants

Patient Population*:* 30 middle-schoolers/adolescents that attend a participating CPS (Oyler, Roberts, Withrow, and School of Creative and Performing Arts schools) will be recruited for a 6 month pilot study of testing the feasibility of a novel, school-based care delivery system to improve asthma outcomes. Given the relationship of the CCHMC Asthma Center with CPS and the CHD in our ongoing quality improvement work, the study investigators have contacts with the school staff, school nurses, and primary care providers associated with the following CPS (Oyler, Roberts, Withrow, and School of Creative and Performing arts). As part of this work, our team also helps the school nurses screen children with asthma to identify those with uncontrolled asthma and help the nurse's contact families to encourage them to establish or connect with an existing medical home to schedule an asthma visit and to obtain asthma medication.

B. Inclusion/Exclusion criteria

Inclusion

- age 10-17 years; history of provider-diagnosed asthma;
- history of uncontrolled asthma in the past 12 months (two ACT scores <20; ≥ 1 UC/ED visit or hospitalization for asthma, ≥2 prednisone bursts) with current persistent asthma as defined by NAEPP guidelines,
- and attendance at a participating school.

Age 10 years is the minimum age to engage the children in an adherence intervention based on CCHMC Adherence Center experience (Hommel, CCHMC Adherence Center, personal communication).

Exclusion

- active chronic disease apart from asthma or allergic disease
- plans to change schools during the school year

C. Recruitment

We have access to eligible middle-schoolers/adolescents from several sources: over 1000 middle-schoolers/adolescents that attend the participating CPS or middle-schoolers/adolescents cared for at the CCHMC ED or hospital units (~4000 per year) that attend a participating CPS. We anticipate that participants will have similar demographic characteristics as our current CPS population (18% Caucasians, 73%

Black, 5% More Than One Race) is comprised of over 70% of participants from low-income families.

The middle-schoolers/adolescents will be recruited by one of the following methods: 1) During the asthma screening process at the school as part of our QI work, 2) a school flyer, 3) CPS-CHD school nurse, 4) CCHMC provider, or 5) the child's primary care provider. Once a child is identified, the study team and school nurse will contact the family and screen for eligibility using a phone script.

We will utilize several successful strategies employed in our past research to retain families. We will implement the following; (1) stress confidentiality, (2) gather detailed information regarding names, addresses, and phone numbers of people who might know where the family is living in case they lose contact with the study, (3) adequate incentives, (4) provide email, phone and/or text reminders of upcoming study visits, (5) frequent mailings of birthday cards, holiday cards, and quarterly newsletters, (8) address tracing software via Accurint®, a subsidiary of NexisLexis, to search for families whose phone numbers become obsolete, (6) home-visits to confirm that the family continues to reside at the available address for those who lack telephone service, and (7) searching publically available resources including social-media websites. The study consent form contains information that we plan to contact them by phone call, text, email or Facebook.

Because this is a long - term study, with extended periods of time between research - related interactions, maintaining the cohort will be a challenging element of completing the research. In order to facilitate the retention of the cohort, specific information will be obtained during the first research encounter (and updated at all subsequent encounters). Although critically important to the successful completion of the research, if a participant expresses concern and or refuses to provide this information they will not be excluded from the research.

The information collected on data collection form, AFS contact form, will be used for this purpose.

Once collected this contact information will be stored in a separate secure database separate from the participants research - related information and will not be shared with additional participating sites, external research coordinating centers or as a part of the main study database.

In the event that a research participant becomes lost to follow - up and traditional re - contact methods (i.e. telephone, email, traditional mail, etc.) are unsuccessful, the use of a nationwide electronic search strategy will be employed. This will include general use of public web - based search functionality, and as a last resort, the use of a 3rd party service (Accurint). The use of Accurint to identify current contact information for a lost to follow-up research participant will be administered through a centralized standard process managed by the CCHMC Center for Clinical and Translational Science and Training (CCTST). Only the demographic/contact information *i*dentified above will be utilized for the purpose of facilitating the Accurint search function. Specific individual request will be submitted to a designated member of the CCTST staff that will perform the search using the Accurint functionality. CCTST staff will provide a report back to the research team that includes the most current available

contact information for the requested research participant(s). Records of each search will be maintained and be available for IRB review if needed.

The research team will attempt to re - contact the lost to follow - up participant. Once contact is re - established, the participants will be reminded of the research study and that they voluntarily agreed to participate, interest in continued participation will be verbally confirmed and documented and the participant will return to active study participation as appropriate based on their status/time point in the research.

Social Media Plan: This plan has been submitted for approval by the CCHMC Social Media Committee and is in compliance with the CCHMC Social Media Policy.
Executing searches on online social networking sites to look for individual middle-schoolers/adolescents and/or parent/guardians would aid our efforts in keeping in contact with these eligible and willing families. Searches on online social networking sites are only to recruit/retain individual middle-schoolers/adolescents, not to send out blanket recruitment messages on the web. Nor are they performed to harass or trouble middle-schoolers/adolescents that are not interested in participating. When searching online for a participant, we will be using the study-specific Facebook (or other social networking profile) page. General news on the wall must be limited to Cincinnati Children's updates and research news. We will ask participants and parent/guardians to “like” our study page and “friend” our study profiles. We will use state of the art confidentiality and privacy settings when “friending” occurs by setting our profile preferences commensurate with keeping all names and identities of all other “friends” hidden. Those who have “liked” the study page will not be allowed to view the names or profiles of others in the study.

For recruitment, the following is the type of message that will be sent to eligible participants identified by recruitment methods. This language is also consistent with what is proposed for the recruitment flyer.

Hi Anne, This is Jackie from Children’s Hospital and the Asthma Free School study. You could be eligible for a study where we are trying to see if providing asthma care at school could make your asthma easier to control. We have been trying to reach you and your caregiver about this project but have been unable to reach you via the phone or through the mail. Visit our Facebook page (www.Facebook.AsthmaFreeSchool) or call us at XXX-XXXX. If enrolled, you will get paid up to $550 for all of your time and effort (12 visits at school) and, you will receive a smart phone for your own use.

For retention, there are two broad categories of communication that will be launched through our Facebook page. First, we will send out study updates and general communication to participants who have “liked” the study page. For example,

Have you moved or gotten new phone numbers? Please call AsthmaFreeSchool (XXX-XXX-XXXX or Toll free at XXX XXX-XXX) or message us your new information through our Facebook page.

You are due for your asthma visit. Please call or text us (XXX-XXX-XXXX or Toll free at XXX XXX-XXX).

We will also utilize Facebook to reach out to participants that are challenging to make phone contact with after a referral and an introductory letter has been sent. Using a study account, study staff will conduct a Facebook search for the participant using their first and last name. The participant's identity will be verified by their date of birth and/or place of residence, if listed on Facebook. If the participant's identity cannot be verified, no message will be sent. If the participant is located and verified on Facebook, a private message will be sent to them from the study account informing them that that they are eligible for a research study at Children's Hospital and the study line phone number will be provided if they are interested in contacting the study staff or have questions. We will only utilize these methods to contact participants once an introductory letter has been sent to their current address.

Since social networking is one of the most common ways middle-schoolers/adolescents communicate we will use social networking to communicate directly with participants about scheduling their study visits. These individual communications will be sent securely though individual private messaging through social networking sites and will not be visible to anyone outside the study team. Hence, these communications will NOT appear in "news feeds" and are akin to email communications like those that are routinely used in studies of this kind.

It is possible that unintentionally these communications will appear in participants' "news feeds", but we will refrain from revealing any PHI in these communications and these updates will be benign in nature. These communications are designed to stay in contact with participants and remind them that they can contact us at any time. Our consent indicates that privacy cannot be guaranteed given that setting could be changed by Facebook without warning. We will not allow comments on the main page and participants will not be able to see each other.

In the consent/assent form, participants and parent/guardians will be told that, we will obtain information that will help us find them in case they move. This information includes several demographic details, various phone numbers, social networking screen names (if different than their name), and the names and addresses of close relatives or friends who will know of their whereabouts. Participants will be informed that we will use this information to locate them and that their information will be secured and will not be shared with anyone outside the study team. However, we will also inform them that social networking sites occasionally use personal information for targeted advertising and we do not have control over this. During the consent/assent, when participants are supplying the "demographic information" we will reiterate the fact that we will use this information to find them in case we lose track of their whereabouts. They will be reminded that we will not share this information with anyone outside the study team. Finally, participants will be informed that they may be eligible for follow-up assessments after the study has been completed and we will use this information to locate them in order to let them know of their eligibility for future research.

D. Vulnerable Populations

For participants under 18 years of age, additional efforts will be made to protect this vulnerable population. Assent will be obtained after age appropriate explanation of the study. The participant is informed that participation in research is voluntary and that they may decline or withdraw at any time for any reason independent of their

parent/guardian. Assent will be reaffirmed before study procedures are performed. They will be informed that participation in the research even though it may be on school property, will not affect their school grades, nor will it affect their clinical care in the school clinic and CCHMC.

E. FERPA and PPRA

In compliance with Statute: 20 U.S.C. § 1232h. Regulations: 34 CFR Part 98 to make provisions for

- *The right of parents to inspect, upon request, a survey created by a third party before the survey is administered or distributed by a school to students and the procedure for granting a request by a parent for such access.*

The survey/questionnaire materials and handouts used in this study will be handed to the parent for review prior to the child receiving them or filling them out. This will occur at the initial visit (Visit 1) when parental informed consent will be obtained and where parental participation at the visit is required by the study protocol. These documents are listed in the attached document AFS Study Visit Table.

7. PROCESS OF OBTAINING CONSENT:

If the parent and child/adolescent state they are interested in the study on the screening phone call, the team will schedule a visit in one of the following locations: the home, CCHMC, school nurse office or school-based health clinic, whichever location is more convenient for the family to consent the parent/legal guardian(s) and obtain assent from the child/adolescent. The consent form includes a modified language from the CCHMC standard consent used to obtain participant consent for a CCHMC clinical telehealth visit.

We are requesting a waiver of written consent for the screening phone call that will include review of medical history information and inclusion/exclusion criteria. An IRB approved phone script will be used. We are asking for a waiver of written HIPAA authorization to identify potential participants by review of school clinic health data records for inclusion/exclusion criteria and contact information/phone number. Signed HIPAA authorization will be obtained at the time of written informed consent.

The subject or the subject and his or her parent will be given the consent for the study and it will be reviewed and time given for questions. The subject will sign the assent or consent after all questions are answered and a signed copy of the consent form will be given to the subject to keep. The subject will be informed that this research is voluntary and that they are able to withdraw at any time. No study related procedures will be done prior to consent being signed.

For participants under age 18, age of assent will be determined by the IRB and those assenting will sign after all questions are answered.

For non-English speaking participants

Because this is a small pilot and heavily dependent on English fluency for teleconference interviews and questionnaires, only participants who are fluent in English will be enrolled. If a parent is non-English speaking, the PI will determine if the subject can be enrolled based on subject's fluency. If a non-English speaking parent will be giving Parental

Permission, the research team will use a short form consent process as per CCHMC SOP 41-1.8. The approved long consent form will serve as the summary of the research.

8. STUDY PROCEDURES:

Visit	Screening Phone call	Visit 1	Visit 2	Self-Management Visit 1	Visit 3	Self-Management Visit 2	Self-Management Visit 3	Visit 4	Self-Management Visit 4	Self-Management Visit 5	Visit 5	Visit 6	Visit 7
Time		Day 1	Month 1	Month 1½	Month 2	Month 2	Month 2½	Month 3	Month 3	Month 3½	Month 4	Month 5	Month 6
Place		H/CCHMC / SNO/ SHC		SNO/SHC	SNO/SHC	SNO/SHC	SNO/SHC	SNO/SHC	SNO/SHC	SNO/SHC			
Procedures													
Telehealth visit		x		x	x	x	x	x	x	x			
Motivational Interview				**x**	**x**	**x**	**x**	**x**	**x**	**x**			
Questionnaires		x	x		x			x			x	x	x
Asthma education		x											
ACT		x	x		x			x			x	x	x
TreatSmart (Web Based)												x	x
Prescriptions as needed		x	x		x			x			x	x	x
Review Smart Cap use			x		x			x			x	x	x
Dispense smart phone and preloaded data plan		x											
Dispense propeller Health cap		x											
Propeller Health system education/load on smart phone			x										

H=Home
SNO=School Nurse Office
SHC=School Health Clinic

The study length is 6 months. 30 participants will be enrolled over 3 months during the 2015-2016 school year. Propeller, TreatSmart program and ACT screenshots are located in the Appendix.

There will be Post-Visit Surveys for subjects, parents and nurses that will be done periodically throughout the study. Survey participants will receive e-mails from the study team through RedCap for the surveys to be completed online directly into RedCap. The purpose of the surveys is feedback for effectiveness/satisfaction with the telehealth and propeller device. All participants who complete their response to the Post-Visit Surveys (subject, parent, school nurses) will receive $10 added to their ClinCard. Nurses may be approached and asked follow-up questions regarding their perceptions of the study (see appendix X).

Visit 1- Baseline Medical Visit: This visit will be conducted in one of the following locations: the home, CCHMC, school nurse office or school-based health clinic, whichever location is more convenient for the family.

The coordinator will consent the parent/legal guardian(s) and obtain assent from the child/adolescent. Baseline questionnaires will be completed by a parent/guardian and participant and the study visits and procedures will be explained. A smart phone prepared by the CCHMC IT team with a data plan will be provided to the participant.

Basic asthma education will be provided. The study coordinator will conduct this visit. The participant will complete an Asthma Control Test (ACT) and the study coordinator will assist the participant to complete the TreatSmart program on a CCHMC secured laptop. The TreatSmart software web-based program, developed at CCHMC and hosted on a CCHMC secure server, will be used to determine the participant's symptom burden, health care utilization, systemic corticosteroid use, and current medication use to determine the level of asthma severity/control the participant has. The program also makes an initial treatment recommendation based on the National Asthma Education and Prevention Program (NAEPP asthma guidelines) if the participant's asthma meets the definition of persistent asthma and if their treatment dose should remain the same or be changed based on their level of control. This program will also produce a visit summary and asthma action plan. The TreatSmart program takes approximately 10 minutes to complete.

After the TreatSmart program is completed, the study coordinator would connect with a CCHMC Asthma Center asthma pulmonary or allergy specialist investigator (Guilbert, Kercsmar, McDowell, Durrani) to conduct a telehealth visit using CCHMC-provider Jabber software on the laptop (similar to Skype but HIPAA compliant) to perform a physical exam, review the TreatSmart program visit summary and treatment recommendations and make a final decision of the level of asthma control and asthma medication needed. The laptop-based Jabber software has been implemented successfully in other clinical visits through the CCHMC Telehealth Program. The visit summary, asthma medication recommendation and asthma action plan from the medical visit will be documented in the CCHMC medical record as a telehealth visit and physically given, mailed or faxed to the participant, family, school nurse and primary care provider by the study team. Through our QI work, the school nurses and community primary care providers have read-only access of EPIC and can access these medical records after this visit.

If no change in current asthma medication required: The study coordinator will place the Propeller Health monitoring caps on the participant's current inhalers, register the Propeller Health inhaler monitoring caps with Propeller Health, and review how to take the medication with the participant. Prescriptions for asthma medications and inhaler spacers will be written by the study physician and sent to a delivery pharmacy as required.

If new asthma medication required: Prescriptions for asthma medications and inhaler spacers will be written by the study physician and sent to a delivery pharmacy if required. The medications will be delivered to a central location; either the school nurse office, school-based clinic or CCHMC depending on the school and family's preference. The study coordinator will place the Propeller Health monitoring caps on the inhalers and arrange a time for the participant to pick up their medications at school or deliver them to their house, sync the inhaler caps with their smartphone app, and review how to take the medication with the participant. Prescriptions for asthma medications and inhaler spacers will be written by the study physician and sent to a delivery pharmacy as required.

Visit 2 - Visit 7: These visits will be conducted in one of the following locations: school nurse office, school conference room or school-based health clinic. These visits will occur at school or CCHMC over the lunch hour, during a study hall or non-core class, or afterschool. The study visits may be combined with school clinic visits with routine clinic care including vital signs and asthma assessments delivered by the school nurse or their assigned nursing students. Parent/guardian participation is not required for these visits. At visit 2, the coordinator will sync the Propeller app on the participant's cell phone and

the Propeller Health web platform with the inhaler caps so they and their family can see their inhaler use data for the rest of the study.

Each visit, the participants will be encouraged to use only the inhalers with the caps on them and given instructions to call the study team for replacements if they lose their medications.

After the baseline visit, 6 monthly medical Study Visits will be scheduled to assess the participant's level of asthma control and adjust the asthma medications as needed by the TreatSmart program using the same procedures as outlined above in the baseline medical visit.

Procedures done at these visits include:

- Questionnaires, ACT, TreatSmart
- Review of adherence from Propeller cap data
- Telehealth visit and medical evaluation
- Review of prescriptions and adjustment as needed
- Post-visit REDCap survey link will be emailed to the parent after medical visits 1 and 6 to solicit feedback on the telehealth visit to elicit feedback on participating in the study and use of the Propeller and telehealth technology.
- Post-visit REDCap survey link will be emailed to the child after the V2 and V6 medical visits and the first adherence visit to solicit feedback on the telehealth visit to elicit feedback on participating in the study and use of the Propeller and telehealth technology. The content of the survey is similar to the parent survey, The parent will be informed at the time they take the survey that a similar survey will be sent to their child and to contact the study team if they have questions or concerns about the survey content.
- Post-visit REDCap survey link will be emailed to participating school nurses, nurse practitioners, and primary care physicians after medical visit 6 to elicit feedback on participating in the study and use of the Propeller and telehealth technology. School nurses or nurse practitioners may be approached and asked follow-up questions regarding their perceptions of the study (see appendix X).

Adherence/Self-Management Visits. These visits will occur at school or CCHMC over the lunch hour, during a study hall or non-core class, or afterschool in a private conference room, school nurse office or school-based health clinic as available. To minimize lost classroom time, these visits will be scheduled separately from the medical Study Visits. An adherence visit summary will be documented in the CCHMC medical record as a telehealth visit. Through our QI work, the school nurses and community primary care providers have read-only access of EPIC and can access these medical records after this visit. Parent/guardian participation is not required for these visits.

Starting at 6 weeks into the study, **every 2 weeks** the participant will receive **self-management visits** (total of 5) with the goal to improve inhaler adherence. The participant will meet with the CCHMC Adherence Health Psychology team investigators. Adherence data from the Propeller Health monitoring system will also be reviewed with the participant by the adherence specialist during adherence visits and the study coordinator during

medical visits. The study coordinator will help the participant connect to the Adherence team using the secure Telehealth Jabber software on the CCHMC laptop. The adherence specialist will also provide customized supportive text messages originating from the CCHMC email system to the participant's study phone. Text messages will not include personal health information, but instead will provide support and reminders related to adherence (e.g., Hello, remember to use your inhaler today!, Don't forget to put a reminder in your locker, Have you been using your monitoring log?).

A meal or snack will be provided to the participant.

Other:
PCP communication:
Based on the community primary care provider (PCP) focus group feedback, the primary care providers will have 2 business days to communicate back to the study team with any concerns about the proposed medication plan and the study physicians will reach out and come to a consensus regarding the asthma medication and new prescriptions will be provided based on the consensus plan.

If the participant does not have a primary care provider, we will follow the current standard of practice at school where the school nurse provides the family a list of practices close to the school. If contact is made with a primary care physician, we will include them in the study as outlined above.

Propeller Health Inhaler monitoring and Web-based Platform During the Study Visit 1:
Propeller Health, a web-based inhaler cap monitoring sensor and mobile software management platform will be used to monitor how frequently the participant uses their inhaled asthma medication (Appendix A). The monitoring cap will be placed on both the controller and rescue inhalers by the study team and they will be registered with Propeller Health. The inhaler use will be recorded on the web platform. Starting at Study Visit 2, a mobile-based app program will be available for both android and IOS platforms and will allows the participant and family to interact directly with the platform. This is a FDA approved, HIPAA compliant device that has been demonstrated to improve asthma outcomes and adherence measures. This equipment has been approved by the CCHMC Equipment committee pending approval by the IRB. A contract and data use agreement is currently being reviewed by the CCHMC legal and business offices.

During the first month of the study, we will establish the participant's baseline adherence to daily asthma controller medication and need for rescue short-acting beta-agonist. Thus, the study team, school nurse, participant and family will be blinded to this baseline data collection.

Propeller Health Inhaler monitoring and Web-based Platform during Study Visits 2-6:
At the second study visit, the Propeller Health platform will be turned on and data on the participant's baseline adherence to daily asthma controller medication and need for rescue short-acting beta-agonist shared with the study team, participant, family, school nurse, and primary care physician. Starting at the second medical visit, the participant and parent/guardian will receive access to the Propeller Health online interface either through their smartphones displaying maps and charts of the participant's inhaler usage (Appendix A). The participant and family will receive a weekly summary of the time and location for each controller and rescue inhaler use and summarized use for the preceding week (Appendix B). They will also receive cell phone alerts from the Propeller Health app when

the use rescue medication prompting them to select their symptoms and triggers based on a pre-populated list.

Based on stakeholder feedback, the school nurse and community primary care physician stakeholders will also receive monthly summary e-mail or faxed reports with the time and location for each controller and rescue inhaler use and summarized use for the preceding month. The study team will be able to see each patient's adherence data through the Propeller Health web portal and receive alerts when a patient changes asthma control status or uses more albuterol than baseline. Access to the Propeller Health portal for a specific participant cared for by the school nurse or primary care physician will also be offered. This data will also be summarized in the participant's CCHMC EPIC medical record.

Asthma Exacerbations:
The current standard of care for middle-schoolers/adolescents who have an acute exacerbation of asthma symptoms is for them to go to the school nurse or health-aide for evaluation and management. The child's asthma action plan also contains advice for handling increased or severe asthma exacerbations. A recommendation is made to the family to take the child for evaluation to their PCP or urgent care. This visit will be documented in the CHD medical record and will be collected at the monthly study visits. The school nurse will also be encouraged to contact the study team if additional advice on asthma treatment of a study participant is desired.

In addition, the CCHMC study team will receive a Propeller Health daily report of participants that have not taken their daily controller medication in the last 7 days, have changed their asthma symptoms control level, or have experienced a 200% increase in their rescue medication use in the past 24 hrs. The study team will communicate with both the school nurse and the participant to gather more information on the severity of their asthma symptoms using the Phone Call Exacerbation Form. If the participant is experiencing severe symptoms, they will be encouraged to be urgently evaluated by the school nurse, school-based health clinic, community primary care provider, or a local urgent care or emergency department.

Study Termination. During each medical visit, the number of severe asthma exacerbations [treated with $\geq$ 4 days of systemic steroids; $\geq$ 2 hospitalizations for asthma; $\geq$1 PICU admission, intubation or hypoxic seizure due to asthma] since the start of the study will be determined. If the participant has $\geq$ 4 severe asthma exacerbations, study participation will be ended. The procedures for the end of study will also be followed with the recommendation of referral to the CCHMC Difficult-to-Treat Asthma Clinic.

End of study. At the end of the study, the participant and their parents/legal guardians will be given a letter which summarizes which medication the participant was prescribed at the last month of the study. The study team will make sure that the participant has 2 additional refills at the end of the study. The letter will encourage them to make an appointment and visit their primary care physician within 2 months of the study end. Information on how to make an appointment at CCHMC Asthma Center will also be provided.

9. DATA ANALYSIS/METHODS:

Study Outcomes:

The adolescent's asthma outcomes and adherence will be measured at baseline and during the monthly medical visits for a total of 6 months. Outcomes will be measured during the monthly medical visits using a computerized TreatSmart program based on the NAEPP asthma guidelines which was adapted by the CCHMC Asthma Center database team from the Inner City Asthma Coalition (Appendix B), ACT scores (Appendix C), and Propeller Health web-based inhaler cap monitoring sensor and mobile software management platform (Appendix A).

Primary Outcome:

Two-week histories of asthma symptoms measured per month (daytime symptoms, nighttime symptoms, or activity limitations) during the intervention period (from completion of the first month to study exit). The symptoms will be measured by a two-week recall of adolescent captured by the TreatSmart program.

Secondary Outcomes:

ACT score over past 4 weeks; rescue medication use (Propeller Health monitoring), oral-steroid requiring exacerbations questionnaires (2-week recall TreatSmart program); school absences (parent and subject report), adherence of controller medication (Propeller Health monitoring).

The asthma symptom burden, ACT score, exacerbation, healthcare utilization outcomes are commonly reported in both the adult and pediatric asthma literature, are endorsed by national asthma guidelines and the National Institutes of Health (NIH) asthma-outcome conference, and will also be measured.

Data Analysis

We will use descriptive statistics to characterize the sample demographics. A descriptive analysis with calculation of means, medians, and standard deviations will be performed for each continuous measure; categorical measures will be examined with percentages. We used paired t-tests to evaluate the null hypothesis that there was no change in the primary outcomes (two-week histories of daytime symptoms, nighttime symptoms, or activity limitations) while participants are blinded to data collected by the Propeller medication sensor in the first month of participation. Nonparametric methods will be used if the assumptions for paired t-tests are violated. The primary analyses will test whether the school-based interventional program improves two-week histories of asthma symptoms measured per month (daytime symptoms, nighttime symptoms, or activity limitations) during the intervention period (from completion of the first month to study exit). Linear mixed effects models with a random effect for subject assessed changes in primary asthma endpoints across the five subsequent months of enrollment (at the completion of the first month, the second month, the third month, the fourth month and the fifth month upon exit) when participants will be able to access their usage data online. Participants with one or more observations will be included in the analysis. All statistical analyses will be implemented in SAS 9.3 (SAS Institute, Cary, NC) and use a significance level of 0.05. Potential confounders identified from the literature, such as age, gender, season of enrollment, severity of asthma at baseline, smoke exposure, history of allergic disease, will be adjusted in the analyses. The REML model used for these analyses requires that any missing data are "missing at random" (MAR) to yield valid estimates. In order to account for the presence of possible non-ignorable missing data, pattern-mixture modeling will be applied for these analyses.

The secondary analyses will look at the health system utilization, rescue medication use, adherence and lost school days. Linear mixed-effect models will be used to compare the continuous outcomes such as lost school days. Generalized linear mixed effect models will be used to compare the discrete outcomes such as health system utilization, both accounting for repeated measurement over time while adjusting for confounders.

Future use

The de-identified data may be used for future research, analysis or recruitment. All reidentification codes will be destroyed.

10. FACILITIES and PERFORMANCE SITES:

External sites will be at Cincinnati Public Schools or home of the participant or the Cincinnati Children's Hospital and Medical Center CCHMC Pulmonary Division and CTRC.

11. POTENTIAL BENEFITS:

Participants will have direct benefit of being closely monitoring for their asthma and clinical care. The future benefit is to strive to develop "asthma-free schools" in neighborhoods where the incidence of asthma is especially high.

12. POTENTIAL RISKS, DISCOMFORTS, INCONVENIENCES AND PRECAUTIONS:

The risks to participants are minimal and include:

- Missed school classroom time to participate in the school study visits: Efforts will be made to minimize testing during class time such as conducting them over the lunch hour, during study halls or non-core classes, or afterschool.
- Asthma Questionnaires: There is a slight inconvenience to the family in the time required to answer questionnaires.
- Confidentiality: There is a slight risk of unintentional release of PHI.

Concerns about Access Adult Websites and Apps on Cell Phones:

Participants will be provided with a cellular phone for use over a 6 month period. During the consenting and assenting process, participants will be asked to use the cellphone "as they normally would use any smartphone that has internet access". We have gone to great lengths to make the cell phones provided easy to use and compelling in terms of incentives and features so that participant will use the cell phone provided as opposed to other cell phones they likely have. However, for this endeavor to be successful, participants must feel confident that their phone activity--how they normally use the phone--will not be met with repercussion or reprimand.

We considered only installing the Propeller Health software apps and severely restricting the internet website allowed to be accessed on the study cell phones. However, this would create an "unnatural" cell phone use environment for those participants that had not previously been exposed to filtering and would cause them to not use the study cell phone as their main device they carry with them. Therefore, we have consulted closely with CCHMC's IT and Office of Research Compliance to adequately design the following

procedures for informing parent/guardians of their options, and adhering to parent/guardians' wishes, while not compromising the integrity of the study. Hence, the smart phones will be loaded with a security software program Air Watch and include a basic package of social media apps that middle-schoolers and adolescents frequently use. We will list out for the parent/guardians that apps are installed on the phone and brief descriptions of the risks and benefits and they will be told this is similar to their teen's current cell phone. After being informed, parent/guardians and participants will then be given an instruction sheet (See Appendix B) on how to use the cell phone. Within this instruction sheet there will be instructions on how to add apps by using the family's apple ID account or removing apps from the cell phone if the participants or parent/guardian desire. However, CCHMC IT will be alerted if the Propeller Health app is removed from the phone. The Air Watch security software enforces specific security measures, such as passcode and encryption. The study team working with the CCHMC IT department will be able to erase all content in the event of a lost/stolen device. The Air Watch security software does not monitor the participants' usage or personal information. Internet access on the smartphone is being restricted with Apple's built in Adult Content Filter for the Safari web browser. This content filter does its best to block websites with inappropriate content. The Internet content filter can identify, with a high degree of accuracy, whether a Web page is safe or not by examining various properties of the website including text and structure. The content filter is being managed by the Air Watch security software and cannot be removed.

13. RISK/BENEFIT ANALYSIS:

This study is minimal risk with direct benefit to the participants. It builds on the CCHMC-CPS-CHD existing asthma QI program to improve asthma care and it provides more comprehensive asthma management and monitoring than many of these participants currently receive.

14. DATA SAFETY & MONITORING:

DSMP:

The Data Safety and Monitoring Plan (DSMP) will consist of a Steering Committee made up of Dr. Guilbert and key study personnel. The committee will meet a annually to review adverse events and to provide oversight and coordination of project management, research administration, publications and data sharing, and integration of all resources needed for the project.

Adverse Events:

Events that are unexpected and related to the conduct of medical or adherence visits or asthma symptoms will be reported promptly to the IRB according to IRB policy. Serious, life threatening events that are related to study related procedures will be reported to the IRB within 48 business hours. All other adverse events that happen in the course of study procedures as well as minor deviations from protocol will be reported in table form at the next continuing review.

Any untoward or unfavorable medical occurrence associated with the subject's participation in the research, whether or not considered related to the subject's participation in the research (modified from the definition of adverse events in the 1996 International Conference on Harmonization E-6 Guidelines for Good Clinical Practice) (from OHRP "Guidance on Reviewing and Reporting Unanticipated Problems Involving

Risks to Subjects or Others and Adverse Events (1/15/07)" http://www.hhs.gov/ohrp/policy/advevntguid.html#Q2).

For this study, the occurrence of wheezing episodes and the development of allergic rhinitis are anticipated events and will be recorded as expected AEs. This information will also be collected on other study forms. Fluctuations in the status of pre-existing atopic dermatitis, a process that is expected to wax and wane in severity, will not be recorded as an AE unless, in the opinion of the site investigator, the degree of deterioration is unexpected for the participant.

An adverse event or suspected adverse reaction is considered "unexpected" if it is not listed is not consistent with the risk information described in the general investigational plan.

An adverse event or suspected adverse reaction is considered "serious" if, in the view of either the investigator, it results in any of the following outcomes (21 CFR 312.32(a)):

1. Death.
2. A life-threatening event: An AE or SAR is considered "life-threatening" if, in the view of either the investigator its occurrence places the subject at immediate risk of death. It does not include an AE or SAR that, had it occurred in a more severe form, might have caused death.
3. Inpatient hospitalization or prolongation of existing hospitalization.
4. Persistent or significant incapacity or substantial disruption of the ability to conduct normal life functions.
5. Congenital anomaly or birth defect.
6. Important medical events that may not result in death, be life threatening, or require hospitalization may be considered serious when, based upon appropriate medical judgment, they may jeopardize the subject and may require medical or surgical intervention to prevent one of the outcomes listed above.

Wheezing episodes and exacerbations of asthma are anticipated events in the population under study even when receiving standard of care therapy. A hospitalization for wheezing or asthma will not be recorded as an SAE unless it is considered a serious and unexpected suspected adverse reaction SUSAR (9.3.2). All other hospitalizations will be recorded in the case reporting forms.

Review with family of possible adverse events will be done at medical visits and follow-up phone calls by the research coordinator if adverse events occur, will be documented. Adverse events will be recorded on an Adverse Event Reporting Form and will be reviewed at the meeting of the Steering committee.

If a parent/guardian response or complaint is not an expected adverse event (see section 4) or if the adverse event presents with greater than expected severity, the adverse event will be brought to the Investigator's attention in a timely manner for evaluation. The reviewing investigator will determine if the event is a Reportable Event as defined below.

Definition of Reportable Events

Reportable events must fall into one of the categories below:

1. Adverse event that is BOTH unexpected AND related or possibly related to participation in the research. This is regardless of whether internal or external site or seriousness.

2. An event that requires a change to the protocol or informed consent.
3. Information that indicates a change to the risks or potential benefits of the research.
4. Breach of confidentiality.
5. Change in labeling or withdrawal from marketing for safety reasons of a device used in research protocol.
6. Change to protocol made without prior IRB review to eliminate an apparent immediate hazard to a research participant.
7. Protocol violation that harmed a participant or others or indicates that participants or others are at increased risk of harm.
8. Incarceration of a participant in a protocol not approved to enroll prisoners.
9. Complaint of a participant that indicates unexpected risks or cannot be resolved by the research team.
10. Other unanticipated problem posing potential risk to participants or others comparable to the events listed above that are BOTH unexpected/unanticipated AND have a reasonable possibility of relatedness to the research.
11. INVESTIGATIONAL DEVICES: Unanticipated adverse device effect, deviation from the protocol to protect the life of a subject in an emergency, or any use of the without obtaining informed consent.

15. PRIVACY and CONFIDENTIALITY:

Confidentiality of Participant Data:

Precautions to protect the privacy of participant data include:

- Participants will be given a study ID that does not include any personal identifiers for study records and questionnaire data stored outside of CCHMC EPIC.
- A study ID not related to any PHI will be used in the study database.
- All electronic research data will be reviewed by the statisticians without PHI.
- The ID code and the research records will be maintained in a secured location and/or in password protected databases.
- Summary of the school-based medical and adherence visits will be documented in the CCHMC EPIC medical record which can be accessed by school nurses and community primary care physicians who have been granted read-only access by CCHMC.
- Propeller Health data is stored on a HIPPA compliant server and has been approved by CCHMC IT and equipment committee.
- TreatSmart program and data are located on a CCHMC secure server.

To minimize risk, the source document will be kept in the research record and stored in a secure location. Data will be entered into password protected databases with participants identified with a study number that contains no PHI. To minimize the inconvenience, we are limiting administration of the baseline questionnaires to the baseline visit. The adherence questionnaire will be given at the first and last medical visit. The TreatSmart program will take 10 minutes to complete.

16. COST OF PARTICIPATION:

There is no cost to participants for the phone, data plan, Propeller caps or for medical care received as part of the study visits.

The cost of prescriptions and sick visits will be the responsibility of the subject and their insurance.

17. PAYMENT FOR PARTICIPATION: *

This compensation is for reimbursement of time for the parent/guardians and participants for time spent in visit and as an honorarium for their ongoing participation.

All compensation given to participants will be in the form of ClinCard. A ClinCard is a reloadable debit card. Incentives will be loaded onto the card after each visit according to the payment schedule. Participants will receive a handout to explain the use of the card. Participants will receive a graduated amount to facilitate retention.

Parent/guardians will receive $20 for completing questionnaires at the baseline visit.

We will provide the participants with payment as they progress through the study visits.

Visits	Amount
V1	$100
V2	$20
V3	$25
V4	$30
V5	$35
V6	$40
V7	$150

Self Management Only Visits	Amount
1 ½ month Visit	$30
2 month Visit	$30
2 ½ month Visit	$30
3 month Visit	$30
3 ½ month Visit	$30

For the Study Visit 2-7: We will also provide the participant with a meal or snack valued at approximately $10 from a local restaurant such as Subway, Chipotle or Chick-Fil-A. An additional $10 or an item valued at approximately $10 will be given if Propeller caps are returned each month to place on new inhalers.

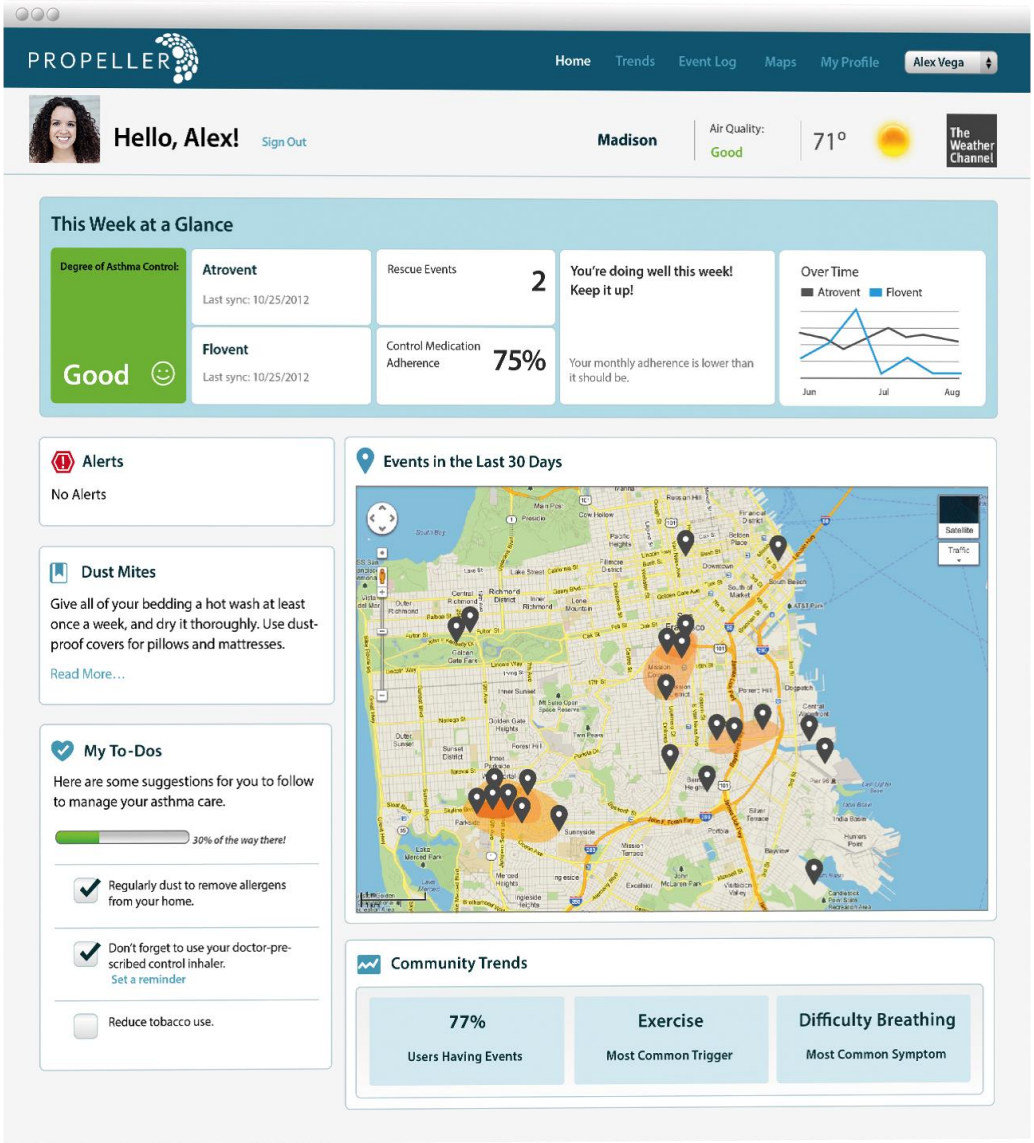
For the Adherence Only visits: We will also provide the participant with a meal or snack valued at approximately $10 from a local restaurant such as Subway, Chipotle or Chick-Fil-A.

For Study Visit 7: The participant will be given the cell phone used in the study to keep but the data plan will be stopped and reset to factory settings.

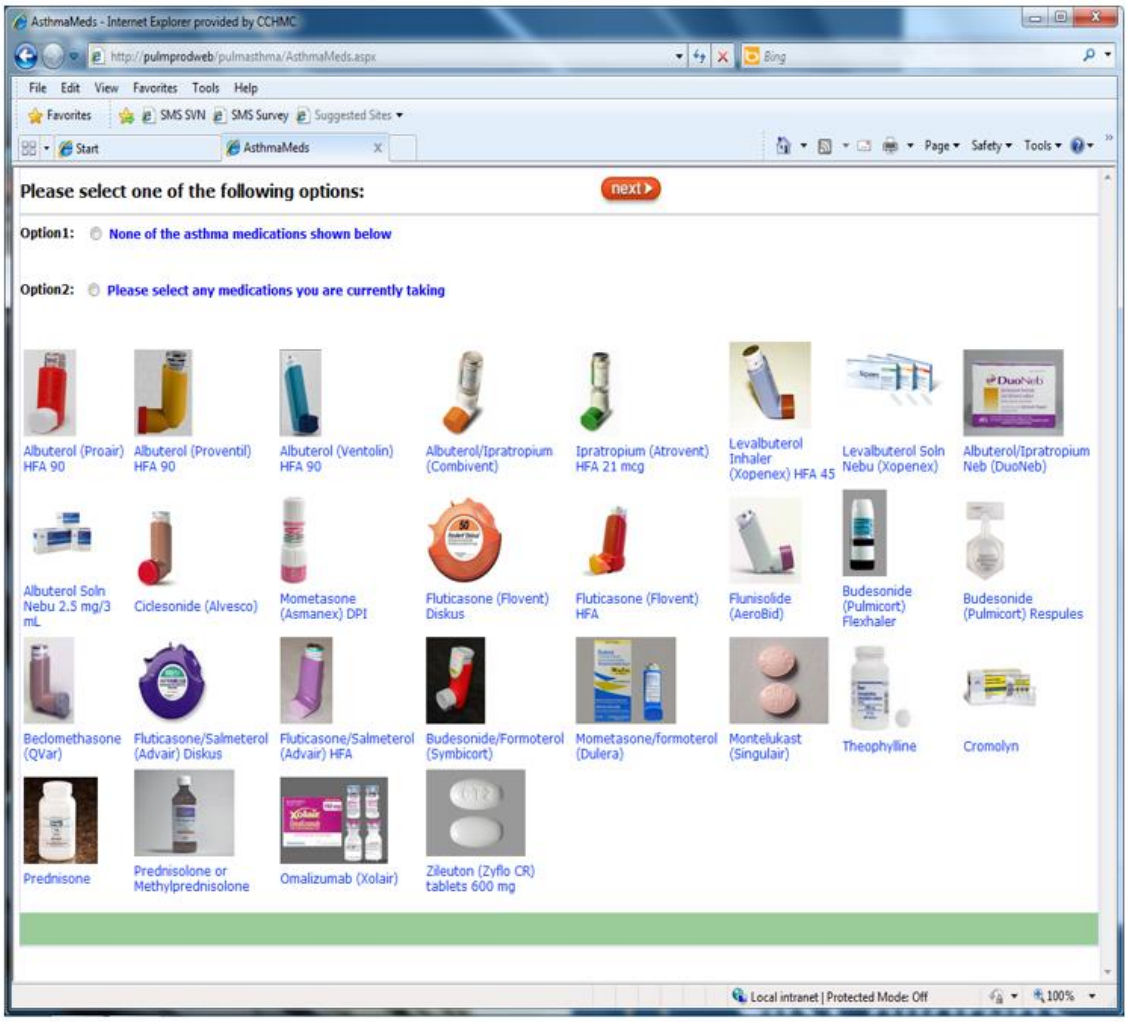
For Post-Visit Surveys:

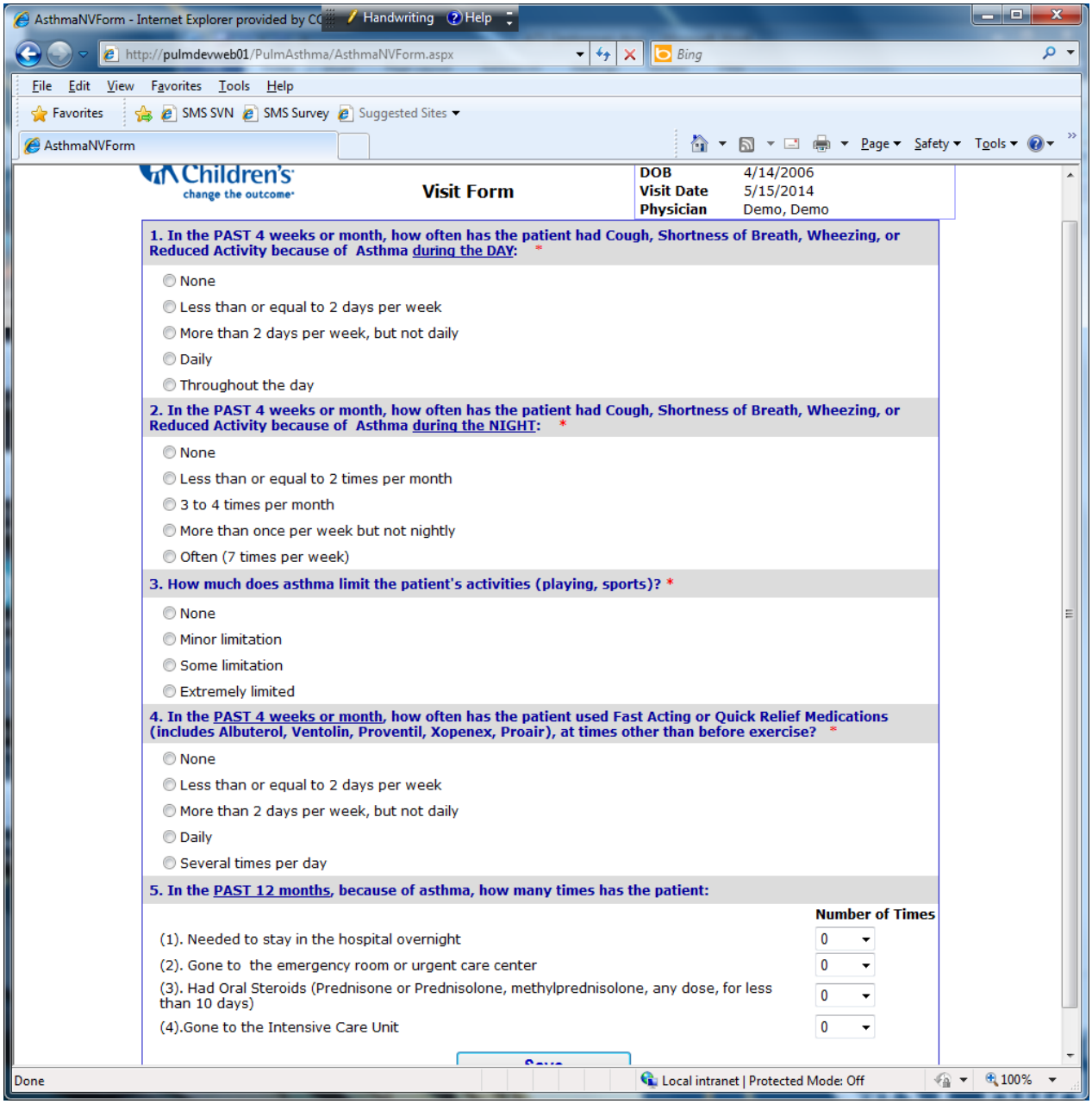
All participants who complete their response to the Post-Visit Surveys (subject, parent, school nurses) will receive $10 added to their ClinCard. Nurses may be approached and asked follow-up questions regarding their perceptions of the study (see appendix X).

Appendix A. Propeller Health System.



Appendix B. TreatSmart Program screen shots.




AsthmaNVForm - Internet Explorer provided by C
Handwriting
Help
http://pulmdevweb01/PulmAsthma/AsthmaNVForm.aspx
Bing
File Edit View Favorites Tools Help
Favorites
SMS SVN
SMS Survey
Suggested Sites
AsthmaNVForm
Page
Safety
Tools
Children's
change the outcome
Visit Form
DOB 4/14/2006
Visit Date 5/15/2014
Physician Demo, Demo
1. In the PAST 4 weeks or month, how often has the patient had Cough, Shortness of Breath, Wheezing, or Reduced Activity because of Asthma during the DAY: *
None
Less than or equal to 2 days per week
More than 2 days per week, but not daily
Daily
Throughout the day
2. In the PAST 4 weeks or month, how often has the patient had Cough, Shortness of Breath, Wheezing, or Reduced Activity because of Asthma during the NIGHT: *
None
Less than or equal to 2 times per month
3 to 4 times per month
More than once per week but not nightly
Often (7 times per week)
3. How much does asthma limit the patient's activities (playing, sports)? *
None
Minor limitation
Some limitation
Extremely limited
4. In the PAST 4 weeks or month, how often has the patient used Fast Acting or Quick Relief Medications (includes Albuterol, Ventolin, Proventil, Xopenex, Proair), at times other than before exercise? *
None
Less than or equal to 2 days per week
More than 2 days per week, but not daily
Daily
Several times per day
5. In the PAST 12 months, because of asthma, how many times has the patient:
Number of Times
(1). Needed to stay in the hospital overnight 0
(2). Gone to the emergency room or urgent care center 0
(3). Had Oral Steroids (Prednisone or Prednisolone, methylprednisolone, any dose, for less than 10 days) 0
(4).Gone to the Intensive Care Unit 0
Done
Local intranet | Protected Mode: Off
100%

Appendix C. Asthma Control Tests. (ACT will only be used for ages 12 and up)

Enter Name
Enter Address
Enter City/State/Zip

Today's Date: _____
Patient's Name: _____

FOR PATIENTS:

Take the Asthma Control Test™ (ACT) for people 12 yrs and older.

Know your score. Share your results with your doctor.

Step 1 Write the number of each answer in the score box provided.
Step 2 Add the score boxes for your total.
Step 3 Take the test to the doctor to talk about your score.

									SCORE
1. In the past **4 weeks**, how much of the time did your **asthma** keep you from getting as much done at work, school or at home?	All of the time	1	Most of the time	2	Some of the time	3	A little of the time	4	None of the time	5	
2. During the past **4 weeks**, how often have you had shortness of breath?	More than once a day	1	Once a day	2	3 to 6 times a week	3	Once or twice a week	4	Not at all	5	
3. During the past **4 weeks**, how often did your **asthma** symptoms (wheezing, coughing, shortness of breath, chest tightness or pain) wake you up at night or earlier than usual in the morning?	4 or more nights a week	1	2 or 3 nights a week	2	Once a week	3	Once or twice	4	Not at all	5	
4. During the past **4 weeks**, how often have you used your rescue inhaler or nebulizer medication (such as albuterol)?	3 or more times per day	1	1 or 2 times per day	2	2 or 3 times per week	3	Once a week or less	4	Not at all	5	
5. How would you rate your **asthma** control during the **past 4 weeks**?	Not controlled at all	1	Poorly controlled	2	Somewhat controlled	3	Well controlled	4	Completely controlled	5	
											TOTAL

If your score is 19 or less, your asthma may not be controlled as well as it could be. Talk to your doctor.

FOR PHYSICIANS:

The ACT is:

- A simple, 5-question tool that is self-administered by the patient
- Clinically validated by specialist assessment and spirometry[1]
- Recognized by the National Institutes of Health

Reference: 1. Nathan RA et al. *J Allergy Clin Immunol.* 2004;113:59-65.