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Applying implementation science to improve adherence to clinical guidelines in asthma care: a public health practice dissertation to improve the utilization of asthma action plans in Tennessee

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Dissertation

APPLYING IMPLEMENTATION SCIENCE TO IMPROVE ADHERENCE TO CLINICAL GUIDELINES IN ASTHMA CARE: A PUBLIC HEALTH PRACTICE DISSERTATION TO IMPROVE THE UTILIZATION OF ASTHMA ACTION PLANS IN TENNESSEE

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ABSTRACT

Background: Tennessee made a commitment to improve the quality of care provided to children with asthma, which affects approximately 10% Tennessee's public school population. Asthma is chronic respiratory condition that can be managed with medications and behavioral and environmental interventions. Asthma action plans (AAP), which document an individual's asthma management plan, are a proven strategy associated with improved asthma outcomes. To improve the utilization of AAPs among children with asthma enrolled in public schools, the Tennessee Department of Health (TDOH) established the Tennessee Asthma Learning Collaborative (TALC), a multidisciplinary, multiagency stakeholder group that engaged in quality improvement activities at selected local sites across the state. This dissertation is an evaluation of TALC and its activities.

Methods: TALC members and their community partners from local sites were interviewed about their experience participating in the learning collaborative. The Consolidated Framework for Research (CFIR) guided this qualitative data collection and

analysis. AAPs were reviewed at local sites. A run chart tool was used to analyze quantitative data obtained from the review of AAPs to determine if a change in the number of forms collected occurred.

Results: Participant interviews yielded information about barriers and facilitators to AAP collection in selected schools. Barriers included school nurse availability, inconsistent AAP forms across school systems, and lack of school nurse leadership at the state level. Facilitators included purposeful communication and collaboration between community healthcare providers and local school nurses. Analysis also revealed strengths and weaknesses in implementing the learning collaborative.

Translation: This project informed two public health practice products. A manuscript was prepared for submission to the Journal of School Health that addresses the original state objective to reach 100% AAP compliance in schools and describes challenges related to implementing improvement strategies. A state report was produced for use by the TDOH which included recommendations for continued quality improvement efforts.

Conclusion: CFIR framework provided a useful tool for evaluating the complex challenges and opportunities associated with implementing a state level multidisciplinary quality improvement effort and generated information that will inform future public health efforts to improve school-based management of chronic health conditions.

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LIST OF ABBREVIATIONS

AAAAI	American Academy of Allergy, Asthma and Immunology
AAFA	Asthma and Allergy Foundation of America
AAP	Asthma Action Plan
BTS	Break Through Series
CFIR	Consolidated Framework for Implementation Research
EBP	Evidence-based Practice
EBT	Evidence-based Treatment
EPR-3	Expert Panel Report 3
GINA	Global Initiative for Asthma
HRSA	Health Resources and Services Administration
IHI	Institute for Healthcare Improvement
MCHB	Maternal and Child Health Bureau
NAEPP	National Asthma Education and Prevention Program
NHLBI	National Heart, Lung and Blood Institute
QI	Quality Improvement
SUD	Substance Use Disorders
TALC	Tennessee Asthma Learning Collaborative
WFM	Workshop Facilitation Method

INTRODUCTION

Asthma is a chronic disease affecting the reactivity of airways of the lungs. When exposed to specific triggers such as tobacco smoke, pet dander and pollution, people with asthma experience difficulty breathing. The airways narrow and produce an excess of mucous making it difficult to move air in and out of the lungs. When this occurs, it can cause coughing, wheezing and chest tightness, which it referred to as an asthma exacerbation or asthma attack.[1] While asthma cannot be cured, it can be clinically managed with medications and prevention measures. The National Heart, Lung and Blood Institute (NHLBI) describes guidelines for all persons diagnosed with asthma, including children, in the Expert Panel Report 3 (EPR-3)[2] In this report asthma action plans (AAPs) are recommended as an important asthma management tool. AAPs are developed with a physician and list the person's triggers, signs and symptoms of an attack, medications and dosing, and appropriate responses during exacerbations. AAPs are considered a key component of quality asthma care for children and promote more effective asthma management at school.[3,4]

Asthma in the United States

Asthma is the most common chronic condition among school-aged children in the United States, affecting approximately 10.5 million children under the age of 18 in 2011,[5,6] which is approximately 1 in 11 children.[7] In children, asthma is noted to disproportionately affect male children (10.0%) over females (7.1%), and black (14.0%) and multi-race (13.2%) children over white children (7.4%).[8] An asthma diagnosis has been linked to an estimated 10.5 million miss school days for children each year,[5] making

it the leading cause of school absenteeism (48%) as compared with neurodevelopment disorders (24%) and learning behavior disorders (12%).[9]

Asthma is the third leading cause of hospitalizations among U.S. children under the age of 15, and cost the healthcare system approximately $50.1 billion dollars per year.[10] Absenteeism from school and subsequent caregiver absenteeism from work cost $3.8 billion dollars per year in loss of productivity.[6]

Asthma in Tennessee

Similar to national statistics, Tennessee, the setting for this dissertation, reports that 9.5% (N=137,242) of children aged 0-17 currently have asthma.[11] In Tennessee, asthma also disproportionately affects low-income and minority children. Data from 2007 shows that 16.1% of black, non-Hispanic children 0-17 years old had asthma compared with 7.6% of white non-Hispanic children in the same age range. According to data from the Tennessee Department of Health's Hospital Discharge Data System, each year in Tennessee, asthma is responsible for nearly 2,000 inpatient hospitalizations and over 14,000 emergency room visits by children ages 1-17 years old. The hospital charges associated with these visits accounted for $41.4 million in 2010, $27.8 million of which was paid for through the state Medicaid program TennCare and nearly $1 million was self-pay by the child's family.

During the 2011-2012 academic year, more than 63,000 children and adolescents enrolled in Tennessee public schools reported an asthma diagnosis, a 64% increase since 2004.[12] These children represent 33% of all public school enrollees diagnosed with a chronic disease. Asthma accounted for 94% (N=57,830) of emergency healthcare

procedures performed by licensed providers in Tennessee schools in the same school year. Research indicates that for students with an asthma diagnosis, poor health outcomes can be associated with multiple educational outcomes including negative effects on cognition, connectedness and engagement in school, and absenteeism.[9] In Tennessee, the Department of Coordinated School Health reports that only 57% of students with asthma having documentation such as an AAP on file with the school.[12]

Tennessee, like many other states, has recognized the need to address the care of children with asthma in general and specifically within the public school system. In 2009, Tennessee issued the "State of Tennessee Asthma Taskforce (STAT) Plan to Reduce Asthma."[13] In September 2010, the Tennessee Department of Health produced a follow-up report outlining progress made toward child-related goals as defined by the state plan.[14] The goals of the STAT plan are divided into four primary areas: Surveillance and Epidemiology, Public Awareness and Education, Medical Management, and Environmental Management. Asthma and its effective management are also currently listed as one of 7 state priority areas by the Tennessee Department of Health's Title V/ Maternal and Child Health Program. This dissertation, conducted in collaboration with the Maternal and Child Health Office of the Tennessee Department of Health, focuses on efforts made to reach the following STAT objective:

> Medical Management Objective 5. "By December 2014, all children with an asthma diagnosis will have an individualized asthma plan from the patient's medical home on file in the school, child care facility or other out-of-home group care setting and used in the home for asthma management."

Public Health Problem and Dissertation Purpose

This public health practice dissertation addresses the gap between NHLBI guidelines for AAP utilization and actual practice. The EPR guidelines put forth by the NHLBI have been in place for over 2 decades, and during that time, many strategies have been used to foster uptake, and yet a gap continues to exist between these guidelines and daily practice surrounding AAP provision and utilization. This dissertation documents and analyzes the state level activities of the Tennessee Asthma Learning Collaborative (TALC) and its effort to support positive change and increased utilization of AAPs at the local level. The purpose of the dissertation project is to identify facilitators and barriers to improvement in the use of AAPs and make recommendations regarding how change can be maximized at a state level.

Dissertation Objectives

This practice dissertation included the initiation and facilitation of a statewide learning collaborative, known as the Tennessee Asthma Learning Collaborative (TALC), which was convened for the 2012-2013 academic school year. The structure of TALC was guided by evidence-based quality improvement methods, specifically the Break Through Series model (BTS).[15]. Qualitative and quantitative data were collected throughout the 11-month working period of the collaborative. Data was analyzed using theories of implementation science to address the following two objectives:

1. To evaluate the implementation of strategies and local activities to increase utilization of asthma action plans in Tennessee schools.
2. To evaluate the role that the statewide learning collaborative played in supporting the local sites to improve use of asthma action plans.

This dissertation uses the theories of implementation science to evaluate the effectiveness of the Tennessee Asthma Learning Collaborative and its efforts to improve adherence with EPR-3 recommendations for AAPs. Implementation science looks not only at the endpoint health outcomes but assesses the formative process of disseminating evidence and implementing it into daily practice; it further aims to address the facilitators and barriers to effective implementation.[16,17]

Chapter Summaries

The dissertation consists of seven chapters following the introduction. Chapter 1 offers a clinical definition of asthma and the scope and burden of the disease at a national and state level. It also provides an overview of the key components of quality asthma care focusing more narrowly on asthma action plans (AAPs) as one of these components. Chapter 1 also addresses the factors indicating a need for improvement and introduces the concept of the learning collaborative including its roots in quality improvement methodology.

In Chapter 2, the Consolidated Framework for Implementation Science (CFIR) is described and applied as a conceptual framework for analyzing the implementation of healthcare interventions. CFIR helps to guide analysis of implementation strategies by identifying barriers and facilitators in 5 domains and their corresponding constructs. CFIR represents evidence-based key constructs from a systematic review of implementation research.

Chapter 3 outlines the efforts made in Tennessee around the issue of childhood asthma. To lay groundwork for analysis, this chapter provides a detailed description of

the planning and execution of the Tennessee Asthma Learning Collaborative (TALC). It describes the key stakeholders and specific activities of TALC for the 2012-2013 academic year.

In Chapter 4, methods used to collect, process and analyze quantitative and qualitative data regarding the implementation of TALC activities at both the state and local level are described. The CFIR framework's employment throughout these activities is also described.

Findings are presented in Chapter 5 in the form of themes found in the analysis of qualitative data are presented and run charts depicting change as determined from quantitative data analysis. Implications for future steps specific to the improved utilization of AAPs for school children in Tennessee are discussed in Chapter 6. Lessons learned from the learning collaborative approach and participants responses to it are also included. Chapter 7 is manuscript prepared for submission to the Journal of School Health as specified by their requirements.

Products

This dissertation will produce the deliverable products as listed in the table below.

Table 1: Summary of Dissertation Products

Product	Intended Audience	Description	Placement
State Report	Department of Health, Coordinated School Health Office	Report documenting the activities of TALC and its pilot site interventions including analysis of implementation efforts and recommendations for next steps	Appendix A
Paper	Peer-reviewed journal	Manuscript identifying the challenges at the state and local level associated with the utilization of asthma action plans	Chapter 7

Disclosure

This researcher worked with representatives of the Maternal and Child Health section of the Tennessee Department of Health to develop and facilitate the learning collaborative. These efforts included coordinating meeting times, identifying expert speakers, collecting quarterly update worksheets and distributing meeting minutes. At the conclusion of the learning collaborative, this researcher conducted interviews with participants, and complied and analyzed data to produce this manuscript. This researcher did not have direct responsibilities or decision-making power at any of the local sites.

CHAPTER 1: BACKGROUND AND LITERATURE REVIEW

A. Clinical Definition of Asthma

Asthma is a chronic disease affecting the reactivity of the airways of the lungs. When exposed to specific triggers, people with asthma can experience an asthma attack during which inflammation in the airways makes breathing difficult. Specific symptoms include coughing, wheezing, shortness of breath, and chest pain or tightness. Severity of the disease can range from mild with occasional symptoms to severe with frequent or persistent symptoms. An asthma attack can be caused by exposure to a number of triggers including allergens, pollutants, infections and exercise. While asthma cannot be cured, it can be clinically managed with oral and inhaled corticosteroid medications, environmental prevention measures, and the avoidance of identified triggers. The goal of management and prevention is effective disease control. Asthma is defined as controlled when a person does not have trouble sleeping, does not wheeze or cough, does not miss school, is not limited in physical activities, and does not require hospitalization due the asthma.[1]

B. Scope and Burden of Childhood Asthma

Asthma is the most common chronic illness experienced by children in the United States affecting approximately 10.5 million children ages 0-17 years; this is the equivalent of 1 in 11 children.[7] Asthma was noted to disproportionately affect male children (10.3%) over females (8.8%), and black (16.5%) and multi-race (14.6%) children over white children (8.1%).[8,18]

Table 2: Asthma Number and Prevalence Rate per 1,000 population by age and race, United States, 2005-2011[8]

		2005		2007		2009		2011	
		Number	Rate	Number	Rate	Number	Rate	Number	Rate
Age									
	<5	1,741465	85.8	1,636,267	79.5	1,668.461	78.9	1,753,100	82.7
	5-17	7,545,500	142.2	7,968,828	149.9	8,527,325	161.3	8,710,191	163.4
Race									
White	<5	1,107802	69.7	954,773	61.2	1,032,703	63.8	1,104,884	68.5
	5-17	5,569,421	134.0	5,518,513	134.7	5,980,779	146.5	6,151,483	149.4
Black	<5	528,218	158.6	544,230	156.5	570,883	161.6	552,220	157.3
	5-17	1,554,894	182.7	1,855,699	210.6	2,079,850	238.4	1,939,192	227.6

Source: Centers for Disease Control and Prevention, National Center for Health Statistics, American Lung Association

In the U.S., children with asthma miss an estimated 10.5 million days each year,[5] making asthma the leading cause of school absenteeism (48%) as compared with neurodevelopment disorders (24%) and learning behavior disorders (12%).[9] Absenteeism from school and subsequent caregiver absenteeism from work cost $3.8 billion dollars per year in loss of productivity.[6] Asthma is the third leading cause of hospitalizations among U.S. children under the age of 15, and cost the healthcare system approximately $50.1 billion dollars per year.[10]

Similar to national statistics, Tennessee reports that 9.5% (N=137,242) of children aged 0-17 currently have asthma.[11] In Tennessee, asthma disproportionately affects low-income and minority children. According to data from the Tennessee Department of Health's Hospital Discharge Data System, each year in Tennessee, asthma is responsible for nearly 2,000 inpatient hospitalizations and over 14,000 emergency room visits by

children ages 1-17 years old. The hospital charges associated with these visits accounted for $41.4 million in 2010, $27.8 million of which was paid for through the state Medicaid program TennCare and nearly $1 million was self-pay by the child's family.

During the 2011-2012 academic year, more than 63,000 individual students enrolled in Tennessee public schools reported an asthma diagnosis to their school, a 64% increase since 2004.[12] These children represented 33% of all public school enrollees diagnosed with a chronic disease, followed by ADHD/ADD (21%) and severe allergies (9%). Asthma accounted for 94% of emergency healthcare procedures performed by licensed providers in Tennessee schools bringing the total number of asthma related procedures to 57,830 during that academic year. Research indicates that for students with an asthma diagnosis, poor health outcomes can be associated with multiple educational outcomes including negative effects on cognition, connectedness and engagement in school, and absenteeism.[9]

Tennessee has been identified as home to four of the "most challenging cities to live with asthma." Each year The Asthma Capitols™, an annual research project conducted by the Asthma and Allergy Foundation of America® (AAFA), ranks cities across the United States based on prevalence factors, risk factors (ie. Annual pollen scores, annual air quality scores, public smoking laws, poverty rates, uninsured rates and school inhaler access laws) and medical factors (i.e., rescue and controller medication use, and number of asthma specialists).[19] In 2013 rankings, four major cities in Tennessee were among the most difficult cities to have an asthma diagnosis. Of the 100 U.S. cities

on the list, Chattanooga was ranked #2, followed by Memphis (#3), Knoxville (#10) and Nashville (#32). All of these cities have been listed in previous years rankings.

C. Asthma Action Plans: A Component of Quality Asthma Management and Prevention

The practice of appropriate management and prevention strategies can help control asthma symptoms. In 2007, the National Heart, Lung, and Blood Institute (NHLBI) in coordination with the National Asthma Education and Prevention Program (NAEPP), released its third set of clinical practice guidelines for asthma. This report, also known as the Expert Panel Report 3—Guidelines for the Diagnosis and Management of Asthma, (EPR-3) is a systematic review of the literature by a specially convened expert panel selected by the NAEPP. The EPR-3 is a report of best clinical practices in asthma care with a specific section on childhood asthma. It was created to help guide decision-making by primary and specialty care providers surrounding efforts to medically control asthma and addresses the importance of focusing on current impairment and potential future risks.[2] One of the key ways EPR-3 differs from its predecessors is the emphasis it places on the use of an asthma action plan.[20] The Global Initiative for Asthma (GINA) also published a detailed strategy for managing asthma in 2012. This document described the patient/doctor partnership as a key component to effective care and listed the written asthma action plan as "essential feature" in the self-management of asthma.[4]

Table 3: Published Asthma Management Guidelines Summaries

Report Name	Year Published	Summary regarding AAP use
EPR-3	2007	"Provide all patients with a written asthma action plan that includes two aspects: (1) daily management and (2) how to recognize and handle worsening asthma. Written action plans are particularly recommended for patients who have moderate or severe persistent asthma, a history of severe exacerbations, or poorly controlled asthma."
GINA report	2012	Listed AAP as 1 of 3 "essential components" of asthma management

An AAP is an individualized written plan of care for a person's asthma and typically captures person-specific information on daily treatment routines, medications, instructions for asthma attacks, and when to contact the doctor. Both the EPR-3 and GINA's strategy recommend that the physician create this management tool in conjunction with the patient and family taking into consideration home life, school and afterschool activities, and suggest that the final document be shared with the child's school.

AAPs can serve as a clinical communication tool sharing individualized asthma management information among primary health care providers, parents, and school-based health care providers.[21–23] The AAP can provide decision support to school nurses or other school-based providers who are caring for children in the community or school setting. Increasing linkages between the community and clinical settings and developing tools to improve decision and self-management support are consistent with best practices for managing chronic illnesses described in the Chronic Care Model.[24–26]

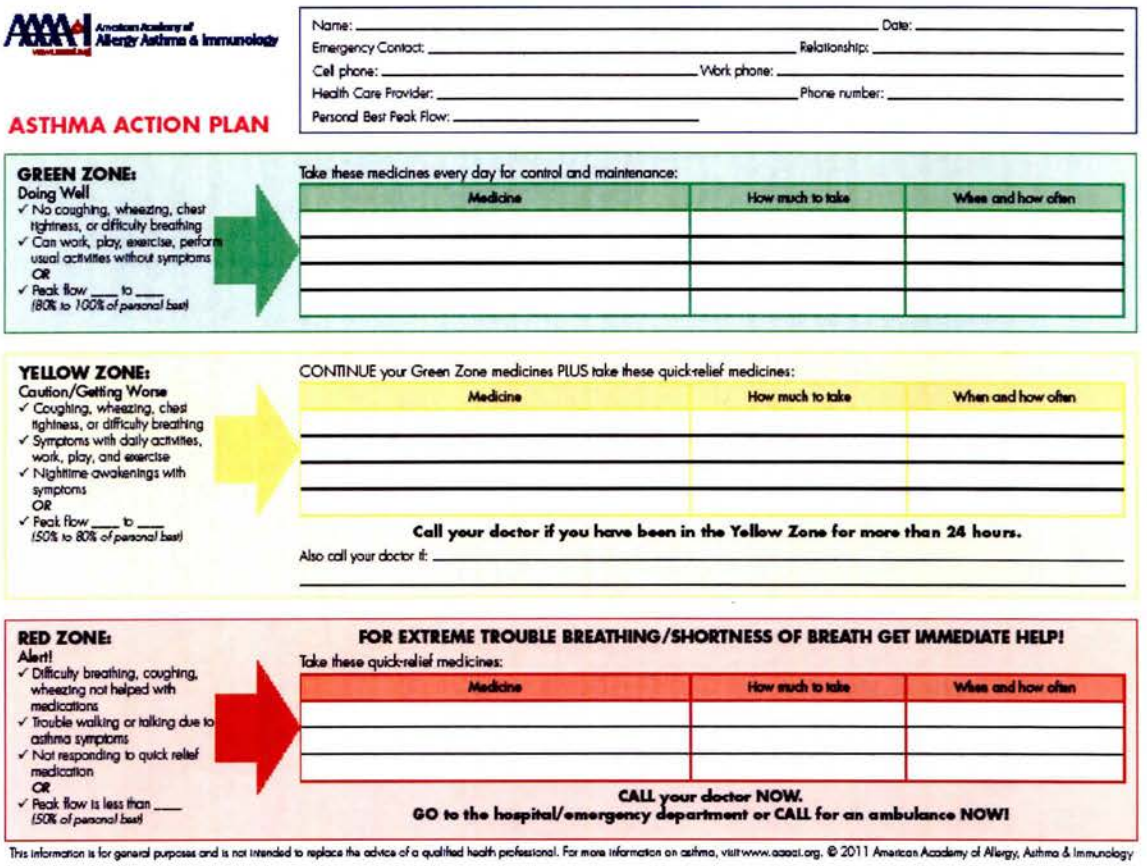
A growing body of evidence supporting the use of AAPs in the management of asthma has emerged.[27–29] A systematic review of randomized control trials[27] concluded

that the provision of symptom-based asthma action plans reduced acute care visits by 27% in children and adolescents diagnosed with asthma. One study included in the review showed that children with AAPs missed fewer school days, experienced less interruption in sleep, and had documented improvement in symptom scores.[28] In a longitudinal follow-up study of children in Italy whose primary care provider followed a GINA-based clinical pathway, written AAPs coupled with regular specialist visits and access to a web-based resource led to clinical improvements. Of the 264 children who completed the study, half decreased from persistent to intermittent symptoms; others were able to stop (47.2%) or reduce (27.6%) maintenance treatment while only 4.9% saw an increase. Nearly all of the participants (98.6%) reported learning how to manage exacerbations.[29] Most published studies discussed the presence of co-interventions such as asthma education, verbal instruction regarding the use of the AAP, or participation in a self-management program[27,30–32] as helpful in promoting the use of AAPs.

When an AAP is provided at the physician's visit, the content, quality and layout of the information can impact its perceived value and ease of use by the patient, family and community or school personnel. Evidence shows that AAPs can be highly variable and that poor design can impact uptake and effectiveness.[33] Readability, suitability and general content can also vary, impacting utilization of the AAP by the patient and family.[34] While the guidelines[35] and aforementioned evidence suggest that the presence of an AAP improves outcomes, the practice of completing a quality AAP document and sharing it with patients and their families is not standardized.

Many types of AAPs have been developed for use, but there are several key components that have proven to be consistently beneficial. Structurally, AAPs are often divided by symptom level as illustrated in an example AAP created by the American Academy of Allergy, Asthma and Immunology (AAAAI) in Figure 1.[36] Under each symptom level, action items to maintain healthy management are listed. In an evidence-based review of key components, the inclusion of 2-4 action points and the use of both oral and inhaled corticosteroids were consistently shown to improve outcomes.[31] Evidence and clinicians remain in conflict regarding the use of peak flow or symptoms to define action points; this review of several randomized control trials showed the use of peak flow readings versus asthma symptoms had equivalent outcomes for hospital admission and emergency room use in adults with asthma. A separate review found that symptom-based action points were more effective for children.[27] The example provided by the AAAAI includes both symptoms and peak flow.

Figure 1: Asthma Action Plan created by AAAAI[36]



American Academy of Allergy Asthma & Immunology

Name: _____ Date: _____
Emergency Contact: _____ Relationship: _____
Cell phone: _____ Work phone: _____
Health Care Provider: _____ Phone number: _____
Personal Best Peak Flow: _____

ASTHMA ACTION PLAN

GREEN ZONE:
Doing Well
- ✓ No coughing, wheezing, chest tightness, or difficulty breathing
- ✓ Can work, play, exercise, perform usual activities without symptoms
  OR
- ✓ Peak flow ___ to ___
  (80% to 100% of personal best)

Take these medicines every day for control and maintenance:

Medicine	How much to take	When and how often

YELLOW ZONE:
Caution/Getting Worse
- ✓ Coughing, wheezing, chest tightness, or difficulty breathing
- ✓ Symptoms with daily activities, work, play, and exercise
- ✓ Nighttime awakenings with symptoms
  OR
- ✓ Peak flow ___ to ___
  (50% to 80% of personal best)

CONTINUE your Green Zone medicines PLUS take these quick-relief medicines:

Medicine	How much to take	When and how often

Call your doctor if you have been in the Yellow Zone for more than 24 hours.

Also call your doctor if: _____

RED ZONE:
Alert!
- ✓ Difficulty breathing, coughing, wheezing not helped with medications
- ✓ Trouble walking or talking due to asthma symptoms
- ✓ Not responding to quick relief medication
  OR
- ✓ Peak flow is less than ___
  (50% of personal best)

FOR EXTREME TROUBLE BREATHING/SHORTNESS OF BREATH GET IMMEDIATE HELP!

Take these quick-relief medicines:

Medicine	How much to take	When and how often

CALL your doctor NOW.
GO to the hospital/emergency department or CALL for an ambulance NOW!

This information is for general purposes and is not intended to replace the advice of a qualified health professional. For more information on asthma, visit www.aaaai.org. © 2011 American Academy of Allergy, Asthma & Immunology

D. Physician Adherence to Management Guidelines

While a variety of clinical practice guidelines and resources for implementing those guidelines exist, clinicians' uptake of guidelines in to practice proves to be slow across a wide range of clinical areas including depression[37], attention deficit disorder[38–40] and subfertility[41,42]. In 1999, Cabana et al. reviewed barriers to adherence placing them into three categories: knowledge, attitudes and behavior. Barriers ranged from internal barriers such as lack of awareness, lack of agreement, and lack of outcome expectancy to external barriers such as guideline characteristics, patient preference, and insufficient staff or resources. This review concluded that barriers will differ by setting and clinical field.[43]

In the field of asthma, there is increased evidence supporting the provision and use of AAPs for children with asthma and the EPR-3 instructs physicians to create and educate patients and families on this document,[2] there continues to be a gap between physician practice and guideline adherence with regards to AAP provision.[44] In 2000, Cabana et al. investigated this "disconnect" between physician practice and published guidelines and identified a range of internal barriers including lack of awareness, familiarity and agreement with guidelines; identified external barriers included environmental (e.g. time), guideline (e.g. distribution), and patient (e.g. health literacy) factors. In a follow-up study in 2008, Cabana further hypothesized that the use of individualized asthma education through the development of AAPs is limited by a lack of time combined with competing demands during a typical primary care visit.[44] A study of 202 care providers in Harlem identified lack of outcome expectancy and poor provider self-efficacy, which is the belief that one can perform the change, as reasons for poor adherence to guidelines including action plans.[45] While our knowledge of asthma and clinical recommendations for management have increased over the past 20 years, asthma prevalence, its impact on the community and healthcare system and adherence to guidelines have not changed significantly.[5,7,46]

E. Tools for Improvement

Several types of interventions could be used to improve the utilization of AAPs including the employment of Quality Improvement methods. Quality improvement (QI), which was originally called quality management, emerged in the early 1900s as a response to improving standards and production within the industrial sector.[47,48] It later

expanded into other arenas including business management and healthcare, and now it is becoming increasingly used in the field of public health. The overarching goal of QI is to implement a sustainable change that results in improvement. Although currently QI is described as relatively unstructured and underutilized within the public health community, one interpretation suggests it can be defined as "a distinct management process and set of tools and techniques that are coordinated to ensure that departments consistently meet the health needs of their communities."[49] QI methods may be particularly well-suited to test improvement strategies given the current economic climate as interventions are small and completed in real time, suggesting they may be less of a financial burden.

F. Learning Collaborative as a Quality Improvement Approach

One QI approach is the initiation of a learning collaborative, which can be defined as a group of representatives from multiple agencies and various disciplines who come together on a short-term basis to improve delivery and quality of a service through innovation and cooperation.[15] This approach to quality improvement, while well established in the health care sector, has only recently gained credibility within the public health community. The Health Resources and Services Administration (HRSA) lists the following successful learning collaboratives supporting populations served by the Maternal and Child Health Bureau (MCHB):[50]

- Improving Access for Care of Children and Youth - A multi-state collaborative working to improve access to primary and speciality care for children with an epilepsy diagnosis.

- Early Hearing Detection and Intervention Program - A multi-state collaborative working to improve follow-up care for newborns who do not pass initial hearing screens.
- Hemoglobinopathy Learning Collaborative – A collaborative designed to improve adoption of the medical home model for the clinical management of people diagnosed with a chronic blood disease.
- Title V System of Services Infrastructure: A collaborative of Title V programs participating in activities to develop and support systemic improvements in services provided to children with special health care needs.

MCHB's Division of Services for Children with Special Health Care Needs (DSCSHCN) regularly uses a learning collaborative approach to systematically improve access to care through the medical home model to engage families and enhance community and state initiatives. DSCSHCN has plans for future learning collaborative activities surrounding genetics, newborn screenings and diversity in MCH training programs.

State level learning collaboratives include such examples as the New Mexico Public Health Learning Collaborative which works to strengthen the infrastructure of public health by providing educational opportunities to frontline providers such as school nurses, early childhood educators and emergency medical technicians.

At the county level, Los Angeles County (LAC), California implemented the Partnership to Eliminate Health Disparities in Infant Mortality Action Learning Collaborative. This group of government and community partners work to enhance

awareness of disparities while also assessing and reporting racism and infant death in LAC. They share these findings with a larger multi-state collaborative group for further analysis.

Breakthrough Series Model

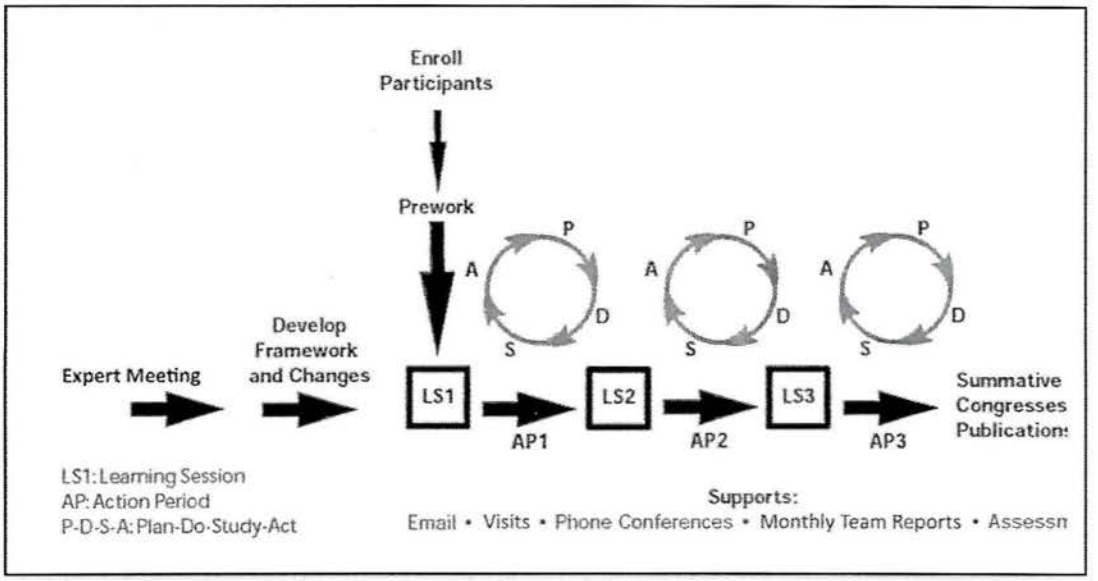
Learning collaboratives can be structured in a variety of ways depending on the size of the group and its goals. The Breakthrough Series (BTS) model is one of the most commonly applied learning collaborative models. BTS, illustrated in Figure 2,[51] was published by the Institute for Healthcare Improvements (IHI) in 1998 and continues to be a gold standard in current QI practice.[52,53] It was initially developed to guide the process by which cost-conscious health care organizations make "breakthrough" improvements in quality and to help close the gap between what we know (research) and what we do (practice). The BTS model is distinctive from other types of group approaches based on several key elements (see Table 4).

Table 4: Key Elements of the Breakthrough Series[52]

BTS key element	Description
Select Topic	Leaders select a topic to be addressed. The topic should reflect an issue that exhibits a certain level of readiness for change.
Recruit Faculty	A diverse group of 20-40 key stakeholders/experts are identified and invited to participate in the collaborative.
Develop Framework and Changes	The group identifies a shared specific aim as well as process and outcome measures used to determine whether change has occurred.
Enroll Participants and Prework	The group identifies areas or populations with whom to implement small changes. Prior to any change being made, baseline data is collected on process and outcome measures.
Learning Sessions	Learning sessions provide a time for participants to discuss progress and exchange ideas between each action period. A didactic presentation on a relevant topic may also be presented.
Action Period	Time during which a change is implemented at the local setting or pilot site and data is collected to determine progress toward shared aim.
Summative Congresses and Publication	Once the collaborative is complete, the group and local teams document and present results to an audience outside the collaborative.
Measurement and Evaluation	Monthly or quarterly reports are used to document and assess overall progress.

According to the model, the learning collaborative should consist of 20-40 organizations whose representatives work together for approximately 9-12 months on a specific and shared goal. Team members should be of various backgrounds and disciplines and demonstrate commitment to the proposed change. Meeting should be held regularly and should include didactic instruction about QI methodology and professional discussions about lessons learned in the field. Throughout the assembly of the group, QI methods should be employed to collect data, track progress and reach measureable goals.

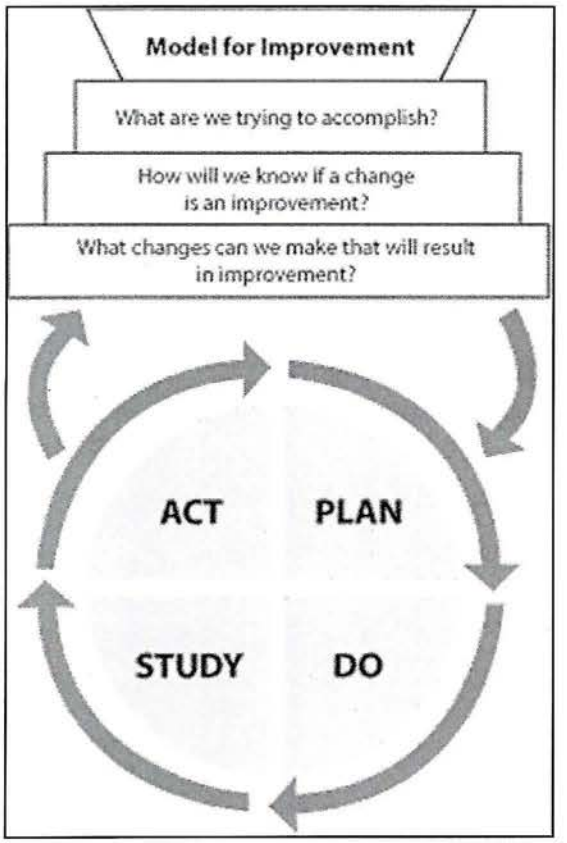
Figure 2: Institute for Health Improvement Breakthrough Series Model[15]



The Model of Improvement

One tool that is used in the BTS model is called the Model of Improvement,[47] a strategy based on a series of small tests of change in a relatively rapid cycle. The tool consists of two parts as illustrated in Figure 3. The first part asks three fundamental questions designed to help an organization to set aims, establish measures, and identify changes to test. The second part of the tool is a Plan-Do-Study-Act cycle, which is a version of the scientific method used for action-oriented, work environment learning. This model allows an organization or group to implement and test small changes in a real setting by planning the change, executing the change, observing the effects of the change, and acting on what is learned in a timely fashion.

Figure 3: The model of Improvement [47]



G. Conclusion

In summary, asthma is a chronic respiratory condition affecting approximately 10% of Tennessee school students, and published clinical guidelines list the use of an AAP as a key component to asthma management. Guidelines also suggest that creating an AAP with a clinical provider and sharing that plan with the student's school helps to support asthma management at school and school sponsored activities. Despite this guideline and its endorsement by entities such as the National Heart, Lung and Blood Institute (NHBLI), American Academy of Pediatrics (AAP), and American Academy of Allergy, Asthma and Immunology (AAAAI), only 57% of Tennessee students with a

known asthma diagnosis are reported to have this type of documentation on file.[1] A multidisciplinary learning collaborative employed quality improvement (QI) techniques to identify ways to improve this gap in practice at the local level. To evaluate the impact and success of this QI effort, theories of implementation science, discussed in the next chapter, were used.

[1] As reported by the Tennessee Department of Education Office of Coordinated School Health in the Annual School Health Services Data and Compliance Report 2011-2012, but it is unclear if it number includes only asthma action plans or other types of documentation such as Individual Health Plans (IHP).

CHAPTER 2: CONCEPTUAL FRAMEWORK: Using Implementation Science to Close the Gap from Research to Practice

A. Introduction

The EPR guidelines put forth by the NHLBI have been in place for over 2 decades, and during that time, many strategies have been used to foster uptake, and yet a gap continues to exist between these guidelines and daily practice surrounding AAP provision and utilization. This dissertation uses the theories of implementation science to evaluate the effectiveness of the Tennessee Asthma Learning Collaborative and its efforts to improve adherence with EPR-3 recommendations for AAPs.

To address the gaps between the NHLBI's EPR-3 guidelines and the recommended practice of utilizing asthma action plans, this dissertation documents and analyzes the state level activities of TALC and its effort to support positive change and increased utilization of AAPs at the local level. Data collected during the 9-month working period of TALC was analyzed using theories of implementation science to address the following two objectives:

1. To evaluate the implementation of strategies and local activities to increase utilization of asthma action plans in Tennessee schools.
2. To evaluate the role that the statewide learning collaborative played in supporting the local sites to improve use of asthma action plans.

B. Implementation Science and its application to this effort

New research findings are continually being produced and have the ability to contribute to a more efficient and effective healthcare system, but putting new clinical findings into practice can be a challenge within an organization or population. An

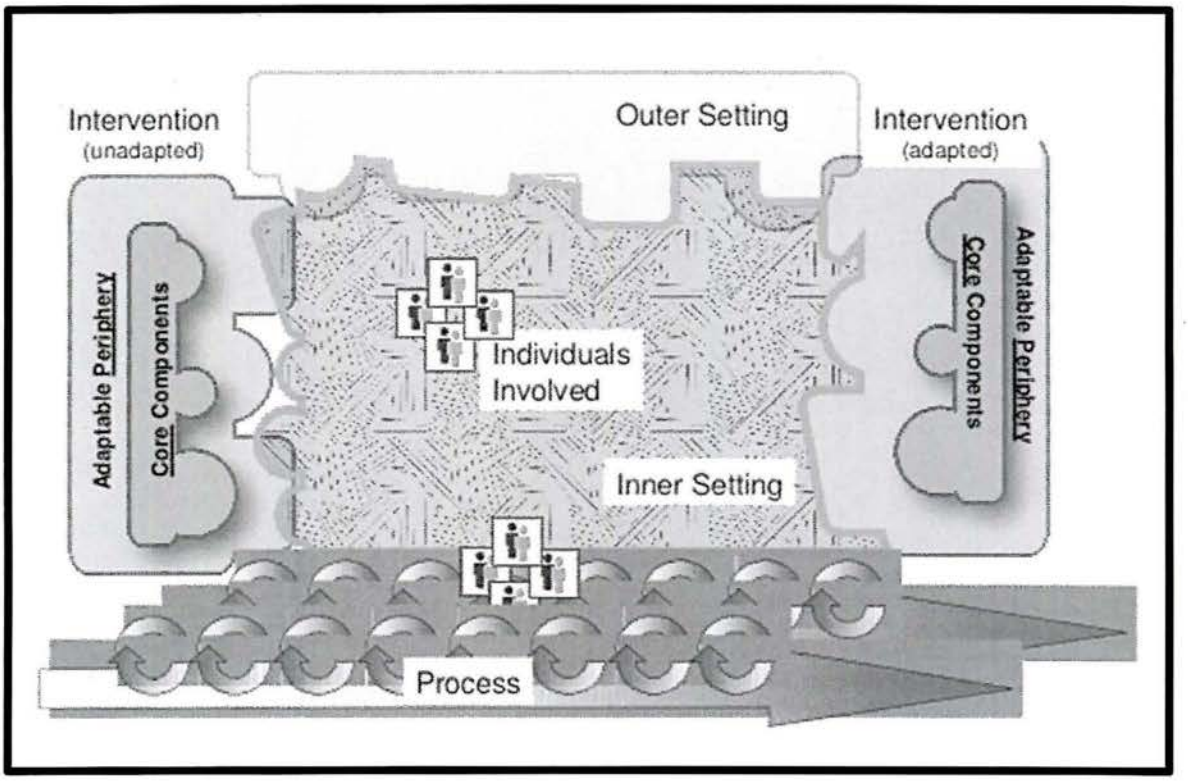
estimated two-thirds of organizations attempting to put an evidence based change into practice experience significant delay and/or failure.[54] Implementation is the process by which new discoveries are introduced to and integrated into practice; "research cannot change outcomes unless health services and healthcare professionals adopt the findings into practice." In 2006, the Journal of Implementation Science commenced, and in its introduction letter to readers, it defined its titled subject matter in the following way: "Implementation research is the scientific study of methods to promote the systematic uptake of research findings and other evidence-based practices into routine practice, and, hence, to improve the quality and effectiveness of health services and care. This relatively new field includes the study of influences on healthcare professional and organizational behavior."[16]

Implementation science looks not only at the endpoint health outcomes but assesses the formative process of disseminating evidence and implementing it into daily practice; it further aims to identify the facilitators and barriers to effective implementation.

C. Consolidated Framework for Implementation Science

Many frameworks exist within the field of implementation science that allows the researcher to investigate an intervention's implementation in a structured way. The Consolidated Framework for Implementation Research (CFIR) is a comprehensive framework produced by evaluating and combining key constructs from nineteen published implementation theories.[17]

Figure 4: Consolidated Framework For Implementation Research[17]



CFIR consists of 5 domains with accompanying constructs (see Figure 2). The first domain in CFIR is the intervention along with its specific characteristics. This domain includes stakeholders' perceptions about the quality, validity and value of the intervention over other options as well as the adaptability and complexity of the intervention. It also takes into account how the intervention is packaged and whether it can be tested on a trial basis. The source of the intervention, internally versus externally designed, and cost are other characteristics included in this domain.

The outer and inner settings are the next two domains described in the framework. The outer setting is comprised of the social, political and economic situation of the

organization in which an intervention is to be implemented. It includes the following four features: patient needs and resources, cosmopolitanism, peer pressure and external policy and incentives.

The inner setting includes the political, cultural and structural atmosphere through which the intervention will be processed. This includes the social networks and identified lines of communication within an organization, the size and history of the organization, and the culture and climate for change within the organization. Leadership engagement, resource availability and understandability of the intervention are also factors in readiness for change within the inner setting. Sometimes, the outer and inner settings can be difficult to distinguish from one another, and often changes in one will influence changes in the other.

The fourth domain of CFIR identifies characteristics of the individuals involved in the implementation of the intervention. This domain aims to "gain understanding of the dynamic interplay between individuals and the organizations within which they work, and how that interplay influences individual and organizational behavior change."[17] This domain describes the individuals' attitudes and beliefs about the value of the intervention and their own capabilities to execute it. It looks at individuals' stage of change related to the intervention and relationship and commitment to the organization. Other personal attributes are included in this domain such as intellect, competence, capacity and motivation.

Process is the fifth and final domain in the CFIR framework. Planning for the implementation and executing the plan as it was designed are constructs within the

process domain. Other important constructs are evaluation and reflection on the quality and effectiveness of the process and the experience of the stakeholders and individuals. Process could be a linear implementation process or a series of non-linear sub-processes; they can be planned or unplanned, purposeful or accidental, related or unrelated, "but ideally are all aimed in the same general direction: effective implementation."[17] (See Appendix B for CFIR constructs and definitions.)

D. Application of CFIR in Evaluating Health Related Interventions

CFIR was originally published in 2009 as a new comprehensive approach to guiding and evaluating implementation strategies. Since then, several researchers have used the framework as summarized in Table 5.

Table 5: Summary of selected studies where CFIR was applied

Study Citation	Application of CFIR
Damschroder LJ, Hagedorn HJ. A guiding framework and approach for implementation research in substance use disorders treatment. *Psychol Addict Behav.* 2011;25(2):194-205.	CFIR was used to evaluate implementation models previously used in substance use disorder treatments and to make 3 overarching recommendations for future implementation of evidence-based practices.
Lash SJ, Timko C, Curran GM, McKay JR, Burden JL. Implementation of evidence-based substance use disorder continuing care interventions. *Psychol Addict Behav.* 2011;25(2):238-51.	CFIR was used in the literature review process to identify barriers in the inner and outer setting domains.
Williams EC, Johnson ML, Lapham GT, et al. Strategies to implement alcohol screening and brief intervention in primary care settings: a structured literature review. *Psychol Addict Behav.* 2011;25(2):206-14.	CFIR was used in the literature review process to identify barriers in the inner setting, outer setting and process domains.
Hartzler B, Lash SJ, Roll JM. Contingency	CFIR was used to evaluate low

management in substance abuse treatment: a structured review of the evidence for its transportability. *Drug Alcohol Depend.* 2012;122(1-2):1-10.	uptake of an evidence based substance use disorder treatment and identify transportability strengths moving forward.
Ruffolo MC, Capobianco J. Moving an evidence-based intervention into routine mental health care: a multifaceted case example. *Soc Work Health Care.* 2012;51(1):77-87.	CFIR was used to evaluate the implementation of an evidence-based intervention for psychoeducation revealing considerations for bringing interventions to scale.
Damschroder LJ, Lowery JC. Evaluation of a large-scale weight management program using the consolidated framework for implementation research (CFIR). *Implement Sci.* 2013;8(1):51.	CFIR domains and constructs guided the development of an interview guide for data collection in a weight management program. It was also used for a codebook in qualitative data analysis.
Robins LS, Jackson JE, Green BB, Korngiebel D, Force RW, Baldwin L-M. Barriers and facilitators to evidence-based blood pressure control in community practice. *J Am Board Fam Med.* 26(5):539-57.	CFIR domains and constructs were used as a codebook for qualitative analysis.

A common thread among all of this published research is an articulation of the gap between the published evidence for specific interventions and the ability to implement it into practice in the community or clinical setting. Implementing an intervention after learning of its clinical value is a challenging task. CFIR creates a common vocabulary to discuss implementation strategies, barriers and facilitators; it "offers a theoretical framework that explains *and* guides implementation constructs and processes."[55]

In this dissertation, the researcher used CFIR to guide the development of qualitative data collection tool, a set of exit interview questions for TALC members. The CFIR domains and constructs were also utilized in the analysis of qualitative data to

create a code book for identifying themes surrounding implementation of the learning collaborative. CFIR is an appropriate framework to apply to this project because it allows for analysis of multiple layers of factors that contribute to the way an intervention is implemented based on multiple perspectives.

CHAPTER 3: Tennessee's Commitment to Improving the Health of Students with Asthma

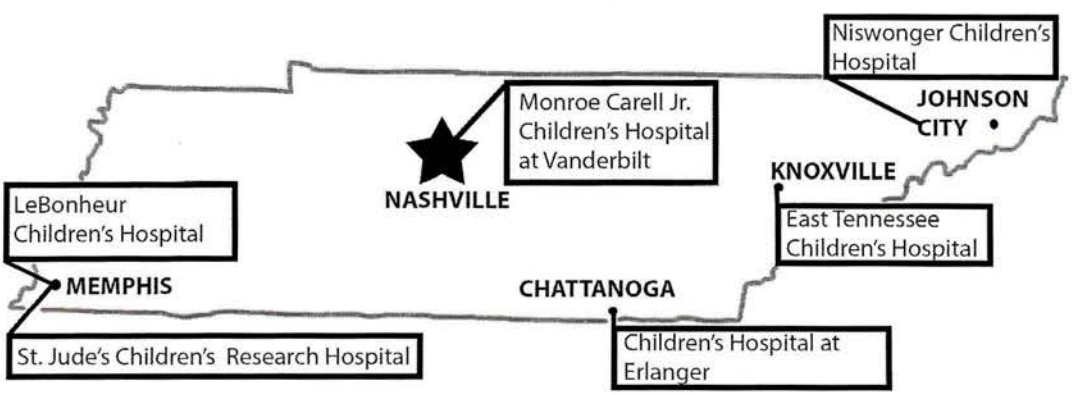
A. State Asthma Activities

To address asthma from the public health perspective, many states, including Tennessee, have adopted and implemented comprehensive state asthma plans. A significant portion of these plans typically focus on issues related specifically to childhood asthma. In 2009, Tennessee issued the "State of Tennessee Asthma Taskforce (STAT) Plan to Reduce Asthma."[13] In September 2010, the Tennessee Department of Health produced a follow-up report outlining progress made toward child-related goals as defined by the state plan.[14] Asthma and its effective management have also been included as one of 7 state priority areas by the Tennessee Department of Health's Title V/ Maternal and Child Health Program. One objective articulated by the STAT plan, which is divided in to Surveillance and Epidemiology, Public Awareness and Education, Medical Management, and Environmental Management, states that "By December 2014, all children with an asthma diagnosis will have an individualized asthma plan from the patient's medical home on file in the school, child care facility or other out-of-home group care setting and used in the home for asthma management." In an effort to address this goal, the Department of Health initiated the Tennessee Asthma Learning Collaborative, a multidisciplinary group of professionals tasked with problem-solving the issue of AAPs.

Within the state of Tennessee there are six large pediatric healthcare providers including Vanderbilt University Medical Center (Nashville), Le Bonhuer Children's Hospital (Memphis), Children's Hospital at Erlanger (Chattanooga), Niswonger

Children's Hospital (Johnson City), East Tennessee Children's Hospital (Knoxille) and St. Jude's Children's Hospital (Memphis). St. Jude's is a research facility specializing in pediatric cancer, but the remaining five facilities, which are diversely located throughout the state, offer Pulmonology programs and specialty physicians who support children diagnosed with asthma and their primary care providers. Representatives from each facility participated in the drafting of the State of Tennessee Asthma Taskforce recommendations and took part in the Tennessee Asthma Learning Collaborative (TALC). The Department of Pulmonology at Vanderbilt sponsors a statewide asthma conference each year, which aims to educate a multidisciplinary audience about state asthma initiatives, new research findings, and implications for practice. This conference is well attended by school nurses, community health providers, educators, and health coordinators from all areas of the state.

Figure 5: Map of Tennessee and major pediatric providers



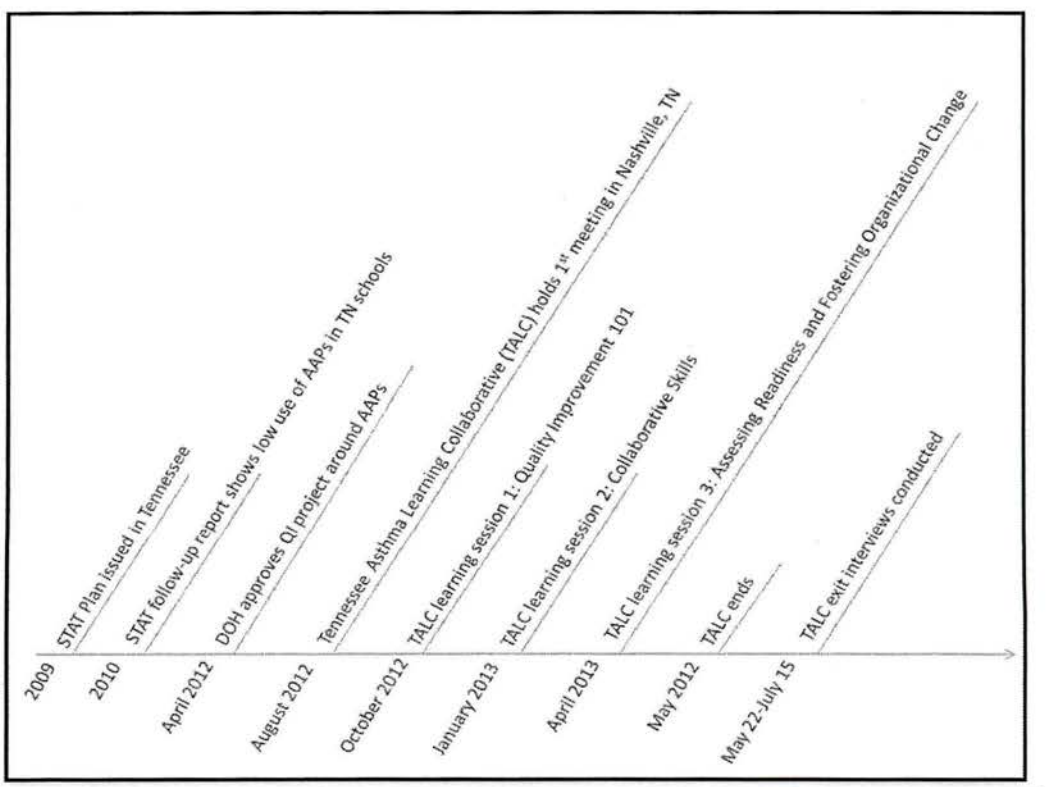
B. Tennessee Asthma Learning Collaborative (TALC)

The Tennessee Asthma Learning Collaborative (TALC) group was convened in August 2012 to address the following STAT objective:

> "By December 2014, all children with an asthma diagnosis will have an individualized asthma plan from the patient's medical home on file in the school, child care facility or other out-of-home group care setting and used in the home for asthma management."

The timeline and activities of the learning collaborative followed the structure and key elements of the Breakthrough Series model as described in Chapter 2 and illustrated in the figure below.

Figure 6: Timeline of TALC Activities



BTS Key Element 1: Select Topic

Asthma Care was identified as a "Priority Area" for the Maternal and Child Health section of the Department of Health in 2010. The overarching objectives associated with this priority area are as follows: (1.) to improve educational outcomes for students with a chronic disease, and (2.) to improve health outcomes for students with an asthma diagnosis. Senior leadership within the MCH section and this researcher identified increased use of asthma action plans as the specific topic TALC would be asked to address.

BTS Key Element 2: Recruit Faculty

For a collaborative learning group to function successfully, it is necessary to create buy-in with a group of early adopters. A group of expert leaders were identified, and their commitment to the project was established, which has helped to solidify the feasibility of creating and maintaining a larger group moving forward. The group of early adopters contributed to the development of the collaborative group by identifying other potential collaborative members, who were subsequently extended an invitation to participate in the learning collaborative group. Representatives from the following organizations were considered during this process:

- State of TN Asthma Taskforce
- Department of Education
- Department of Coordinated School Health
- TN Association of School Nurses,
- TN Parent-Teacher Association,
- TN chapter of the American Academy of Pediatrics,
- TN Regional Health Directors and Health Officers,
- TennCare, and
- Family Voices.

Attendees included 5 providers, 5 schools nurses or school nurse managers, 5 members of the TDOH, 5 payers, 4 members of CSH, and 2 parents.

BTS Key Element 3: Develop Framework and Changes

Members of the learning collaborative participated in an initial in-person meeting on August 22, 2012. The meeting was held at the Tennessee Department of Health in Nashville, TN and the agenda consisted of 4 parts.

Part 1 provided a general overview of childhood asthma in Tennessee. The following four expert speakers gave brief lectures based on their area of practice and vision for improvements in asthma care:

- Dr. Michael Warren- TN, Dept of Health, Director, Maternal and Child Health
- Dr. Yvette Mack- Asthma Program Director, TN Dept of Health
- Dr. Rebecca Johnson-Wommack- Director, TN Coordinated School Health
- Dr. Paul Moore- Pulmonologist, Vanderbilt Children's Hospital

The remainder of the meeting's activities included facilitated small and large group discussions surrounding the questions posed in the Model for Improvement. According to the BTS model, the Model for Improvement is an integral tool for organizing and implementing change at the local level.

To ensure participant engagement, discussion leaders followed the Workshop Facilitation Method (WFM), a strategy geared toward active participation and contribution toward a common goal.[56] This method is used to foster small group conversations around questions posed to the larger group; representatives from each small group then verbally presents the conclusions or ideas to the large group and posts

them visually on the wall. After each group has presented, the large group discusses overlaps and similarities and visually represents items that are the same.

Part 2 of the meeting devoted approximately one hour of time toward brainstorming potential areas for improvement around asthma action plans. Participants broke into small, professionally diverse groups to answer the first question of the Model for Improvement, "What are we trying to accomplish?" Collaborative members were encouraged to consider various avenues and perspectives. Possible ideas generated were 1) increasing physician awareness of AAP importance, 2) educating school nurse and teachers about AAP function, and 3) standardizing the AAP form. At the conclusion of this session, the group agreed upon the following shared aim:

AIM: To increase the number of students with individual asthma action plans at three pilot sites by 25% points from the current baseline by the end of the 2012-2013 school year.

This aim was selected as a progression toward the STAT goal for 100% adherence to AAP utilization at school.

Part 3 of the meeting focused on the second Model for Improvement question, "What changes can we make that will result in improvement?" and generated discussion about how the group might accomplish the shared aim. Because all improvements require making change, but not all changes result in improvements,[57] participants were encouraged to consider appropriateness, impact, effectiveness and sustainability of potential areas for improvement change. In small groups, participants listed potential partners for hypothetical interventions and what each partner could do to help meet the shared aim.

The final question in the Model for Improvement, "How will we know that a change is an improvement?" Discussions resulted in a list of possible outcome, process, and balancing measures (Table 6) that could be used to identify whether a specific change had caused the desired improvement.

Table 6. TALC potential outcome, process and balancing measures

Outcome Measures	Process Measures	Balancing Measures
Asthma-related absentee rates	# students w/ inhaler at school	School nurse time
Return to class rates	AAP form completeness	Satisfaction of school staff
Family/student perception/satisfaction	System protocol- quality	Time spent on AAP collection and management
School staff perception/satisfaction	% of students with AAPs	
Decrease asthma-related ED visits	AAP utilization	
Teacher satisfaction/comfort	Content of AAP form	
Asthma Control Test (ACT)	School nurse presence at school	
	Level of engagement of community partners	
	Physician refusal	
	Parent refusal	
	Cost of paperwork	
	Healthy school team engagement	

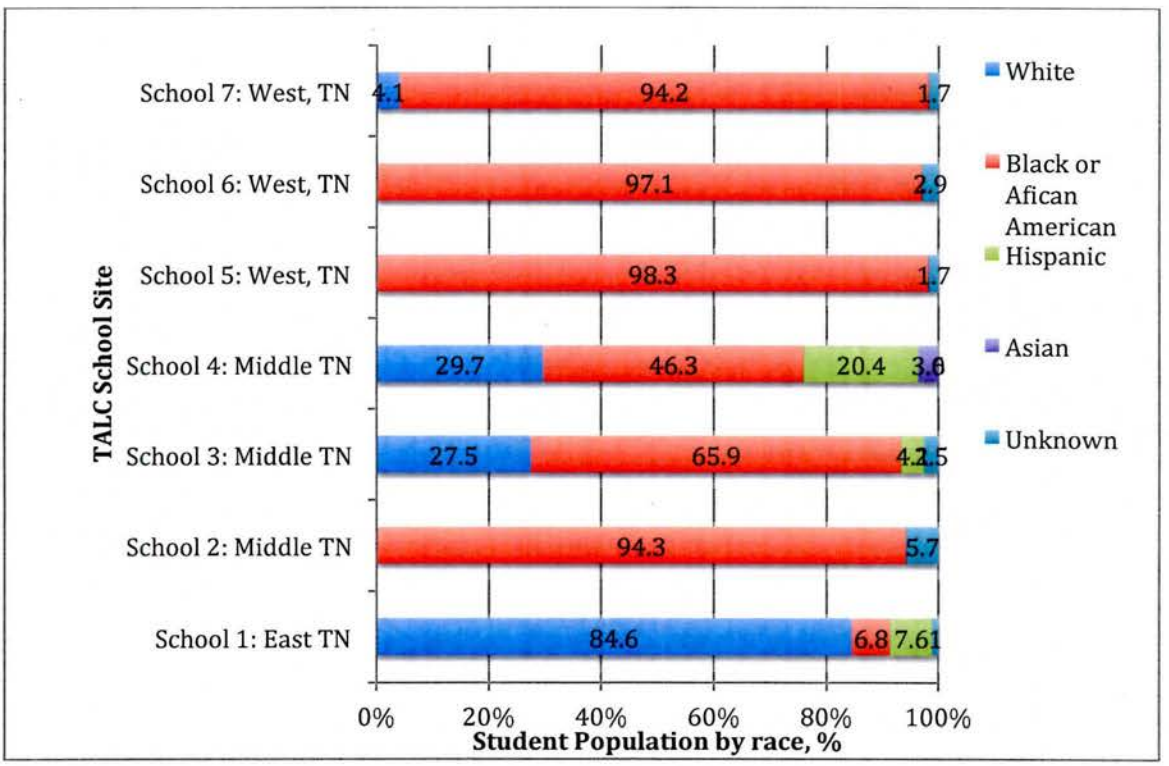
TALC members decided that all of these options identified at the kick-off meeting would serve as a menu, a list from which to customize local activities based on real time needs and resources.

BTS Key Element 4: Enroll Participants and Prework

Following the August meeting, members of TALC divided themselves by geographic regions (east, middle and west Tennessee) and were tasked with identifying

appropriate local sites to enroll. In east Tennessee, Northwest Elementary school, located in Cocke County, was selected. The school serves K-8th grade students in this mountainous county. TALC members chose this school as an appropriate site to carry out improvement activities because they identified it as a "high risk and underserved population," and they believed they could have an impact my initiating asthma related activities at the site. This school also expressed significant buy-in for the project and its administrators were in full support of an intervention. In middle Tennessee, three elementary schools were selected in Davidson County, home to Metro School System serving the greater Nashville area. These three schools were chosen from 3 different zip codes based on school nurse availability and productivity. And in west Tennessee, Memphis's Frayser Elementary Achievement School, Corning Elementary Achievement School and Westside Elementary Achievement School were selected from the Shelby County Achievement School district, which serves students previously scoring in the bottom 5% academically. These schools were selected because the school nurse serving this population expressed interest and was able to commit adequate time to the project.

Figure 7: Tennessee Asthma Learning Collaborative School Sites by Race, Oct 2012[58]



Once the local sites were selected, TALC members were asked to complete prework to document baseline measures including number of students enrolled, number of students known to have asthma, number of students with an AAP at school, school nurse availability and site policies and/or procedures on asthma action plans. As part of the prework, TALC members were also asked to describe their change strategy at their chosen site. Each site was allowed to choose individualized change strategies based on the unique qualities of the site.

BTS Key Element 5: Learning Sessions

As a key element of the BTS model, learning sessions were held quarterly to engage TALC members in professional development surrounding the issue at hand, in

this case asthma. The purpose of the learning session was to continue to learn about the BTS model and strategies for change, as well as to share progress from local sites and lessons learned from experience; these collaborative meetings intended to provide a place to dialogue with colleagues from various disciplines about the shared aim. TALC learning sessions were held either in-person at the DOH or in webinar format. During the 90-minute meetings, pilot site leaders were asked to share formal updates, guided by the quarterly written report, from each action cycle. Other TALC members were expected to engage in professional conversations about the PDSA cycle and how to research findings could be further integrated into the next cycle.

Table 7: Tennessee Asthma Learning Collaborative learning session topics, speakers and formats

Learning Session Date	Topic	Guest Speaker	Format
October 30, 2012	Quality Improvement 101	Dru Potash	Webinar
January 31, 2013	Collaborative Skills: Self-Assessment and Best Practices	Jaime Bruce	Webinar
April 4, 2013	Assessing Readiness and Fostering Organizational Change	JoAnn Kirchner, MD University of Arkansas	Webinar

BTS Key Element 6: Action Period

During each action period, the TALC members associated with each local site would work together with their identified community partners to implement their chosen change strategy. Each local site had a different strategy for creating change and each documented different areas of success and challenge. Strategies (listed in Table 8) included implementation of an in-school screening program with regular follow-up,

partnership with local pediatricians regarding asthma education, and letters home to parents about the importance of AAPs at school. During the action period each local site was asked to document activities and outcome and process measures.

Table 8: Changes Strategies by Regional Team and PDSA Cycle

	PDSA Cycle 1	PDSA Cycle 2	PDSA Cycle 3
Regional Team 1	Informed community providers of project and importance of AAP collection	Held screening session #1	Held screening session #2
Regional Team 2	Emailed policy reminder to school nurses	Informed school nurses of QI project	Informed school nurse of STAT goal to have 100% AAP on file at school
Regional Team 3	School nurse called local providers and parents educating then of need for AAP at school; school nurse gave providers fax information for school nurse	TALC members hosted parent education sessions after school; school nurse included educational material with report card	Followed up with provider offices by phone; Followed up with parents by phone

BTS Key Element 7: Summative Congresses and Publication

A report documenting the activities and findings of the Tennessee Asthma Learning Collaborative were distributed as appropriate by the Tennessee Department of Health, Maternal and Child Health Section (see Appendix A).

BTS Key Element 8: Measurement and Evaluation

TALC members from each local site completed quarterly report worksheets to document progress toward the aim and the activities at each local site (see Appendix C).

TALC concluded its work at the end of the 2012-2013 academic year in June 2013. After the final quarterly reports were received, TALC members were asked to

participate in interviews to gain more information about the learning collaborative process and local site activities. These interviews were used in the evaluation of TALC and its implementation.

Overall, the timeline and activities of TALC followed the BTS model as prescribed by the IHI. The group was assembled for the specific purpose of improving utilization of AAPs in selected schools with a finite deadline within the time frame recommended by the IHI. The group successfully convened to participate in quarterly didactic learning sessions, engaged in local QI efforts, and dialogued regularly about ongoing efforts. Challenges experienced during the implementation of TALC included variable attendance at learning sessions (see Table 9) and differences in strategies and documentation between local sites. In-depth analysis of this process is described in Chapter 6.

Table 9: Tennessee Asthma Learning Collaborative member participation summary

Participant profession	Kick-off	Learning Session 1	Learning Session 2	Learning Session 3	Exit Interview
Provider	5	3	4	3	5
School nurse	5	4	4	3	4
Coordinated School Health	4	2	3	2	3
Department of Health	5	4	4	2	2
Payer	4	2	3	1	1
Parents	2	0	0	0	0
TOTAL	**25**	**15**	**18**	**11**	**15**

CHAPTER 4: METHODOLOGY

A. Introduction

This chapter describes the primary methods used to complete this dissertation and gain an understanding of the implementation of the TALC and its local site activities. Data for this dissertation were collected through key informant interviews conducted at the completion of the 2012-2013 school year, analysis of school records filed with the school nurse and observational data from a site visit. A mixed method approach was used to analyze data. Qualitative data was analyzed for themes and concepts using the CFIR model as a guide. Quantitative data was analyzed using run chart analysis.

B. Data Sources and Collection

During the active working period of TALC, a designated leader at each local site submitted quarterly update worksheets. The worksheets (see Appendix C were designed to collect baseline data regarding AAP use, document change strategies conducted and assess change in AAP use after change strategy implementation. The worksheets included 7 questions that solicited information on identified community partners, attempted intervention or change strategies, and successes and challenges related to the implementation process or outcome. Additionally, the worksheet prompted the leader to describe a recent Plan-Do-Study-Act cycle.

Qualitative data was collected through semi-structured interviews (N=15) with individual TALC participants at the state and local levels. These interviews were held at the completion of the state and local TALC activities from April 30 through June 27. In-person interviews were conducted when possible, and telephone interviews were

performed when an in-person interview was not an option (see Table 10). One in-person group interview was held following a site visit. Interviews began with learning collaborative participants and local site leaders, then, using a snowball sampling method, other local level participants were identified for interviews. These interviews lasted approximately 30-60 minutes. With permission of the interviewee, interviews were digitally recorded by the researcher and later transcribed by a professional transcriptionist prior to analysis.

Table 10: Tennessee Asthma Learning Collaborative member exit interview summary

Participant profession	In person Interview	Phone interview	TOTAL
Provider	2	3	5
School nurse	2	2	4
Coordinated School Health	1	2	3
Department of Health	1	1	2
Payer	0	1	1
Parents	0	0	0
TOTAL	**6**	**9**	**15**

Interview questions were structured based on Patton's methods for qualitative interviewing,[59] and the content development was guided by the CFIR framework and its 5 domains (the intervention, the inner and outer settings, the individual participant and the process). The interview questions were open ended to elicit descriptions of each participant's role and experience during the course of the learning collaborative. Follow-up questions probed how specific CFIR constructs affected implementation of TALC at the state level and the local level based on the participant's level of engagement. For

example, one question asked the interviewee to "describe the preferred process/path by which an AAP is created and shared with a school," with a follow-up question probing if there "are specific barriers or facilitators to that process?" While the literature describes several barriers to AAP utilization including provider barriers (lack of time, lack of understanding), parental barriers (poor communication disconnect with provider, lack of understanding/value benefits of AAP) and school nurse barriers (receipt incomplete/inconsistent forms, lack of asthma knowledge, lack of confidence using AAP), the structure of the interview questions required the participant to draw from their own experience and perception. Separate questionnaires were created to account for the participant's level of involvement in the project (ie. TALC member with pilot site involvement, TALC member with no pilot site involvement, Community partner at pilot site). (see Appendix D)

In addition to interviews, the researcher completed a site visit to 1 of the 3 local sites (East Tennessee, Cocke County) to observe the local activities. During this visit the researcher acted in a strictly observational role as defined by Patton.[59] Site visits were not completed at the Nashville or Memphis sites due to staffing changes and availability.

C. Quantitative Analysis

Quantitative data from each local site including total student population, number of students known to have asthma, and number of AAPs was collected from each site. These data were entered into an Excel spreadsheet and analyzed using a run chart tool produced by the Institute for Healthcare Improvement (IHI).[60] Run chart analysis is a type of time series analysis that is easy implemented by practice sites and is an

accessible, effective way to evaluate change over time in a practical setting. Run chart analysis is designed to illustrate pattern and direction of the data over a process or period of time. Decision rules of the run chart can be applied to determine if plotted data depicts a shift, a trend, or a run. Because AAP data from each local site was collected at three points in time during the 2012-2013 school year, a run chart is able to graphically depict the change over time. Analysis was completed for individual sites and for the project as a whole. The results of this analysis will be used to determine TALC's success at reaching its stated goal at each site, which was to increase AAP utilization by 25% points above baseline.

D. Qualitative Analysis

Qualitative data analysis methods as described by Patton[59] in *Qualitative Research and Evaluation Methods* were used to process data. CFIR domains and constructs as listed by Damschroder et al.[61] were utilized as codes. Transcribed interviews were coded by hand, with applicable codes noted in the margins. Electronic qualitative analysis software was not employed. Not all constructs codes were used, only those that applied to the collected data were noted. After coding the transcript of each interview, specific quotes were categorized by code, and emerging themes and concepts were identified in the data.

To be consistent with the CFIR domains in this analysis, the key elements of the project were labeled by their representative domain. The intervention was defined as the AAP tool, the outer setting as the state of Tennessee (including Departments of Health and Education), the inner settings as the 3 pilot sites, the individuals as the TALC

members and site leaders, and the process as the learning collaborative. Table 11 lists the CFIR domains, constructs and potential study questions answered with each domain.

Table 11: Consolidated Framework Implementation Research applied to Asthma Action Plans and Tennessee Asthma Learning Collaborative

CFIR Domain	Domain Constructs	Study questions
Intervention Characteristics (AAP)	A. Intervention Source B. Evidence Strength and Quality C. Relative advantage D. Adaptability E. Trialability F. Complexity G. Design quality and packaging H. Cost	What evidence supports the use of AAP? Is this evidence reputable and of sound quality? Are AAP tools easily accessed, completed and shared? Is the AAP understandable for the intended audience? Is there an alternative that serves the same purpose?
Outer Setting (Tennessee Department of Health, Department of Education, Coordinated School Health)	A. Patient needs and resources B. Peer pressure C. External policy and incentives	Are they working to lower barriers and increase facilitators associated with AAP utilization? Are there state level policies, regulations, guidelines, mandates, etc. in place driving increased use of AAP?
Inner Setting (Pilot site locations)	A. Structural characteristics B. Networks and communications C. Culture D. Implementation climate E. Readiness for implementation	How did capacity and readiness for change within this group contribute to the outcome? What aspects of the group led to successful or unsuccessful implementation? What characteristics about each site may have contributed to implementation? Cultural priorities? Competing programs? What was the capacity for change at each site? Was there a perceived need for increased utilization of AAPs?
Characteristics of Individuals (Learning Collaborative members and pilot site	A. Knowledge and beliefs about intervention B. Self-efficacy C. Individual stage of change D. Individual	How did individual perception of AAP contribute to the implementation and effectiveness of the LC? How do members perceive their relationship with DOH and DOE and how does it impact

participants)	identification with organization	engagement in LC?
	E. Personal attributes	What are the perceptions of the stakeholders about the learning collaborative (CL) approach?
Process	A. Planning B. Engaging C. Executing D. Reflecting and evaluating	How did planning contribute to the level of success for LC meetings and pilot activities? Were their perceived "champions" within the LC? How did they influence the process? Was the LC carried out according to plan? During the implementation process, was regular feedback provided/collected? Were changes made based on feedback? Is the participation in a LC a worthwhile activities for members?

These data were analyzed to address the following objectives:

1. To evaluate the implementation of strategies and local activities to increase utilization of asthma action plans by 25% points from baseline in Tennessee schools.
2. To evaluate the role that the statewide learning collaborative played in supporting the local sites to improve use of asthma action plans.

CHAPTER 5: FINDINGS

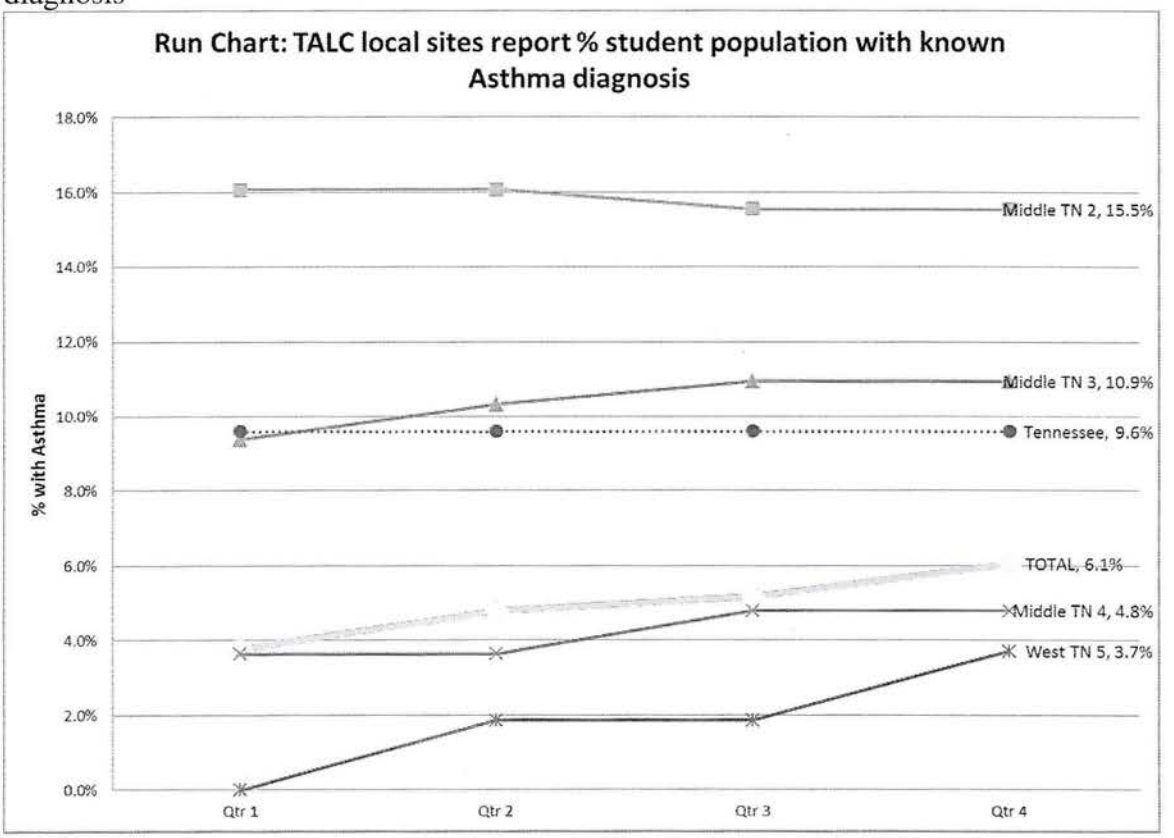
A. Findings from Quantitative Analysis

TALC members selected 7 schools as local sites for QI intervention around AAP utilization. Of the selected schools, 1 school (East TN 1) implemented a screening program rather than AAP utilization project. This school reported identification of 10 students as having an asthma diagnosis from the total 410 student population; 20% (i.e. 2) of the identified students subsequently returned an AAP to the school. Two schools (West TN 6 and 7) started the project but were unable to continue because the school nurse covering these sites took a leave of absence, during which time the covering school nurse declined participation in the project; no changes were implemented at these sites and data was not collected. The remaining 4 schools (Middle TN 2, Middle TN 3, Middle TN 4, and West TN 5) participated in the project from start to finish and collected data on the number of students known to have an asthma diagnosis and the number of students having asthma documentation in the form of either an AAP or IHP on file. Data for AAP and IHP are represented together as any type of asthma management plan because some sites collected one preferred type of documentation over the other. West TN collected data on AAP collection while all three middle TN sites collected data on IHP collection.

Run chart analysis of data on the 4 schools able to complete the project and collect comparable data during each PSDA cycle shows that the local sites collectively improved their identification of students with an asthma diagnosis from 3.8% during the BTS pre-work phase to 6.1% at the end of the school year; comparatively the DOH reports nearly 10% of the total student population of the state has an asthma diagnosis. Individual sites

showed improvement in identification with the exception of one middle Tennessee site that reported a slight decrease in the identified number of students with asthma. (See Figure 8)

Figure 8: Run Chart: TALC local sites report % student population with known asthma diagnosis [1]

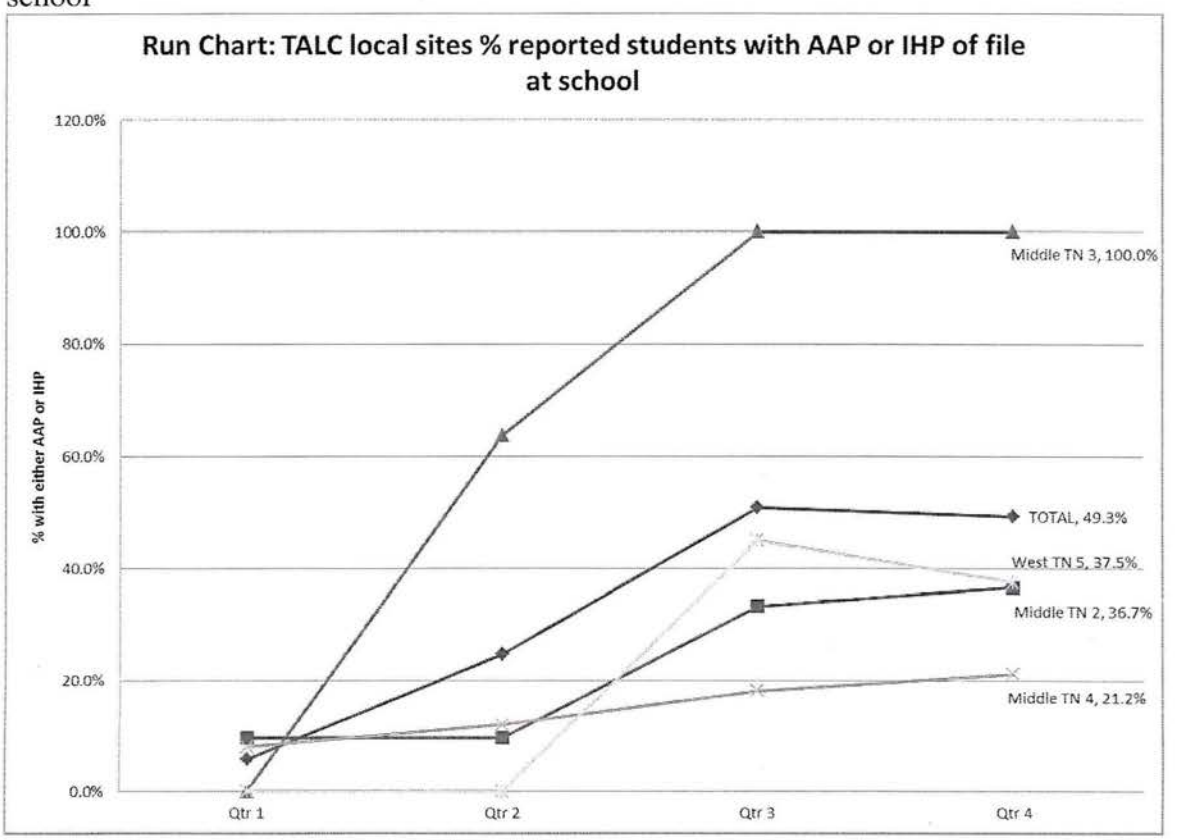


Of those students known to have asthma at each local site, Figure 9 shows the run chart analysis results for students having either an AAP or IHP on file with the school. None of the participating sites had IHPs or AAPs on file for any students with known asthma at the start of the learning collaborative. The four sites that provided data on their

[1] In Figure 8, TN data is shown as reported by Surveillance, Epidemiology and Evaluation; Division of Policy, Planning and Assessment; Tennessee Department of Health based on data from the National Survey of Children's Health. NSCH 2007. Data query from the Child and Adolescent Health Measurement Initiative, Data, Resource Center for Child and Adolescent Health website (www.childhealthdata.org).

efforts are represented in Figure 9. Of them, only site 5 in West TN reached the TALC goal of 25 percentage points increase from baseline for AAP collection with a 37 percentage point increase. Middle TN 2 and Middle TN 3 also appear to have reached the goal with 27 and 100 percentage point increases respectively, but it is important to note that all documentation collected at the three Middle TN sites were IHP forms completed by the school nurse with no physician or parent engagement. Middle TN 4 site reported only a 13.2 percentage point increase and collected only IHP.

Figure 9: Run Chart: TALC local sites % reported students with AAP or IHP on file at school



B. Concepts emerging from Qualitative Analysis

This section describes findings from interviews with 15 participants. Six primary concepts and their supporting themes emerged during analysis (see Table 12). Each concept and theme is linked to a CFIR domain and construct(s). In the next chapter these concepts and themes will be discussed as either barriers or facilitators to implementation at both the learning collaborative and local site level.

Table 12: Concepts and themes from analysis of qualitative data by CFIR

CFIR Domain, Construct and subconstruct	Concepts and Supporting Themes
Inner Setting-Implementation Climate	**Concept 1: The capacity for change and shared receptivity of participants impacted the ability to create change.**
Tension for Change	Theme: There were differing beliefs among participants about the need for students with asthma to have an AAP on file.
Compatibility	Theme: Participants expressed concern that added responsibilities associated with AAP utilization would impact existing workflow and work load.
Inner Setting-Readiness for Implementation	**Concept 2: Participants did not believe that local sites or the state possessed tangible indicators surrounding resources needed for AAP implementation.**
Available Resources	Theme: Participants perceived that utilization of AAPs is affected by staffing at the school level.
Intervention	**Concept 3: There is not agreement on the AAP as a tool for asthma management at school.**
Intervention Source	Theme: School require their own approved AAP form and will often not accept unapproved forms.
Relative Advantage	Theme: There are conflicting policies and practices regarding AAP use and IHP use.
Design, Quality and Packaging	Theme: Participants did not have consensus on content and design of AAPs.
Characteristics of Individuals	**Concept 4: There is a perceived lack of knowledge about AAPs.**
Knowledge and Beliefs about the Intervention	Theme: School staff perceived that parents and students do not understand the purpose or value of an AAP.
	Theme: Providers perceived that school staff did not understanding the purpose or value of an AAP.

Outer Setting	**Concept 5: A cohesive state plan and state level nursing leadership would help guide policy and practice regarding the utilization of AAPs.**
External Policy and Incentives	Theme: School nurse participants believe the presence of a state level nursing leader within the TDOH would help to create an appropriate plan about AAP use.
Process	**Concept 6: The flexibility in QI activities implemented at local sites had perceived challenges and benefits to the process.**
Engaging	Theme: Local sites with a "champion" perceived greater levels of collaboration and buy-in.
Executing	Theme: Local sites were able to develop the interventions that best fit their needs.
Reflecting and Evaluating	Theme: Allowing flexibility at local sites impacted the ability to compare measureable outcomes between sites.

Concept 1: The capacity for change and shared receptivity of participants impacted the ability to create change.

Tension for Change Theme: There were differing beliefs among participants about the need for students with asthma to have an AAP on file.

Participants expressed differing opinions about AAPs and the use for them at school. Some participants believed that AAPs made a difference in care at the family and school level, while others expressed that it was better suited only in under specific circumstances.

> *"I think they're effective. Um, I've had numerous families tell me how much they appreciate having these especially those whose child is newly diagnosed or really has gone uncontrolled for quite a while and they didn't know what to do. So I have found that they are effective. Then there are others that have had so many of them and they've had asthma for so long that you give them another one and it's just another piece of paper because they already know what to do" – provider*
>
> *"I think they're as effective if the providers give you an education." –provider*
>
> *"Asthma care plan is really designed more for the families; you do X amounts of treatments and then you wouldn't have to call your doctor type of stuff. And so the action plans working for the school nurses is going to be oh, quite different." – school nurse*

> *"It [AAP] might have impact on how they [school nurses] treat an acute exacerbation in the school but it's not going to have any long term impact on overall control.---if a nurse isn't present at the school providing management support." –school nurse*

Compatibility Theme: Participants expressed concern that added responsibilities associated with AAP utilization would impact existing workflow and workload.

A perception exists that school nurses have a heavy work load that may impede their ability to provide asthma management at school.

> *"Their primary responsibility will be to do the skilled nursing services in the schools....a nurse goes to that school every day and sees students for skilled nursing. Skilled nursing will be things like helping students manage their diabetes, catheterizations, tube feedings, things like that. That's what we called skilled nursing."*- school nurse representative

Adding the task of monitoring and managing students diagnosed with asthma, especially those believed to be symptom-free or well-managed, is perceived as a lower priority and potentially too much additional responsibility for a school nurse's workload and time constraints.

> *"...they already have their hands full with different responsibilities and things that they're expected to do."*- representative of the Department of Health

> *"They're handling a lot – they're going to one classroom, giving somebody their, you know, sugars test and their insulin, then they're driving to another school to sit with some other kid for lunch and do the same thing. Then they're coming back for, you know, and so they're in their cars a lot. And time is an issue." –* provider

One physician provider recognized the limitations of the school nurse role given the work load, but went on to articulate the potential health management support that can happen at the school level when an AAP is utilized.

> *"I realize that sort of takes the super nurse who's really there just holding down the fort in terms of treating the acute situations but I think we've seen in some of the smaller counties where there's smaller numbers that somebody can take that to the next level and making sure that the kids, you know, if there's a kid there*

who's coming in every day for Albuterol, then maybe they should be asking that question. Let's see your asthma action plan which should be on file. So I think these efforts are really important in terms of getting them on file with the state."- provider

Concept 2: Participants did not believe that the state or local sites possessed tangible indicators surrounding resources need for AAP implementation.

Available Resources Theme: Participants perceived that utilization of AAPs is affected by staffing at the school level.

It is perceived that utilization of AAPs is affected by school nurse staffing at the school level. A majority of participants including community providers, school nurses and public health representatives shared the perception that schools have limited access to school nurses in statements such as the following:

"And, you know, we have nurses who are covering maybe six or seven schools." - Provider

"So part of the barrier[to AAP use] is not enough nurses." - Provider

"I think there are very few schools in this county who have a nurse in the school every day."- Provider

Leaders in the school nurse community confirmed that this is often an accurate perception. A school nurse representative for an urban school system stated,

"Most nurses have 3-4 schools they are responsible for. The other schools that don't have a school nurse that goes there on a daily basis, those are called contact schools. Basically those schools manage themselves. If they all have a nurse assigned to them, they contact her if they need something." – school health coordinator

And one school nurse articulated this perceived lack of nurse staffing as a direct barrier to having AAPs on file in schools.

"And then the other thing is if you're going to be looking at the state level and looking at nursing and action plans, then the obvious question comes up does every school has a nurse assigned to it and so there's not, then for state wide level then getting the action plans into a – the schools hands.".- school nurse

Responses clarified what happens when a student does experience asthma symptoms at school, particularly in the absence of a school nurse. Schools are instructed to be self-reliant and be able to react without the presence of a school nurse.

> *"It's not appropriate for schools to call the nurse and say oh can you come over and look at this kid? We want - we want the schools to be able to act independently because the nurse may be busy, she - they maybe they can't reach her."* – District Director of School Nurses

When a school nurse is not available, schools often take action to get the child emergency medical attention.

> *"The schools need to know what to do and be able to act, which by default is just call 911 if - if there's a problem."* – school nurse

> *"...if the child is, you know, saying and this is a direct sort of quote from somebody, the child goes to their teacher and is exhibiting any sort of problems with breathing, they just immediately call 911. They're like we're not going to look for paperwork, we're not going to – we're going to give them the medicine that we have for them in our drawer and we're going to call an ambulance and because we need – we don't have anybody to assess them."* – provider

Concept 3: There is not agreement on the AAP as a tool for asthma management at school.

Intervention Source Theme: Schools required their own approved AAP forms and would not accept unapproved forms.

Participants shared repeated incidences of schools requiring use of their school-developed and approved AAP form instead of the forms that may be used at the provider's office or those available online.

> *"All these different systems have different forms and what's happened with us is that we give them our asthma action plan and then we get notification either from parent or from school that we don't like, you know, you have to use our form."*- provider

Providers who participated in interviews expressed that time is a barrier to

completing school specific forms.

> *"You ask PCP's, especially because they are so busy, to do two different forms, you're asking too much." provider*

Participant responses suggested that some school systems or districts perceive a legal concern for using "non-approved forms."

> *"the reason they had their asthma action plan [system developed form] is because that's what's their legal counsel has told them."* - provider

Relative Advantage Theme: There is inconsistent use of AAPs versus Individual Health Plans (IHP).

Participants discussed an Individual Health Plan (IHP) as a widely used alternative to the AAP. Of note, during the data collection process, this researcher discovered that some districts have a written policy in place requiring all children with a diagnosis of any kind have an IHP on file at the school, but none have a policy specifically requiring an AAP.

> *"I think that a lot of the schools are feeling like that they are addressing the issue with the IHP's. So I don't know exactly what the percentage is off hand of AAP use but I know that every child with a health issue has an IHP. So if we can just get some of that asthma action plan information into that IHP, again you can call it what you want to call it as long as we're addressing asthma."* – Department of Health representative

While IHPs are frequently written for students with an asthma diagnosis or a suspected diagnosis, data revealed that these plans are often written without parent involvement.

> *"There are many, many individual health plans that are written for asthma because it is by far the most thing that we write individual health plans about. There are many, many, many of those that are developed without parent input."* –school nurse representative

Design, Quality and Packaging Theme: Participants did not have consensus on content and design of AAPs.

While some participants agreed that having a form of documentation regarding an

asthma diagnosis is appropriate to maintain at school, there was not agreement on the form this documentation may take. The data showed that not only are their many variations to the AAP form itself, but that there are conflicting opinions about the format and key elements to be included in the content. In describing the typical key elements of an AAP, a representative from the original STAT committee and a representative of the Department of Health stated the following:

> *"You're mainly going to be looking at those three areas like they're doing well, they're having breathing difficulties and then the emergency time. Once they have those basic things on them listing your maintenance meds and how much you're supposed to take, how are you supposed to take it? The emergency meds how they're supposed to be utilized, that's basically the crooks of an asthma action plan."* – Department of Health representative

When talking about the perception of key elements for AAPs, a community specialty provider shared other potential information to include.

> *"I've seen asthma plans from some schools where they have all of that but they also have what are your triggers, who do you want to be called, what emergency room do you want to use? For me in a school situation, I would prefer these sorts of plans that are a little bit more comprehensive than your green, yellow, red..."* - provider

Some participants talked about the value of a single standardized AAP form that was approved and used statewide.

> *"I could say again that you could make the process a lot easier and therefore, you know, not having to have both [an IHP and an AAP.] One really needs to take the place of the other."*- school nurse

> *"The standardized state one [AAP] is still a good idea because you – even in this area, you have every county has their own and it's – they are required to print information a little bit, so having a standardized one would be a heck of a lot easier for the providers."*-provider

Concept 4: There is a perceived lack of knowledge about AAPs.

Knowledge and Beliefs Theme: School staff perceived that parents and students do not understand the purpose or value of an AAP.

Among the group of school nurses who participated in this effort, there is the perception that an AAP is a tool primarily useful to educate parents and students.

> *"What does the parent know about it? They don't - they haven't been educated on it. I think the key with the asthma action plans is education, education to the parents."* - District Director of School Nurses

One school nurse articulated students' lack of knowledge about medication use and suggests that education take place with the physician at the time an AAP is created.

> *"It's very often that students will present to the school, they'll have an inhaler and they actually don't even have a clue how to use it. They, you know, they maybe have been instructed but they don't know they need to wait a minute between puffs. It's just there's not enough education. So I think that that relationship between the physician, the student and the parent is key and is important if an asthma action plan is going to be written."* – school nurse

Another school nurse went on to say the following:

> *"The physician needs to write it and explain to the patient on site, what it all means. And you can't really do that if you just have the physician; oh fax me an asthma action plan."*- school nurse

Knowledge and Beliefs Theme: Providers perceived that school staff did not understanding the purpose or value of an AAP.

On the other hand, the providers that participated have the perception that school nurses have not received sufficient training around AAP utilization and its value in the school setting.

> *"The other question comes up and that is what kind of education are the school nurses have been prepped for in order to be able to understand the action plans and the medications and how to safely give them and how often they can give them, you know, that type of stuff. And so there needs to be a big educational component to that."* – provider

Concept 5: A cohesive state plan and state level nursing leadership would help guide policy and practice regarding AAP utilization.

External Policy and Incentives Theme: Participants believe that the presence of a state level nursing leader within the TDOH would help to create an appropriate plan about AAP use.

Many of the participants made statements about the variety of AAP forms and policies regarding their utilization. School nurse, school nurse management, and school health coordinator participants suggested that this lack of a cohesive approach to asthma management at school could be improved by recreating the role of a state level nursing leader.

> *"There is no - there really is no head. The only things that the nurses have to go on - or the districts have to go on are the state guidelines that were written in 2 - that were last updated in 2007. And that's pretty much all you can reference when it comes to anything that you're doing in the school setting - as far as nursing services. So there is no go to person, there is no guru."* – District Director of School Nursing

> *"I mean you know the bigger more global problem in school health across the state is that there is no state school nurse state consultant."* – Coordinated School Health coordinator

Concept 6: The flexibility in QI activities implemented at local sites had perceived challenges and benefits to the process.

Executing Theme: Local sites were able to develop interventions that best fit their needs.

Reflecting and Evaluating Theme: Allowing flexibility at local sites impacted that ability to compare measureable outcomes between sites.

TALC participants valued the opportunity to engage in a multidisciplinary group focused on a shared goal, and in general, had the opinion that the process fit the needs of that goal. When asked what aspect of the process could have been changed or improved, the most common response addressed the lack of uniformed activities and data collection at the local level.

"I think where it was less effective was the amount of freedom that all the different people were given and to a degree and they need to be able to tailor it to their local sites but I think there was a lot of really enthusiastic people who took it and ran and started trying to, trying to do something that in a short time frame and with limited resources may have kind of hindered their success." – TALC member

"I do see a lot of value in it but I think with the added more as far as like more structure on how things are implemented at the site level but I do believe the model as a whole was really successful in getting people together, getting the conversation started." – Department of Health representative

CHAPTER 6: DISCUSSION AND IMPLICATIONS

CFIR is a framework that can be used to identify the complex and interrelated issues associated with implementing change and improvement strategies in a practice setting. This dissertation employed CFIR to evaluate the implementation of a learning collaborative that set out to improve the utilization of asthma action plans in several local sites across the state of Tennessee. This chapter addresses the objectives set forth in this dissertation while discussing implications and recommendations based on analysis of change at local sites and interviews with TALC participants. The following questions help to guide this discussion:

1. Does this finding represent a barrier or facilitator to implementing change?
2. What effect did the finding have on each of the dissertation objectives?
3. What recommendations surrounding this finding could be used if this implementation strategy is used in the future?

A. Inner Setting

Implementation Climate

Implementation climate is a reflection of shared receptivity to absorb a change and the extent to which the climate or group will support or reward the change. This construct includes an organization's tension for change, compatibility with an intervention, and perceived importance of the change, as well as its ability to offer incentives and clearly communicated goals.

Tension for Change

TALC participants expressed differing degrees of "tension for change," or perceptions that the current practices around AAP collection at school needed attention.

Responses spanned from championing the use of AAPs to questioning the need for AAPs at school at all. Implementation of local activities was more successful when local stakeholders involved in activities at the local level expressed a need for improved use of the AAP tool. In 2 regions, TALC members and community partners, all of whom volunteered participation with their sites, expressed an acute desire to see the AAP utilized at the school level in a way that would foster communication and better health management. Members of the East TN regional group had a shared high tension for change; they collectively articulated a problem and set about finding ways to improve it, but the tension for change may have been so high that they attempted to implement a program that was outside the scope of this project. In West TN, a shared dissatisfaction with the status quo helped members work together to create a comprehensive and inclusive approach to their local interventions. At the 3 Middle TN sites, where regional TALC leaders expressed different degrees of tension for change and local schools expressed no urgency to change, interventions were limited by the member with the lowest tension allowing them to only implement the "least amount of change" interventions.

Table 13: Changes Strategies by Regional Team

	PDSA Cycle 1	PDSA Cycle 2	PDSA Cycle 3	Outcomes
Region 1: East TN School site #1 410 students	Informed community providers of project and importance of AAP collection	Held screening session #1 where students participated in pulmonary function tests, verbal assessments and	Held screening session #2 where students participated in pulmonary function tests, verbal assessments and	92/410 students screened 10 students identified with asthma 2 AAPs filed

		asthma education opportunities	asthma education opportunities	
Region 2: Middle TN School site #2 193 students	Emailed policy reminder to school nurses	Informed school nurses of QI project	Informed school nurse of STAT goal to have 100% AAP on file at school	30/193 students with asthma identified 10 IHPs filed
School site #3 320 students				35/320 students with asthma identified 35 IHPs filed
School site #4 687 students				687 total student body 33/687 students with asthma identified 6 IHPs filed
Region 3: West TN School site #5 1077 students	Enlisted school nurse to call local providers and parents educating them of need for AAP at school; school nurse gave providers fax information for school nurse	TALC members hosted parent education sessions after school; school nurse included educational material with report card	Followed up with provider offices by phone; Followed up with parents by phone	40/1077 students with asthma identified 15 AAPs filed
School sites #6, #7				No data

At the local sites, tension for change acted as both a barrier and a facilitator. When the tension was high and shared among group members, it was a facilitator and motivator, but when it was low or unequal among group members, the person with the lowest tension for change appeared to set the bar for the amount of intervention that

could be attempted. At the local level this discrepancy in tension could potentially be mitigated by the presence of a strong leader or peer pressure to comply with specific changes.

At the TALC level, tension for change appeared equal until participants broke out into regional groups. In the larger group, people agreed with the need for improvement. In considering future implementation of a learning collaborative such as this one, it would be important to build recognition of the need for change and gauge this tension at the outset of the learning collaborative through a survey such as Organizational Readiness for Change Assessment (ORCA)[62] or Organizational Readiness for Change (ORIC),[63] both of which have proven effective in assessing this construct.

Compatibility

The degree to which an intervention is compatible with individuals and organizations has a positive association with implementation. In the case of AAPs, many participants expressed concern about the compatibility of the additional responsibilities associated with collecting and interpreting the documents with the current workload and work flow of school nurses. They questioned whether it would change the way school nurses currently practice and prioritize their time, a perceived lack of compatibility. The fear was that they would spend time and energy calling physicians' offices and parents chasing the form down. One region (West TN) problem-solved this dilemma by educating physicians and their office staff on the value of the form at school and asking them to fax it at the student's annual visit. The initial education was provided physician to physician by a member of the TALC team with follow up by the school nurse on

logistics and communication strategies. Local West TN TALC members perceived this change as an "easily maintained practice once we shared contact information" that could become part of a yearly routine.

In Middle TN there was a strong perception that utilizing AAPs was not compatible with the school nurse workload or the current policies requiring school nurses to generate an IHP for all students known to have a chronic diagnosis. "It's just double the work," said one school nurse coordinator. This incompatibility created such a resistance at the local level that the sites only collected data on IHP forms rather than AAPs.

Compatibility has a positive association with implementation,[64] but it will be resisted if seen as a threat to the status quo.[65] Both West and Middle TN had concerns about the compatibility of the intervention with current practice and expressed initial resistance, but they expressed differences in their attachment to the current situation. Although West TN articulated concern about the compatibility of the AAP, they also expressed no attachment to the status quo, which allowed them to identify ways to minimize the impact on school nurses and also adopt the change. Middle TN resisted the change in part because of an attachment to the current practice which included the use of IHPs. This attachment to the status quo led to little action toward AAP collection. The approach of West TN is an example of how perceived incompatibility can be mitigated through systems change- in this instance improving the system for collecting AAPs in a way that minimizes the impact the school nurses' workload. West TN began the process of developing a system that would support these efforts in their area.

Readiness for implementation

According to CFIR, organizational readiness for implementation of a change includes the presence of specific indicators of the organization's commitment to the intervention in question. These indicators include the engagement of leaders within the organization, the amount of resources available to support the intervention's implementation plan, and the ability to access information on the value and role of the intervention.

Available resources

Resources needed to improve the use of AAPs within public schools include staffing resources, specifically school nurses, and education and training needed to support their use of AAPs. The National Association of School Nurses (NASN) and Healthy People 2010 guidelines suggest school nurse-to-student ratios of 1:750 (well students) or 1:225 (student population that may require some daily school nursing services) or 1:125 (students with complex health care needs). As reported by NASN, Tennessee has made encouraging progress in this area over the last decade improving its ratio from 1:10,000 in 1994 to 1:3,000 in 2006 as a result of a legislative mandate (TN 49-3-359-c-1) to reach this ratio. The has continued to strive to toward the 1:750 national guideline, and in its 2011-2012 annual compliance report, the Office of Coordinated School Health stated that1,345 school nurses worked in Tennessee schools, which represents a 24% increase from the 2006-2007 school year.[12] Despite these improvements, a commonly shared perception evident from participant interviews is that the current level school nurse staffing is not sufficient to achieve 100% AAP utilization

without impacting other areas. Given the current economic climate, it is not feasible for school systems to place a school nurse in every school for the entirety of each school day. With the knowledge that school nurse staffing is a fixed resource, it becomes even more important to have documentation of how to manage students experiencing asthma symptoms and exacerbations.

Having the perceived level of resources needed to implement and sustain an intervention is positively associated with implementation. Within the state of TN, it is unlikely that current economic resources will increase in the near future. This acceptance of limited staffing resources then adds to the tension for improved documentation regarding asthmatic students and their management plan while at school. Having an accurate AAP on file at school could help the school nurse to provide education that may prevent exacerbations or help other school staff know how to respond in an emergency situation. Further investigation of how work flow or systems could better utilize existing resources or change the perception of what resources are needed for successfully maintaining AAPs at school is needed. Potential options to investigate include delegating AAP collection to an administrative person at the school or school system level or elevating it to the school health coordinator at the system level.

B. Intervention Characteristics

Intervention Source

The construct "intervention source" is defined in short as the perception about whether an intervention is externally or internally developed. The idea of an AAP including its content and structure was developed by an external organization and is

recommended by external organizations, but the learning collaborative was an internally driven effort to adopt an externally derived intervention. TALC physician participants discussed the numerous AAP forms used in each of their local sites as barriers to utilization. But members working within the school system reasoned that the numerous forms indicated each system's desire to internally adapt the form such that it met their needs. Having ownership over the form also helped to create buy-in for individuals using the forms at school.

Externally developed interventions, especially those created without a transparent process in the decision to adopt them, can be more difficult to implement unless they can be tailored to the organization's needs and priorities.[65,66] In this effort to improve AAP utilization, participants recognized both the inefficiencies created by having multiple forms available and the barriers to limiting the variety of forms accepted at the school level. For the Middle TN group, an understanding of this inconsistency may have contributed to their decision to utilize the IHP as an alternative to AAP as it is a standard form used throughout the district. West TN also found the lack of a single, agreed upon AAP form to be a barrier. They began discussions with key leaders about ways to limit the number of different forms. The larger TALC group discussed, with varying degrees of support, the possibility of creating a single form, approved at the state level, and disseminated to all providers for consistent use. The possibility of partnering with the Department of Health and Department of Education to work on this issue is a potential next step.

Relative Advantage

In the course of this learning collaborative, an IHP was used at the local level as an alternative to an AAP, and in this scenario, having an IHP on file at the school had fewer perceived barriers than collecting an AAP. IHPs can be created solely by the school nurse with little or no input from providers, parents or the student. The school nurse is familiar with the form and he or she can determine the level of detail required. If the goal is simply for schools to document about a child's medical condition, then creating an IHP is a more manageable choice. But the question, as one participant asked, is "do we want to do more than just document? Do we want to help manage kids' asthma?" An AAP created by the student's outside healthcare provider would allow school staff to understand symptoms, triggers and medications in a way that would benefit management monitoring that an IHP cannot. The use of an AAP also supports a sense of partnership between the family, healthcare provider and school that could positively influence the student's asthma management at overall. Unfortunately, these benefits are not easily observed or measured, making it challenging to see the advantage of implementing AAP use over IHP use. Making this transition will require both communication and education creating more of a tension for change at the school level and at the state level.

In this context, the relative advantage of the AAP diminishes because there is an alternative to AAP that is presently in use and perceived to be both meeting the need and more manageable to sustain. This perception is complicated by the inability to observe clear benefits of having an AAP on file over an IHP. Furthermore, the potential benefits of an AAP cannot be fully realized unless appropriate education and support is in place at

the school level to properly use the form in a structured and valuable way. Possible benefits include a proactive approach to supporting asthma control by helping children use proper technique for inhaled medications, monitoring medication use and overuse, minimizing exposures and avoiding unnecessary emergency room visits and absences from school.

To facilitate improved documentation of students with asthma, it may be appropriate to embrace an alternative to AAP adoption and rather engage in monitoring and evaluation efforts regarding the use of IHP. Because the IHP is a tool with which schools and school nurses are comfortable, it may be less threatening to reinforce their efforts to use this tool more effectively. To begin this process, it would be helpful to have an understanding of the quality and depth of its content and determine a minimum standard for this information moving forward. Assessing the viability of this option could be a potential next step for TALC.

Design, Quality and Packaging

During the course of TALC, members had the opportunity to review different types of AAP forms including paper forms published internally at multiple sites and those available electronically from various national organizations. Consensus could not be reached on key content or design to meet the needs of the provider, the school nurse and the family simultaneously. Knowing that interventions perceived to be of poor quality undermine implementation,[67,68] it is important that key stakeholders and direct users of the form support its design. If the state does choose to move forward with a standard

form, it will be important to have these "super-user" stakeholders represented during the development phase.

This construct neither acted as a facilitator or a barrier to the implementation efforts of TALC or its local activities, but it was a topic that was highly discussed and could continue to be discussed as the state moves forward to reach their STAT goals and objectives. As part of next steps it would be beneficial to investigate the possibility of online AAP tools that could be accessed electronically by both the healthcare provider and the school.

C. Characteristics of Individuals

Knowledge and Beliefs about Intervention

In order for AAPs to be successfully used in schools, it is important to gain an understanding of key stakeholders knowledge and beliefs about AAPs. From the information analyzed in this learning collaborative, an "us vs. them" mentality between community providers and school providers became apparent in terms of the skills and enthusiasm of the two disciplines. Members from each discipline believed members of the other discipline to either lack the ability or the drive to adopt the use of AAPs. To overcome this barrier to progress, the West TN group provided peer to peer educational opportunities to raise and bridge the level of knowledge of AAPs and their intended use, and also to encourage inter- and intra- disciplinary conversations around misconceptions. All parties, including parents and other school personnel, would benefit from such educational and rapport building opportunities so that they might foster skill development and increase enthusiasm around asthma management.

Tension between community providers and school nurses existed at the learning collaborative level as well, and while quarterly learning sessions were designed to create an opportunity for open dialogue, it was often challenging. The group may have benefitted from an opportunity to engage in an exercise that helped create a shared base of knowledge about AAPs and their value.

D. Outer Setting

External Policy and Incentives

Guidelines for AAP use exist at a national level and within Tennessee. School systems have policies in place that promote compliance with these guidelines, and yet AAP use at the school level continues to fall short of state goals. Typically a strong "push" from external sources such a political directive or external mandate will generate motivation toward implementing a change.[64] In TN, the state legislature's passage of Chapter 1154, which called for the development of a state level asthma plan, provided such a push and resulted in the 2009 STAT Plan to Reduce Asthma. While the STAT plan documents the state goals and objectives for reducing the asthma burden, unfortunately, it neither articulates a strategy to reach those goals nor does it identify barriers or facilitators likely to be encountered during the implementation process. The absence of an implementation strategy was a barrier to reaching both the goals and objectives of the state plan, as well as the more limited goals of TALC.

TALC members identified the reinstatement of a state-level school nurse representative as a key strategy to support implementation of policies and procedures at

the school level, specifically to ensure that recommended policies are realistic and within the scope of work for frontline school nurses.

E. Process

The process domain, with its four constructs, aims to describe not just *how* implementation of a change should occur but also *why* it was a success or a failure. For the TALC collaborative, process existed at the learning collaborative level and at the site level, which had reciprocal effects on each other.

DOH leaders were instrumental in the planning phase during which they approved the learning collaborative as the strategy for this quality improvement effort. The BTS model was also approved during this phase as it was important that the project have a clear timeline and model to guide its activities. During the planning meetings, DOH leaders felt that it was important to strike an appropriate balance between DOH driven goals and participant driven goals. DOH leaders believed that participants would have more "buy-in" if they had opportunities to make decisions throughout the process; therefore the plan remained flexible within the general outline of the BTS model.

Engaging a balance of the "right" people to join this collaborative was the next key step in the process. DOH leaders identified a multidisciplinary, geographically diverse group to invite to the initial meeting. This list was generated based on three pieces of criteria including the individual's level of engagement with children diagnosed with asthma, his or her perceived interest in facilitating improved health outcomes for these children, and the individual's position in either a leadership role or as an innovator

in their field. DOH leaders were strategic in this selection process knowing that having strong collaborative members be among the intervention's early adopters would be essential to successful implementation. It was equally important not to overlook key people from various sectors including users, agents and leaders in this engaging phase in order to have meaningful and fully-developed conversations around ways to reach the TALC goals.

Once identified, potential participants received an engagement letter from the Director of the Division of Family Health and Wellness asking for their participation in this important project. The letter stressed the state's support of the project and importance of having esteemed collaborative members. The strong role of the DOH during this phase was imperative to the engagement of key stakeholders.

TALC participants also commented on the strong facilitation of the initial TALC meeting as a factor contributing to their continued commitment to the effort. This meeting had a balanced agenda that illustrated the problem and offered context for a solution while meeting the learning needs of individuals and the group. It was during this meeting that participants were educated on the BTS model and the structure to be used moving forward. Participant interviews revealed that one of the attributes of the learning collaborative was the flexibility to design a plan for change that best met the needs of their local sites. They also appreciated that this flexibility was executed within the structure of the BTS model in terms of timeline and tasks. During the execution phase of the learning collaborative, which examines whether implementation was carried out according to the planned course of action, this flexibility within structure was a facilitator

to participation and accountability. Barriers to execution of the learning collaborative existed around scheduling a multidisciplinary, geographically diverse group to identify mutually convenient times to hold quarterly learning sessions, which was mitigated by using technology to meet virtually rather than in person as well as electronic scheduling applications such as doodle to identify most convenient times. Other barriers included retention of TALC members who did not become involved at the local sites. Attendance records showed that these members were less likely to have attended learning sessions after the initial in-person kick-off meeting.

During the evaluation and reflection stage, this same flexibility, which was valued at the learning collaborative level, allowed inconsistencies at the local level. Because local sites were given the opportunity to choose different methods of change, the data collected was difficult to compare across sites and it was challenging to identify which actions created the most change. Middle TN had the most direct relationship between their change strategy to simply communicate policy and oversight to the school nurse at 3 separate intervals. West TN engaged in simultaneous strategies with different audiences (providers, parents and school nurses), and it was therefore difficult to assess which strategy or the combination of them had the improvement effect.

F. Summary

TALC was a quality improvement project conducted by the Tennessee Department of Health in an effort to increase AAP utilization in public schools. The implementation of TALC and the introduction of change at the local sites were evaluated

guided by the CFIR framework to identify facilitators and barriers to improvement. Throughout this process, lessons were learned in the following three areas:

1. learning collaboratives as a strategy for creating change
2. asthma action plan utilization in public schools
3. CFIR as a framework for guiding analysis

Learning Collaboratives as a Strategy for Change

Overall, only one local site (West TN) met the original goal set forth by TALC to increase AAP utilization by 25 percentage points, but TALC, as a strategy to facilitate change, was overall successful in that it engaged a group of key people in a dialogue around AAP utilization and generated knowledge that will inform decisions moving forward. Strengths in the implementation of this learning collaborative as a strategy included the engagement of a multidisciplinary group of stakeholders, the employment of a model to provide structure, and the diversity of information gained from change activities at multiple sites.

Having the endorsement of DOH leadership and their active participation in identifying the participants to join the collaborative was paramount to the establishment and ongoing efforts of the learning collaborative. The diversity of the group gave members the opportunity to gain knowledge about the perspectives and roles of other professionals, which allowed participants to take steps toward mitigating some barriers to change such as perceived lack of compatibility and differences in knowledge and beliefs surrounding AAP use and value.

Another strength in the implementation of TALC was the use of the BTS model,

which added needed structure to the otherwise flexible activities of the group. This structure facilitated the development of a timeline for change activities and large group meetings, and as well as supported timely documentation of change and accountability for participation. The learning sessions prescribed by the BTS model created a structure for sharing information about successes and challenges experienced at the local sites while also providing a forum for learning about broad concepts of quality improvement, collaboration and assessing readiness for change.

While completing change activities at multiple local sites made data collection more challenging, it was also a strength in this project. Each site's experience added to the knowledge of what to expect and how to prepare in undertaking a larger scale implementation around asthma management in schools. Making changes based on local needs allowed for the identification of different barriers and facilitators as well as problem solving strategies. For example, in West TN, the local group learned that providers only complete an AAP if a patient will self-carry and self-administer medications. Moving forward, it will be beneficial to know if this is a common practice among other providers. Furthermore, West TN implemented a multi-faceted approach that attempted to create change in 3 different audiences: school nurses, physicians/providers and parents. This simultaneously created an education campaign and an opportunity to create buy-in from key care providers.

Asthma Action Plan Utilization

The STAT Plan to Reduce the Asthma Burden in Tennessee aims to have an AAP on file at school for every public school student with an asthma diagnosis by the end of

2014. The state will not reach that goal as it is currently stated, and this learning collaborative revealed some of the barriers and facilitators to consider moving forward. Options for moving forward include:

1. Create a strategy based on known barriers and facilitators and roll out an implementation plan to school nurses through the Office of Coordinated School Health which will to include education on AAP, form letters to send home to parents, and suggestions for communicating with local providers.
2. Amend state goal to reflect the IHP as an appropriate alternative for use at school. Develop an educational program to better educate school nurses on the important information to include in an IHP. Offer techniques to better engage parents in the completion of IHPs.
3. Investigate the possibility of reopening state level nurse to advice and advocate for appropriate implementation efforts regarding all health management concerns at school.

CFIR as a Framework for Analysis

The CFIR framework has 5 domains, 26 constructs, and 13 sub-constructs. Each of these overlaps and interlinks with each other to create connections around the implementation process. The authors of CFIR are careful to articulate that it is a framework developed to help guide a thoughtful examination of an implementation; it is not, however, a model or recipe to follow. CFIR allows the researcher to identify the elements that are important to a specific intervention, but does not stipulate that all elements of CFIR will be important in every implementation. In the evaluation of

implementation of TALC and its local activities, the researcher examined all of the domains of TALC and how they played into the whether or not the learning collaborative was successfully implemented. In moving forward, this researcher would employ CFIR to devise an implementation plan for a future collaborative effort.

CHAPTER 7: POLICY PAPER

This chapter is a general article manuscript written in preparation for submission to the Journal of School Health.

Title: Role of a State Learning Collaborative in Improving Asthma Action Plan Utilization

Asthma is the most common chronic condition among school-aged children in the United States, affecting approximately 10.5 million children under the age of 18 in 2011,[1,2] which is approximately 1 in 11 children.[3] Asthma is the third leading cause of hospitalizations among U.S. children under the age of 15, and costs the healthcare system approximately $50.1 billion dollars per year.[4] Absenteeism from school and subsequent caregiver absenteeism from work cost $3.8 billion dollars per year in loss of productivity.[2]

Detailed clinical guidelines exist to manage asthma symptoms. The goal of these guidelines is to minimize acute exacerbations and extend periods during which the individual is symptom free. With adherence to established standards of care, the morbidity associated with asthma can be reduced significantly.[5] However, lack of adherence to established clinical guidelines is a widespread problem.[6] Among children with asthma, it is estimated that less than 50% received guideline concordant care.[7–9] The National Heart, Lung and Blood Institute (NHLBI) has disseminated guidelines for all persons diagnosed with asthma in their Expert Panel Report 3[10] (EPR-3). This report describes best clinical practices in asthma care and includes a specific section on childhood asthma. It was created to help guide decision making by primary and specialty care providers who care for patients with asthma.[10] One of the key ways EPR-3 differs

from its predecessors is the emphasis it places on the use of an asthma action plan.[11]

Despite the NHLBI guidelines for best practices and, specifically the use of action plans, asthma care guidelines are not widely followed.[9,12] This paper addresses this gap between knowledge and practice by examining the role of a state-initiated learning collaborative to improve guideline-concordant asthma care for children.

A learning collaborative is one approach that can be employed to facilitate quality improvement efforts and can be structured using various models. The Breakthrough Series (BTS) model, which was published by the Institute for Healthcare Improvements (IHI) in 1998, is one of the most commonly applied learning collaborative models and continues to be a gold standard in current quality improvement (QI) practice.[13,14] It was initially developed to guide the process by which cost-conscious health care organizations make "breakthrough" improvements in quality and to help close the gap between what we know (research) and what we do (practice). An integral part of the BTS model is the use of plan-do-study-act (PDSA) cycles. During each cycle, participants identify and implement a change strategy, measure its impact and consider next steps. Within the structure of the BTS model, learning sessions are held between cycles to encourage conversations about implementation and change strategies. This approach has been used successfully as part of quality improvement efforts by the Human Resources and Services Administration to improve access to primary and specialty care for children. It has been used successfully to improve access to care among children with an epilepsy diagnosis[15] and follow-up care for newborns who did not pass initial hearing screens.[16] The focus of the learning collaborative presented in this paper was on improving the use

of asthma action plans in schools in Tennessee. Understanding its potential to drive state-level asthma quality improvement efforts can help other states determine if this approach is one that should be replicated.

Background: Asthma among School Children in Tennessee

Consistent with national asthma data, in 2009 Tennessee reported that 9.5% of its children aged 0-17 (137,242 individuals) had asthma.[17] In Tennessee, asthma disproportionately affects low-income and minority children.[18] It is responsible for nearly 2,000 inpatient hospitalizations and over 14,000 emergency room visits by children ages 1-17 years old. Asthma is the most common chronic disease reported among school children. Children with asthma represented 33% of all public school enrollees diagnosed with a chronic disease. During the 2011-2012 academic year, more than 63,000 individual students enrolled in Tennessee public schools reported an asthma diagnosis to their school, a 64% increase since 2004.[19]Asthma-related care accounted for 94% of emergency healthcare procedures performed by licensed providers in Tennessee schools bringing the total number of asthma related procedures to 57,830 during that academic year.

Tennessee, like many other states, recognized the need to address the care of children with asthma. In 2009, Tennessee issued the "State of Tennessee Asthma Taskforce (STAT) Plan to Reduce Asthma."[20] The goals of the STAT plan were divided into four primary areas each of which included goals and objectives related to the following: surveillance and epidemiology, public awareness and education, medical

management, and environmental management. This learning collaborative focused on the medical management objective, which stated that all children with an asthma diagnosis should have an individualized asthma plan from the patient's medical home on file in the school by December 2014. A follow-up state report published in 2010 outlined progress made toward child-related goals as defined by the state plan.[21] It reported that 57% of students with an asthma diagnosis had an AAP on file with their school.

In an effort to improve the percentage of Tennessee children who have an AAP on file at their school, the Maternal and Child Health section of the Tennessee Department of Health (TDOH) initiated a QI endeavor to evaluate progress toward this objective in 2012. As part of this QI effort, a group of key stakeholders were convened to discuss potential ways to reach the stated objective. The meeting resulted in the creation of the Tennessee Asthma Learning Collaborative (TALC) and the establishment of a shared goal to raise AAP utilization by 25 percentage points at local sites involved in TALC. This paper examines the implementation of the learning collaborative to gauge its value as an improvement strategy and identify barriers to AAP guideline adherence.

METHODS

The aim of the project was to gain understanding of the value of a state level learning collaborative to identify facilitators and barriers to increased AAP utilization. The study used a mixed methods approach drawing on multiple data sources including participant interviews, meeting minutes, observations and site visits.

Framework

The Consolidated Framework for Implementation Research (CFIR) is a comprehensive framework that can be used to identify the complex and interrelated issues associated with implementing change and improvement strategies in a practice setting. This framework guided the evaluation of TALC. CFIR helps identify barriers and facilitators in the following 5 domains: intervention, inner setting, outer setting, characteristics of individuals and process. Each domain has a list of corresponding constructs that overlap and interlink with each other to create connections around the implementation process. Table 14 shows how the framework was used to further understand the implementation of TALC.

Data Sources

A structured questionnaire was developed based on the 5 CFIR domains (See Table 14) and was used to conduct semi-structured interviews with the fifteen TALC members who remained active throughout the project. The questionnaire was divided into 5 sections based on the 5 CFIR domains. These 15 participants represented the range of stakeholder involved in TALC (Table 15). They were interviewed about their experience with the learning collaborative including participation in didactic learning sessions, networking opportunities, and planning and completing change activities. The interviews were conducted at the completion of the 2012-2013 school term either in-person or via phone. They were electronically recorded and transcribed and then analyzed by hand using CFIR domains and corresponding constructs for coding.

Forms documenting improvement activities and the collection of AAPs were completed quarterly. The worksheets were designed to collect baseline data regarding AAP use, document change strategies, and assess change in AAP use after the implementation of a change strategy. The worksheets included 7 questions that solicited information on identified community partners, attempted intervention or change strategies, and successes and challenges related to the implementation process or outcome. Additionally, the worksheet prompted the leader to describe a recent Plan-Do-Study-Act cycle.[13] In addition to interviews and update forms, additional sources of data were participant observations conducted during site visits and meeting minutes.

Documentation of TALC Activities

The activities of the learning collaborative and its regional groups followed the structure and key elements of the Breakthrough Series (BTS) model. Over the course of the 2012-2013 academic school year, TALC completed three plan-do-study-act (PDSA) cycles during which they planned a change, carried out the change, measured and studied the effects of the change, and took further action based on results. A timeline of these activities are depicted in Figure 10.

The approach to documentation of TALC activities was based on the BTS model. A reporting form was created and included the following questions:

1. What partners have you recruited to help with your project?
2. What pilot site have you selected?
3. What is your baseline measure of students with AAPs?
4. What other outcome measures are you collecting, if any?
5. What change strategies are you planning for your site?

6. What lessons have you learned thus far that might be valuable for other groups?
7. Describe a Plan-Do-Study-Act cycle?

The form was completed quarterly, after each change strategy was implemented, to record any improvement in AAP collection at school. It was submitted electronically to the learning collaborative facilitator and used as a discussion guide for verbal updates shared at learning sessions.

Analysis of Asthma Action Plans

TALC members and community partners were charged with collecting baseline data on the number of students with a known asthma diagnosis and the number of AAPs on file at the school. Sites varied in their method for identifying students with an asthma diagnosis. Methods included self report by the student, parent report, and the use of medications (inhalers) at school. The number of AAPs was documented by the school nurse at each site at the end of each Plan-Do-Study-Act cycle.[13] An Excel-based run chart analysis[22], a type of trend analysis, was employed to analyze and report data on AAP collection. Run chart analysis is an easily constructed and simply interpreted method that allows us to understand improvement over a period of time.[23]

These data were analyzed using the domains of the CFIR to evaluate the role that the statewide learning collaborative played in supporting quality improvement efforts around use of asthma action plans. Data from interviews, meeting minutes and observation were triangulated to deepen understanding of learning collaborative implementation and specific CFIR constructs that facilitated or hindered improvement efforts. Analysis also

provided evaluation TALC strategies and local activities to increase utilization of asthma action plans by 25% points from baseline in Tennessee schools.

RESULTS

Implementation of the Tennessee Asthma Learning Collaborative (TALC).

Participants

Participants in the learning collaborative were identified by leadership in the Tennessee Department of Health and included representatives from the Department of Education, Department of Health and the Office of Coordinated School Health as well as insurance providers, school nurses and parents. TALC members were divided by geographical region into three groups representing east, middle and west Tennessee. Each regional group was tasked with planning and implementing local activities surrounding improved AAP utilization at the school level. Each of the three regional teams established relationships with community partners including school personnel, parents, and local providers. All teams had at least one provider and one school nurse representative engaged in the activities at the local level. Two regions had a school health coordinator and a parent advisor actively participating at the local level.

Local implementation activities

Each site was asked to implement a series of changes designed to increase the number of AAPs on file at school, collecting data following each change. A list of potential interventions had been previously generated and discussed at the initial TALC meeting, and local sites were encouraged but not required to choose from those listed. Sites were instructed to identify the change strategy for their area based on the local conditions

including resources, feasibility and sustainability of the change. After each change the number of AAPs collected was documented.

Regional teams selected a total of 7 schools statewide as local sites for QI intervention around AAP utilization. Each of the regional teams also considered the burden of asthma in their identification of sites, making sure to select schools where asthma was a concern. Of those selected, 4 schools participated in the project from start to finish and collect data; 1 school participated in the project start to finish but implemented a screening program rather than AAP utilization project. Implementation was attempted at the two remaining schools but was discontinued due to a change in school nurse staffing. Below we describe implementation activities by region.

Region 1. In Region 1, TALC members collaborated with community partners to select a K-8th grade school identified as serving "high risk and underserved" students from a rural mountainous county. This school also expressed significant buy-in for the project and its administrators were in full support of an intervention. Regional Team 1 had an established relationship with a pulmonary team that had previously expressed interest in collaborating with the school system. This partnership drove their selection of their strategy, which was to hold asthma screening sessions at the school. The goal at this site was to screen students and connect them with community providers for follow-up. Local leaders coordinated with school personnel to schedule screening days in the classroom. Screenings were staffed by 2 physicians, 2 respiratory therapists, a clinical nurse specialist, and an asthma educator. An assembly line process included a pulmonary function test (PFT), an assessment of forms on file, and an education session. For

students recommended for follow-up, the school nurse called provider offices and encouraged them to provide AAPs to parents at this visit. Region 1 screened 94 students recommending 44 for follow-up with a healthcare provider for abnormal PFT results and/or reported symptoms.

Region 1 did not follow the PDSA cycle for data collection, but reported outcomes at the completion of the project. Out of a total student population of 410, 10 students were identified with an asthma diagnosis; 2 provided AAPs to school. Table 15 depicts the regional activities and outcomes for all regions and sites.

Region 2. Three elementary schools serving a metropolitan area were selected from Region 2; these schools were chosen from 3 different zip codes based on asthma rates and perception of school nurse workload. Regional Team 2 had a member who voiced concerns that the project would be too cumbersome for school nurses in terms of workload. Therefore this team decided to implement a simple reminder system for school nurses regarding current requirements for documentation of chronic health conditions among students and measure compliance. Region 2 TALC members sent an electronic message to school nurses at each of the 3 selected schools to heighten awareness of the policy on healthcare documentation. This policy states:

> "any child with acute or chronic health issues should have a health assessment completed by a Registered Nurse. As warranted by the child's condition or diagnosis, an individual health plan (IHP) will be completed by the registered nurse."

According to the policy,[24] the development and approval of the IHP should include input from the parent and other health care providers. During the second PDSA cycle, the

Director of School Nurses for the selected school system informed the school nurses of the QI project and encouraged them to attempt contact with parents regarding asthma documentation at school. This action was repeated during the third and final PDSA cycle resulting in overall increases in IHP development but no improvement in AAP collection. The efforts in Region 2 resulted only in improved collection of IHPs and had no increase in AAP collection.

Region 3. Region 3 chose 3 elementary schools from an Achievement School district, which serves students previously scoring in the bottom 5% academically, when the school nurse serving these schools volunteered to participate. In Regional Team 3, team members wanted a multi-faceted approach to interventions that addressed educational and systems-based issues with multiple audiences. Region 3 TALC members and the sites' school nurses chose the following three strategies to create change:

1. increase contact between school nurse and community providers via phone calls and fax communication,
2. provide parent asthma education sessions at school
3. promote awareness by sending educational information home with report cards

Following the first PDSA cycle, site leaders discovered that local physician practice was to provide only self-carrying and/or self-medicating school age patients with an AAP which lead to an increased effort to educate specialty and primary care providers on the importance of AAP utilization at school for all children with a diagnosis. Peer-to-peer communication between a physician champion and other local providers initiated a discussion surrounding the development of a standardized AAP form to be used system-

wide. Peer-to-peer communication among school nurses also promoted efforts to connect with parents and local providers regarding students AAP forms. Region 3 TALC leaders discontinued efforts at 2 of their 3 sites when the school nurse was unable to participate. Region 3 was the only site that reached the original TALC goal of increasing AAP by 25% percentage points. Table 15 shows regional activities and outcomes.

Asthma action plan improvement

Of those students known to have asthma at each local site, Figure 10 shows the run chart analysis results for students having either an AAP or IHP on file with the school. None of the participating sites had IHPs or AAPs on file for any students with known asthma at the start of the learning collaborative. The four sites that provided data on their efforts are represented in Figure 10. Of them, only site #5 in Region 3 reached the TALC goal of 25 percentage points increase from baseline for AAP collection with a 37-percentage point increase. Region 2 sites #2 and #3 also appear to have reached the goal with 27 and 100 percentage point increases respectively, but it is important to note that all documentation collected at the three Region 2 sites were IHP forms completed by the school nurse with no physician or parent engagement. Region 2 site # 4 site reported only a 13.2 percentage point increase and collected only IHP.

Implementation Analysis

Using the CFIR framework, we identified key constructs affecting the use of a learning collaborative as a means to improve for AAP utilization.

Readiness for change at the local site. Readiness or tension for change, a construct of the inner setting domain, is defined as the "degree to which stakeholders perceive the current situation as intolerable or needing change."[25] In this project, local sites were more successful in creating change when participants shared a high tension for change. Mismatched tension for change resulted in the "least amount of change" interventions. Readiness for change exists on a spectrum, with individuals falling between poles of no need to change and impatience for change.

Compatibility of intervention at the local site. Another construct of the inner setting domain, compatibility of an intervention with a site takes into consideration the degree to which the intervention fits within an existing system and work pattern.[25] Stakeholders expressed a concern that the additional tasks associated with collecting and maintaining AAPs at school was not compatible with the current workload and work flow of most school nurses in the state. Furthermore, participants questioned whether the AAPs would be used as a management tool, as intended, or if they would simply be filed for compliance purposes.

Available resources at the local site. Resources of the inner setting may include such things as money, time, available personnel, education, and space.[25] Limited school nurse staffing was a perceived barrier to change around AAP collection or use. Participants, including school nurses and school nurse managers, shared concerns that with the current number of school nurses, priority must be given to skilled nursing care at school rather than symptom management of chronic disease. Participants also raised questions of the

appropriateness of delegating asthma management and care to other school personnel, concluding that with proper training, other school staff may be able to support this effort.

Relative advantage of the intervention. Relative advantage is a construct in the intervention domain. One regional team focused their efforts not on the collection of AAPs, but rather identified an alternative intervention, the IHP, as a more easily implemented form. Participants voiced concern for the quality and accuracy of information in IHP, as it is completed without the input of a physician and often without parental input.

Design and quality of the intervention. Also a construct of the intervention domain, perceived design and quality of the intervention plays a role in the success of its implementation. During the course of this learning collaborative, participants identified the variety of AAP forms required by different school systems as a barrier to adherence to AAP completion. Parents and physicians cited the task of identifying and completing system specific forms as a burden that created double work and inconvenience. With the variability and numerous AAP forms used through the state, participants discussed the benefits and drawbacks of a standardized AAP form approved statewide. This discussion was neither a barrier nor facilitator to implementation of the learning collaborative or the local activities, but rather a topic that participants believe merits more research and discussion.

External policies and incentives. Policies outside the learning collaborative, or in the outer setting domain, had an impact on implementation of local activities. Participants

recognized that some local and district policies were in conflict with the STAT plan objective regarding AAP utilization. Furthermore, the STAT plan stated the objective, but did not offer strategies for successfully meeting it. School nurse participants in TALC suggested that nursing representation at the state level may help make policies more congruent as well as offer support and advocacy for health management at school.

DISCUSSION

The STAT Plan to Reduce Asthma produced in 2009 documented the state's goals and objectives to better manage the burden of asthma on the state of Tennessee. Unfortunately, it neither articulated a strategy to reach those goals nor identified barriers or facilitators likely to be encountered during the process. The CFIR, an established implementation science framework, provided a rigorous approach to understand the lessons learned during this quality improvement project. Its use can inform future local improvement efforts and support the generalizability of findings to similar efforts conducted in other states.

The efforts put forth by the Tennessee Department of Health and the TALC members resulted in improved identification and understanding of current process barriers related to AAP utilization and began the task of finding interventions to facilitate improvement. Despite only one region (Region 3) meeting the original goal set forth by TALC to increase AAP utilization by 25 percentage points, TALC, as a strategy to facilitate change, successfully engaged a group of key people in a dialogue around AAP utilization and generated knowledge that will inform decisions moving forward. Strengths in the implementation of this learning collaborative as a strategy included the

engagement of a multidisciplinary group of stakeholders with representatives from both the inner setting (local site) and outer setting (DOH), the employment of a model to provide structure, and the diversity of information gained from change activities at multiple sites.

Having the endorsement of the Tennessee Department of Health leadership and their active participation in identifying the participants to join the collaborative was paramount to the establishment and ongoing efforts of the learning collaborative. The diversity of the group gave members the opportunity to gain knowledge about the perspectives and roles of other professionals, which allowed participants to take steps toward mitigating some barriers to change such as perceived lack of compatibility with work load and work flow and differences in knowledge and beliefs surrounding AAP use and value.

The use of the Breakthrough Series (BTS) model, which provided structure to the otherwise variable activities of the group, strengthened the efforts of TALC. This structure facilitated the development of a timeline for change activities, supported timely documentation of change and maintained accountability for participation. The learning sessions prescribed by the BTS model created a structure for sharing information about successes and challenges experienced at the local sites while also providing a forum for learning about broad concepts of quality improvement, collaboration and assessing readiness for change. Learning sessions provided participants were able to engage in conversation about specific barriers such as relative advantage of the IHP and staffing limitations at the inner setting, then brainstorm potential opportunities for change.

While implementing change activities at multiple local sites made data collection more challenging, each site's experience added to knowledge that can be applied in a larger scale implementation around asthma management in schools. Decisions about interventions were affected by factors such as community partners' interests and ability to engage in activities, individual site's desire to change versus comfort with the status quo, and leadership participation at the local level. Making changes based on local needs allowed for the identification of different barriers and facilitators as well as problem solving strategies. For example, one region learned that providers only complete an AAP if a patient is advised to self-carry and self-administer medications. If this is a common practice among providers, they will need to be educated on the need for AAPs for all students with a diagnosis. Another region helped to identify inconsistencies in policy requiring the completion of a different form of documentation, an Individualized Health Plan. More research is needed to determine if an IHP can be a sufficient alternative for an AAP at the school level.

Implications for School Health

Engaging a multidisciplinary group of key stakeholders in working towards a shared goal can help uncover barriers to improved AAP use and allow schools, school system and local providers to identify process changes to facilitate increased communication and potentially better symptom management at school. AAPs, or other appropriate forms of asthma documentation, have the ability to guide schools and their personnel in supporting students affected by asthma, but the first step is ensuring

completion of an AAP at the provider level and facilitating its transport to the student's school.

Human Subjects Approval Statement

The evaluation of this quality improvement effort was approved by the Boston University Institutional Review Board, which ruled it as exempt.

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Tables

Table 14: Consolidated Framework Implementation Research applied to Asthma Action Plans and Tennessee Asthma Learning Collaborative

CFIR Domain	Domain Constructs	Study questions
Intervention Characteristics (AAP)	A. Intervention Source B. Evidence Strength and Quality C. Relative advantage D. Adaptability E. Trialability F. Complexity G. Design quality and packaging H. Cost	What evidence supports the use of AAP? Is this evidence reputable and of sound quality? Are AAP tools easily accessed, completed and shared? Is the AAP understandable for the intended audience? Is there an alternative that serves the same purpose?
Outer Setting (Tennessee Department of Health, Department of Education, Coordinated School Health)	A. Patient needs and resources B. Peer pressure C. External policy and incentives	Are they working to lower barriers and increase facilitators associated with AAP utilization? Are there state level policies, regulations, guidelines, mandates, etc in place driving increased use of AAP?
Inner Setting (Pilot site locations)	A. Structural characteristics B. Networks and communications C. Culture D. Implementation climate E. Readiness for implementation	How did capacity and readiness for change within this group contribute to the outcome? What aspects of the group led to successful or unsuccessful implementation?

CFIR Domain	Domain Constructs	Study questions
		What characteristics about each site may have contributed to implementation? Cultural priorities? Competing programs?
		What was the capacity for change at each site? Was there a perceived need for increased utilization of AAPs?
Characteristics of Individuals (Learning Collaborative members and pilot site participants)	A. Knowledge and beliefs about intervention B. Self-efficacy C. Individual stage of change D. Individual identification with organization E. Personal attributes	How did individual perception of AAP contribute to the implementation and effectiveness of the LC? How do members perceive their relationship with DOH and DOE and how does it impact engagement in LC?
		What are the perceptions of the stakeholders about the learning collaborative (CL) approach?
Process	A. Planning B. Engaging C. Executing D. Reflecting and evaluating	How did planning contribute to the level of success for LC meetings and pilot activities?
		Were their perceived "champions" within the LC? How did they influence the process?
		Was the LC carried out according to plan?

CFIR Domain	Domain Constructs	Study questions
		During the implementation process, was regular feedback provided/collected? Were changes made based on feedback? Is the participation in a LC a worthwhile activities for members?

Table 15. Tennessee Asthma Learning Collaborative Exit Interview Summary

Participant profession	In person Interview	Phone interview	TOTAL
Provider	2	3	5
School nurse	2	2	4
Coordinated School Health	1	2	3
Department of Health	1	1	2
Payer	0	1	1
Parents	0	0	0
TOTAL	**6**	**9**	**15**

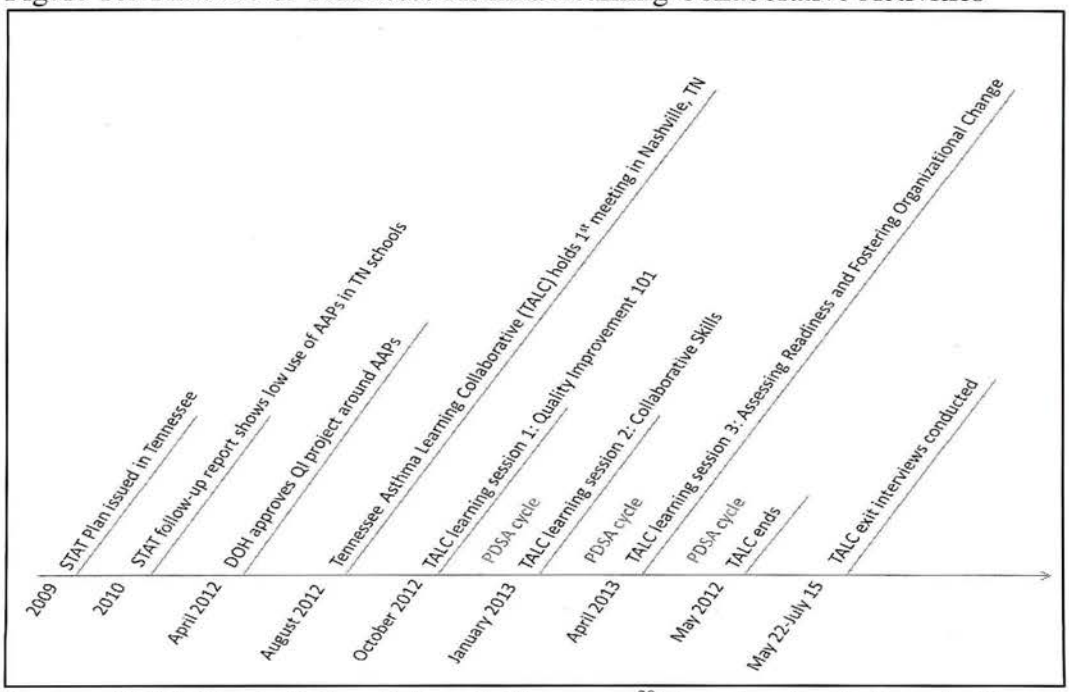
Table 16. Changes Strategies by Regional Team and PDSA Cycle

	PDSA Cycle 1	PDSA Cycle 2	PDSA Cycle 3	Outcomes
Region 1: East TN School site #1 410 students	Informed community providers of project and importance of AAP collection	Held screening session #1 where students participated in pulmonary function tests, verbal assessments and asthma education opportunities	Held screening session #2 where students participated in pulmonary function tests, verbal assessments and asthma education opportunities	92/410 students screened 10 students identified with asthma 2 AAPs filed
Region 2:Middle TN School site #2 193 students	Emailed policy reminder to school nurses	Informed school nurses of QI project	Informed school nurse of STAT goal to have 100% AAP on file at school	30/193 students with asthma identified 10 IHPs filed
School site #3 320 students				35/320 students with asthma identified 35 IHPs filed
School site #4 687 students				687 total student body 33/687 students with asthma identified 6 IHPs filed
Region 3:West TN	Enlisted school nurse to call local providers	TALC members hosted parent education	Followed up with provider offices by phone;	40/1077

School site #5 1077 students	and parents educating them of need for AAP at school; school nurse gave providers fax information for school nurse	sessions after school; school nurse included educational material with report card	Followed up with parents by phone	students with asthma identified 15 AAPs filed
School sites #6, #7				No data

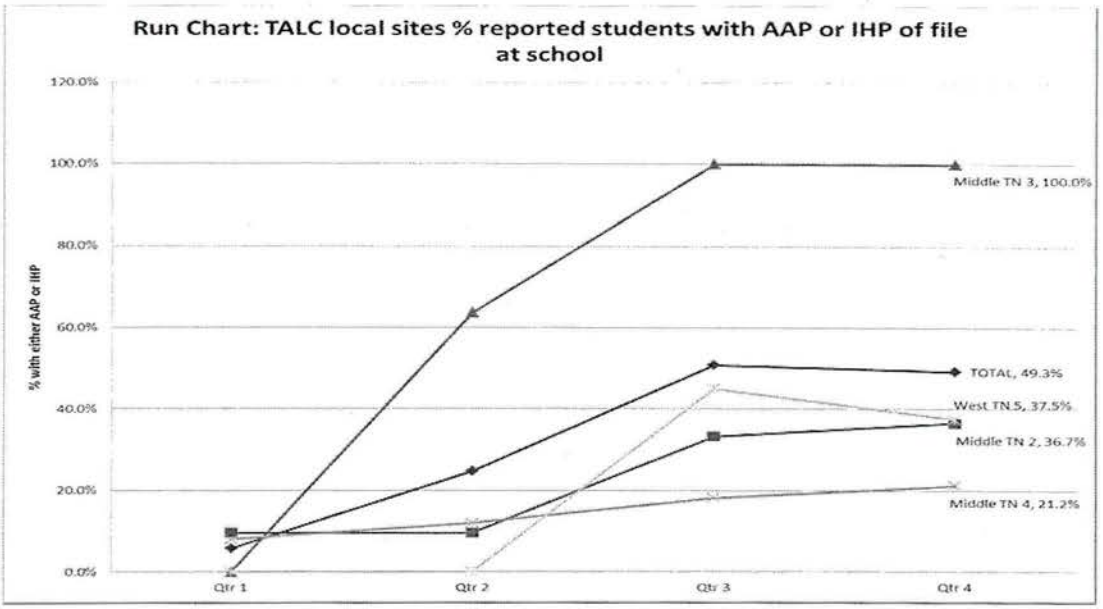
Figures

Figure 10: Timeline of Tennessee Asthma Learning Collaborative Activities



Sources: STAT Plan to Reduce Asthma in Tennessee,[20] Report on the Design of a Comprehensive State Plan to Reduce the Burden of Asthma on Tennessee School Children[21]

Figure 11: Run Chart: Tennessee Asthma Learning Collaborative local sites % reported students with AAP or IHP on file at school


Run Chart: TALC local sites % reported students with AAP or IHP of file at school
120.0%
100.0%
80.0%
60.0%
40.0%
20.0%
0.0%
% with either AAP or IHP
Qtr 1
Qtr 2
Qtr 3
Qtr 4
Middle TN 3, 100.0%
TOTAL, 49.3%
West TN 5, 37.5%
Middle TN 2, 36.7%
Middle TN 4, 21.2%

APPENDIX A. A Report on the Activities of the Activities of the Tennessee Asthma Learning Collaborative

A Report on the Activities of the Tennessee Asthma Learning Collaborative (TALC)

Tennessee Department of Health

Contents

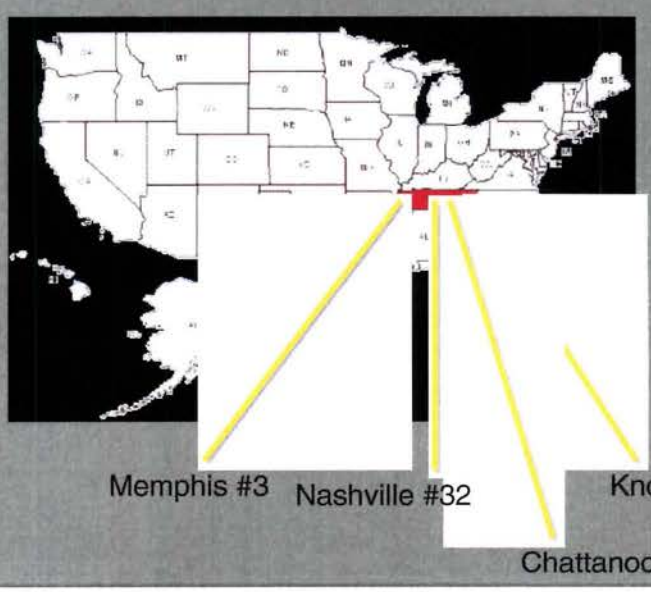
Introduction

Asthma Burden in Tennessee School Children

Similar to national statistics, Tennessee reports that 9.5% (N=137,242) of children aged 0-17 currently have asthma.[1] In Tennessee, asthma disproportionately affects low-income and minority children. According to data from the Tennessee Department of Health's Hospital Discharge Data System for 2001-2010, each year in Tennessee, asthma is responsible for nearly 2,000 inpatient hospitalizations and over 14,000 emergency room visits by children ages 1-17 years old. The hospital charges associated with these visits accounted for $41.4 million in 2010, $27.8 million of which was paid for through the state Medicaid program TennCare and nearly $1 million was self-pay by the child's family.

During the 2011-2012 academic year, more than 63,000 individual students enrolled in Tennessee public schools reported an asthma diagnosis to their school, a 64% increase since 2004.[2] These children represented 33% of all public school enrollees diagnosed with a chronic disease, followed by ADHD/ADD (21%) and severe allergies (9%). Asthma accounted for 94% of emergency healthcare procedures performed by licensed providers in Tennessee schools bringing the total number of asthma related procedures to 57,830 during that academic year. Research indicates that for students with an asthma diagnosis, poor health outcomes can be associated with multiple educational outcomes including negative effects on cognition, connectedness and engagement in school, and absenteeism.[3]

Tennessee has been identified as home to four of the "most challenging cities to live with asthma." Each year The Asthma Capitols™, an annual research project conducted by the Asthma and Allergy Foundation of America® (AAFA), ranks cities across the United States based on prevalence factors, risk factors (ie. Annual pollen scores, annual air quality scores, public smoking laws, poverty rates, uninsured rates and school inhaler access laws) and medical factors (ie. rescue and controller medication use, and number of asthma specialists).[19] In 2013 rankings, four major cities in Tennessee were among the most difficult cities to have an asthma diagnosis.



Components of Quality Asthma Care

The practice of appropriate management and prevention strategies can help control asthma symptoms. In 2007, the National Heart, Lung, and Blood Institute (NHLBI) in coordination with the National Asthma Education and Prevention Program (NAEPP), released its third set of clinical practice guidelines for asthma. This report, also known as the Expert Panel Report 3—Guidelines for the Diagnosis and Management of Asthma,[4] (EPR-3) is a systematic review of the literature by a specially convened expert panel selected by the NAEPP. The EPR-3 is a report of best clinical practices in asthma care with a specific section on childhood asthma.

Components of Quality Care

- Attending regular doctor visits
- Identifying and avoiding asthma triggers
- Monitoring symptoms to maintain asthma control
- Using medications as prescribed
- Developing and utilizing an asthma action plan

Asthma Action Plans

Asthma action plans (AAPs) are an individualized written plan of care for a person's asthma and typically captures person-specific information on daily treatment routines, medications, instructions for asthma attacks, and when to contact the doctor. Guidelines recommend that a medical provider create this management tool in conjunction with the patient and family taking into consideration home life, school and afterschool activities, and suggest that the final document be shared with the child's school. The AAP is meant to provide decision support to school nurses or other school-based providers who are caring for children in the community or school setting.

Tennessee's Commitment to Improving the Health of Students with Asthma

To address asthma from the public health perspective, in 2009 Tennessee adopted a comprehensive state asthma plan, the "State of Tennessee Asthma Taskforce (STAT) Plan to Reduce Asthma," a portion of which focused specifically on childhood asthma.[5] One year later, in September 2010, the Tennessee Department of Health produced a follow-up report outlining progress made toward child-related goals as defined by the state plan.[6] More recently, asthma and its effective management have also been included as one of 7 state priority areas by the Tennessee Department of Health's Title V/ Maternal and Child Health Program.

One objective articulated by the original STAT plan, which is divided in to Surveillance and Epidemiology, Public Awareness and Education, Medical Management, and Environmental Management, states that

> "By December 2014, all children with an asthma diagnosis will have an individualized asthma plan from the patient's medical home on file in the school, child care facility or other out-of-home group care setting and used in the home for asthma management."

Tennessee Asthma Learning Collaborative

In an effort to address this goal, the Department of Health initiated the Tennessee Asthma Learning Collaborative (TALC), a multidisciplinary group of professionals tasked with problem-solving the issue of AAPs. Participants included representatives from the following organizations:

- State of TN Asthma Taskforce
- Department of Education
- Department of Coordinated School Health
- TN Association of School Nurses,
- TN Parent-Teacher Association,
- TN chapter of the American Academy of Pediatrics,
- TN Regional Health Directors and Health Officers,
- TennCare, and
- Family Voices.

TALC identified a shared goal for each of the local sites where improvement activities would occur.

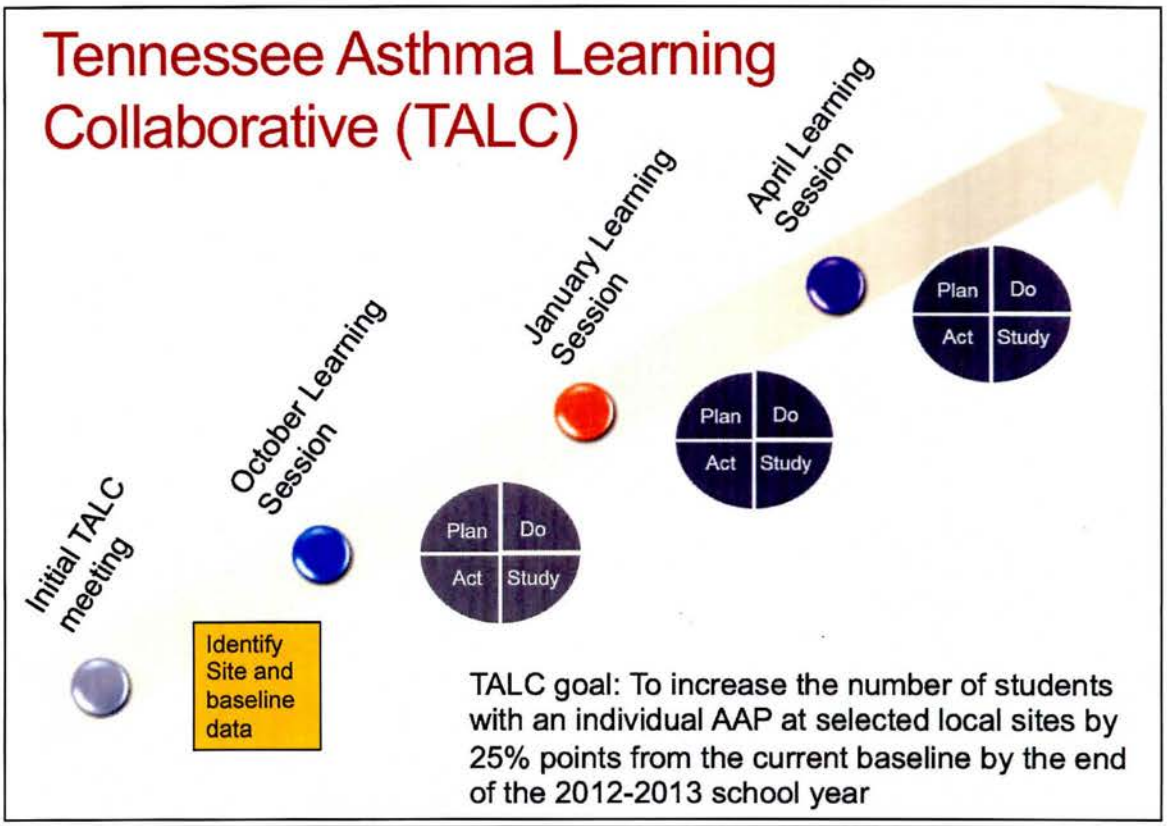
GOAL: To increase the number of students with individual asthma action plans at three pilot site by 25% points from the current baseline by the end of the 2012-2013 school year.

TALC formally convened 4 times from during the 2012-2013 school year and held multiple other regional and small group meetings, both formal and informal. Activities at formal meetings included guest speaker presentations, reports on regional improvement efforts, and open discussion about barriers and facilitators to AAP use.

Table 1: Tennessee Asthma Learning Collaborative Meetings

Meeting Date	Learning Session Topic	Guest Speaker(s)	Format
August 22, 2012	Asthma overview, Learning Collaboratives, and Plan-Do-Study-Act cycles	Dr. Michael Warren Dr. Paul Moore Dr. Yvette Mack	In-person meeting
October 30, 2012	Quality Improvement 101	Dru Potash	Webinar
January 31, 2013	Collaborative Skills: Self-Assessment and Best Practices	Jaime Bruce	Webinar
April 4, 2013	Assessing Readiness and Fostering Organizational Change	JoAnn Kirchner, MD University of Arkansas	Webinar

Figure 1. Timeline of TALC Activities



Tennessee Asthma Learning Collaborative Activities

East Tennessee: In East Tennessee, TALC members collaborated with community partners to select a K-8th grade school identified as serving "high risk and underserved" students from a rural mountainous county. This school also expressed significant buy-in for the project and its administrators were in full support of an intervention. The East TN team had an established relationship with a pulmonary team that had previously expressed interest in collaborating with the school system. This partnership drove their selection of their strategy, which was to hold asthma screening sessions at the school. The goal at this site was to screen students and connect them with community providers for follow-up. Local leaders coordinated with school personnel to schedule screening days in the classroom. Screenings were staffed by 2 physicians, 2 respiratory therapists, a clinical nurse specialist, and an asthma educator. An assembly line process included a pulmonary function test (PFT), an assessment of forms on file, and an education session. For students recommended for follow-up, the school nurse called provider offices and encouraged them to provide AAPs to parents at this visit. East TN team screened 94 students recommending 44 for follow-up with a healthcare provider for abnormal PFT results and/or reported symptoms.

East TN did not follow the PDSA cycle for data collection, but reported outcomes at the completion of the project. Out of a total student population of 410, 10 students were identified with an asthma diagnosis; 2 provided AAPs to school. Table 2 depicts the regional activities.

Middle Tennessee. Three elementary schools serving a metropolitan area were selected from middle TN; these schools were chosen from 3 different zip codes based on asthma rates and perception of school nurse workload. The middle TN team had a member who voiced concerns that the project would be too cumbersome for school nurses in terms of workload. Therefore this team decided to implement a simple reminder system for school nurses regarding current requirements for documentation of chronic health conditions among students and measure compliance. Middle TN TALC members sent an electronic message to school nurses at each of the 3 selected schools to heighten awareness of the policy on healthcare documentation. This policy states:

> "any child with acute or chronic health issues should have a health assessment completed by a Registered Nurse. As warranted by the child's condition or diagnosis, an individual health plan (IHP) will be completed by the registered nurse."

According to the policy,[7] the development and approval of the IHP should include input from the parent and other health care providers. During the second PDSA cycle, the Director of School Nurses for the selected school system informed the school nurses of the QI project and encouraged them to attempt contact with parents regarding asthma documentation at school. This action was repeated during the third and final PDSA cycle resulting in overall increases in IHP development but no improvement in AAP collection. The efforts in middle TN resulted only in improved collection of IHPs and had no increase in AAP collection.

West Tennessee. West Tennessee chose 3 elementary schools from an Achievement School district, which serves students previously scoring in the bottom 5% academically, when the school nurse serving these schools volunteered to participate. Team members wanted a multi-faceted approach to interventions that addressed educational and systems-based issues with multiple audiences. West TN TALC members and the sites' school nurses chose the following three strategies to create change:

1. increase contact between school nurse and community providers via phone calls and fax communication,
2. provide parent asthma education sessions at school
3. promote awareness by sending educational information home with report cards

Following the first PDSA cycle, site leaders discovered that local physician practice was to provide only self-carrying and/or self-medicating school age patients with an AAP which lead to an increased effort to educate specialty and primary care providers on the importance of AAP utilization at school for all children with a diagnosis. Peer-to-peer communication between a physician champion and other local providers initiated a discussion surrounding the development of a standardized AAP form to be used system-wide. Peer-to-peer communication among school nurses also promoted efforts to connect with parents and local providers regarding students AAP forms. West TN TALC leaders discontinued efforts at 2 of their 3 sites when the school nurse was unable to participate. West TN was the only site that reached the original TALC goal of increasing AAP by 25% percentage points. Table 2 shows regional activities.

Table 2: Changes Strategies by Regional Team and PDSA Cycle

	PDSA Cycle 1	PDSA Cycle 2	PDSA Cycle 3
East TN team	Informed community providers of project and importance of AAP collection	Held screening session #1	Held screening session #2
Middle TN team	Emailed policy reminder to school nurses	Informed school nurses of QI project	Informed school nurse of STAT goal to have 100% AAP on file at school
West TN team	School nurse called local providers and parents educating then of need for AAP at school; school nurse gave providers fax information for school nurse	TALC members hosted parent education sessions after school; school nurse included educational material with report card	Followed up with provider offices by phone; Followed up with parents by phone

Recommendations

Learning Collaboratives as a Strategy for Change

Overall, only one local site (West TN) met the original goal set forth by TALC to increase AAP utilization by 25 percentage points, but TALC, as a strategy to facilitate change, was overall successful in that it engaged a group of key people in a dialogue around AAP utilization and generated knowledge that will inform decisions moving forward. Strengths in the implementation of this learning collaborative as a strategy included the engagement of a multidisciplinary group of stakeholders, the employment of a model to provide structure, and the diversity of information gained from change activities at multiple sites.

Having the endorsement of DOH leadership and their active participation in identifying the participants to join the collaborative was paramount to the establishment and ongoing efforts of the learning collaborative. The diversity of the group gave members the opportunity to gain knowledge about the perspectives and roles of other professionals, which allowed participants to take steps toward mitigating some barriers to change such as perceived lack of compatibility and differences in knowledge and beliefs surrounding AAP use and value.

Another strength in the implementation of TALC was the use of the Breakthrough Series model, which added needed structure to the otherwise flexible activities of the group. This structure facilitated the development of a timeline for change activities and large group meetings, and as well as supported timely documentation of change and accountability for participation. The learning sessions prescribed by the BTS model created a structure for sharing information about successes and challenges experienced at the local sites while also providing a forum for learning about broad concepts of quality improvement, collaboration and assessing readiness for change.

While completing change activities at multiple local sites made data collection more challenging, it was also a strength in this project. Each site's experience added to the knowledge of what to expect and how to prepare in undertaking a larger scale implementation around asthma management in schools. Making changes based on local needs allowed for the identification of different barriers and facilitators as well as problem solving strategies. For example, in West TN, the local group learned that providers only complete an AAP if a patient will self-carry and self-administer medications. Moving forward, it will be beneficial to know if this is a common practice among other providers. Furthermore, West TN implemented a multi-faceted approach that sought to create change with 3 different audiences: school nurses, physicians/providers and parents. This was simultaneously an education campaign and an opportunity to create buy-in from key care providers.

Best practices for future learning collaborative implementation:

- Engage key stakeholders from diverse backgrounds
- Prioritize in-person meetings and schedule meeting dates at the outset of the project
- Identify and articulate a shared goal with measureable outcomes

- Measure readiness for change in learning collaborative members as well as community partners
- Encourage multi-faceted approach change including education of multiple audiences and within various systems
- Specify a documentation process to insure comparability among sites
- Invite relevant guest speakers to learning sessions

Asthma Action Plan Utilization

The STAT Plan to Reduce the Asthma Burden in Tennessee aims to have an AAP on file at school for every public school student with an asthma diagnosis by the end of 2014. The state will not reach that goal as it is currently stated. This learning collaborative revealed some of the barriers and facilitators to consider moving forward.

Barriers to increased AAP utilization:

- Schools and participants who were comfortable with status quo or who did not articulate a need for improved use of AAPs did not meet goals for change.
- The high student to school nurse ratio and priority toward skilled nursing activities did not support AAP utilization activities.
- School nurses' workloads and workflow patterns did not easily integrate this additional responsibility.
- School nurses did not value the AAP as a tool to manage acute asthma exacerbations.
- The use of IHP and AAP creates additional work for school nurses and devalues the need for AAP.
- The number and variety of AAP forms used in TN creates additional work for parents and providers.

Options for moving forward include:

1. **Create a strategy based on known barriers and facilitators and roll out an implementation plan to school nurses through the Office of Coordinated School Health.** This strategy would include education on AAP, form letters to send home to parents, and suggestions for communicating with local providers.
2. **Amend state goal to reflect the IHP as an appropriate alternative for use at school.** Changing state goals to list IHP as a state endorsed tool would require the development of an educational program to better educate school nurses on the important information to include in an IHP and how to better engage parents in the completion of IHPs.
3. **Investigate the possibility of reopening state level nurse** to advice and advocate for appropriate implementation efforts regarding all health management concerns at school.
4. **Continue improvement efforts toward lowering school nurse to student ratio** in order to lessen workload on school nurse.

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Appendices

Asthma Facts[1]

Asthma Prevalence

- Prevalence of current asthma among Tennessee children was 11.5 percent in 2011.
- Lifetime asthma prevalence was higher among boys than among girls.
- Asthma prevalence was higher among black non-Hispanics than among white non-Hispanics.
- Asthma prevalence increased with age.
- In Tennessee the percent of children who live in households where someone uses tobacco was 32.7 percent compared to 24.1 percent nationally.
- Among children with public insurance 47.3 percent were reported to live in households where someone smokes compared to 21.0 percent of those with private health insurance.
- The percentage of mothers who smoked during pregnancy in Tennessee in 2012 was 16.3 percent.

Health Care Utilization and Cost

- Annually from 2003 to 2012, there were approximately 1,900 inpatient hospitalizations and 14,530 emergency department visits for asthma among children in Tennessee.
- Between 2003 and 2012 inpatient hospitalizations for asthma decreased 27.7 percent while emergency department visits increased 12.5 percent.
- The annual inpatient hospitalization rate for primary asthma averaged 140 per 100,000 children between 2003 and 2012.
- The annual emergency department visit rate for asthma averaged 1,057 visits per 100,000 children.
- Boys had higher inpatient hospitalization and emergency department visit rates compared to girls.
- Black children had higher inpatient hospitalization and emergency department visit rates than white children.
- Shelby region had the highest inpatient hospitalization rate and emergency department visit rate among Tennessee's health department regions.
- Among Tennessee's 95 counties Fentress County had the highest inpatient hospitalization rate while Hardeman County had the highest emergency department visit rate in the state.
- In 2012 total hospital charges for childhood asthma in Tennessee were $53.7 million.

[1] Kakoti G. and Dewan H. (2014). Childhood Asthma in Tennessee, 2003-2012. Division of Policy, Planning & Assessment, Tennessee Department of Health, Nashville, Tennessee.

- Per visit charges for both inpatient and outpatient hospitalizations increased over 100 percent between 2003 and 2012.
- The per visit inpatient hospitalization charges averaged $9,950 between 2003 and 2012 while the per visit outpatient hospitalization charges averaged $1,427.

Asthma Among TennCare Enrollees

- The prevalence of asthma among children enrolled in TennCare was 13.7 percent between 2010 and 2012.
- Asthma prevalence was highest among children 1-4 years old.
- Among the state's 14 health department regions Hamilton had the highest prevalence rate for asthma among TennCare children enrollees.
- Van Buren County had the lowest asthma prevalence while Hardeman County had the highest asthma prevalence among TennCare.

APPENDIX B. CFIR Domains and Constructs

ADDITIONAL FILE 3: CFIR Constructs with Short Definitions

Damschroder LJ, Aron DC, Keith RE, Kirsh SR, Alexander JA, Lowery JC: **Fostering implementation of health services research findings into practice: A consolidated framework for advancing implementation science**

	Topic/Description	Short Description
I. INTERVENTION CHARACTERISTICS		
A	Intervention Source	Perception of key stakeholders about whether the intervention is externally or internally developed.
B	Evidence Strength & Quality	Stakeholders' perceptions of the quality and validity of evidence supporting the belief that the intervention will have desired outcomes.
C	Relative advantage	Stakeholders' perception of the advantage of implementing the intervention versus an alternative solution.
D	Adaptability	The degree to which an intervention can be adapted, tailored, refined, or reinvented to meet local needs.
E	Trialability	The ability to test the intervention on a small scale in the organization [8], and to be able to reverse course (undo implementation) if warranted.
F	Complexity	Perceived difficulty of implementation, reflected by duration, scope, radicalness, disruptiveness, centrality, and intricacy and number of steps required to implement
G	Design Quality and Packaging	Perceived excellence in how the intervention is bundled, presented, and assembled
H	Cost	Costs of the intervention and costs associated with implementing that intervention including investment, supply, and opportunity costs.
II. OUTER SETTING		
A	Patient Needs & Resources	The extent to which patient needs, as well as barriers and facilitators to meet those needs are accurately known and prioritized by the organization.
B	Cosmopolitanism	The degree to which an organization is networked with other external organizations.
C	Peer Pressure	Mimetic or competitive pressure to implement an intervention; typically because most or other key peer or competing organizations have already implemented or in a bid for a competitive edge.
D	External Policy & Incentives	A broad construct that includes external strategies to spread interventions including policy and regulations (governmental or other central entity), external mandates, recommendations and guidelines, pay-for-performance, collaboratives, and public or benchmark reporting.
III. INNER SETTING		
A	Structural Characteristics	The social architecture, age, maturity, and size of an organization.
B	Networks & Communications	The nature and quality of webs of social networks and the nature and quality of formal and informal communications within an organization.
C	Culture	Norms, values, and basic assumptions of a given organization.
D	Implementation Climate	The absorptive capacity for change, shared receptivity of involved individuals to an intervention and the extent to which use of that intervention will be rewarded, supported, and expected within their organization.
1	Tension for Change	The degree to which stakeholders perceive the current situation as intolerable or needing change.
2	Compatibility	The degree of tangible fit between meaning and values attached to the intervention by involved individuals, how those align with individuals' own norms, values, and perceived risks and needs, and how the intervention fits with existing workflows and systems.
3	Relative Priority	Individuals' shared perception of the importance of the implementation within the organization.
4	Organizational Incentives & Rewards	Extrinsic incentives such as goal-sharing awards, performance reviews, promotions, and raises in salary and less tangible incentives such as increased stature or respect.

5	Goals and Feedback	The degree to which goals are clearly communicated, acted upon, and fed back to staff and alignment of that feedback with goals.
6	Learning Climate	A climate in which: a) leaders express their own fallibility and need for team members' assistance and input; b) team members feel that they are essential, valued, and knowledgeable partners in the change process; c) individuals feel psychologically safe to try new methods; and d) there is sufficient time and space for reflective thinking and evaluation.
E	Readiness for Implementation	Tangible and immediate indicators of organizational commitment to its decision to implement an intervention.
1	Leadership Engagement	Commitment, involvement, and accountability of leaders and managers with the implementation.
2	Available Resources	The level of resources dedicated for implementation and on-going operations including money, training, education, physical space, and time.
3	Access to knowledge and information	Ease of access to digestible information and knowledge about the intervention and how to incorporate it into work tasks.
IV. CHARACTERISTICS OF INDIVIDUALS		
A	Knowledge & Beliefs about the Intervention	Individuals' attitudes toward and value placed on the intervention as well as familiarity with facts, truths, and principles related to the intervention.
B	Self-efficacy	Individual belief in their own capabilities to execute courses of action to achieve implementation goals.
C	Individual Stage of Change	Characterization of the phase an individual is in, as he or she progresses toward skilled, enthusiastic, and sustained use of the intervention.
D	Individual Identification with Organization	A broad construct related to how individuals perceive the organization and their relationship and degree of commitment with that organization.
E	Other Personal Attributes	A broad construct to include other personal traits such as tolerance of ambiguity, intellectual ability, motivation, values, competence, capacity, and learning style.
V. PROCESS		
A	Planning	The degree to which a scheme or method of behavior and tasks for implementing an intervention are developed in advance and the quality of those schemes or methods.
B	Engaging	Attracting and involving appropriate individuals in the implementation and use of the intervention through a combined strategy of social marketing, education, role modeling, training, and other similar activities.
1	Opinion Leaders	Individuals in an organization who have formal or informal influence on the attitudes and beliefs of their colleagues with respect to implementing the intervention
2	Formally appointed internal implementation leaders	Individuals from within the organization who have been formally appointed with responsibility for implementing an intervention as coordinator, project manager, team leader, or other similar role.
3	Champions	"Individuals who dedicate themselves to supporting, marketing, and 'driving through' an [implementation]" [101](p. 182), overcoming indifference or resistance that the intervention may provoke in an organization.
4	External Change Agents	Individuals who are affiliated with an outside entity who formally influence or facilitate intervention decisions in a desirable direction.
C	Executing	Carrying out or accomplishing the implementation according to plan.
D	Reflecting & Evaluating	Quantitative and qualitative feedback about the progress and quality of implementation accompanied with regular personal and team debriefing about progress and experience.

APPENDIX C. TALC Quarterly Update Worksheet

Instructions: Complete worksheet for the learning session scheduled for [DATE]. It will serve as a guide for sharing progress with other sites.

Overall Project Aim: To increase the number of students with individual asthma action plans at each pilot site by 25% by the end of the 2012-2013 school year.

Team Members:

What partners have you recruited to help with your project?
What pilot site have you selected?
What is your baseline measure of students with asthma action plans? (# of students with current AAP on file divided by # of students with asthma)?
Are you collecting any other measures? (Outcome, process, or balancing measures)
What change strategies are you planning for your pilot?

What lessons have you learned thus far that might be valuable for the other pilot groups?

Do you have questions for the other groups?

Please describe a recent Plan-Do-Study-Act cycle.
Plan:

Do:

Study:

Act:

APPENDIX D: TALC Interview Questions

Questions for LC members not otherwise involved in pilot site activities

1) Intervention Characteristics- AAP
   a) What is your perception of asthma action plans as a tool?
      i) Is it effective, cost efficient?
      ii) Is there a better alternative to an AAP to manage asthma in schools?
   b) Describe the preferred process/path by which an AAP tool is developed and introduced to the school community.
      i) Are there specific barriers or facilitators to that process?
2) Inner Setting- TALC
   a) How would you define the goal of TALC?
      i) Do you believe that TALC was successful in accomplishing its goals? Why or why not?
      ii) Was it an appropriate goal?
   b) Why did you choose NOT to participate in local pilot site activities?
   c) What were the most and least valuable aspects of participating in this group?
   d) Is this a strategy you would recommend in the future to support a similar change? Why or why not?
3) Outer setting- State of Tennessee
   a) Can you describe the role of the state (DOH or DOE) in AAP utilization.
      i) What is your perception of the level and spread of AAP use in TN?
      ii) Have there been state level changes that have helped or hindered the use of AAPs in any way?
      iii) In your opinion, what types of state level support would be beneficial to increasing the use of AAPs statewide?
4) Individual characteristics- TALC members
   a) Looking at the members of TALC, were there any key stakeholders or agencies missing or under represented in the group? Over represented?
   b) How did interpersonal relationships contribute to the process of TALC?
5) Process- Learning Collaborative Process
   a) Did you find TALC to be a valuable use of your time? Why or why not?
   b) How did the multidisciplinary group add or detract from the group's ability to reach its goal?
   c) What would you change about the process of the learning collaborative?
   d) What lessons can be learned from this experience?

Questions for LC members involved in pilot site activities

1) Intervention Characteristics- AAP
   a) What is your perception of asthma action plans as a tool?
      i) Is it effective, cost efficient?
      ii) Is there a better alternative to an AAP to manage asthma in schools?
   b) Describe the preferred process/path by which an AAP tool is developed and introduced to the school community.
      i) Are there specific barriers or facilitators to that process?
2) Inner Setting- TALC
   a) How would you define the goal of TALC?
      i) Do you believe that TALC was successful in accomplishing its goals? Why or why not?
      ii) Was it an appropriate goal?
   b) What were the most and least valuable aspects of participating in this group?
   c) Is this a strategy you would recommend in the future to support a similar change? Why or why not?
   d) Why did you participate in the pilot site in your region?
   e) Can you describe the setting and nature of the pilot site activities?
      i) How did you choose these activities?
      ii) Were they successful? Why or why not?
   f) What role did community partners play in the activities at your region's pilot site?
3) Outer setting- State of Tennessee
   a) Can you describe the role of the state (DOH or DOE) in AAP utilization.
      i) Have there been state level changes that have helped or hindered the use of AAPs in any way?
      ii) In your opinion, what types of state level support would be beneficial to increasing the use of AAPs statewide?
4) Individual characteristics- TALC members/pilot site partners
   a) Can you describe the members of TALC?
      i) Were there any key stakeholders or agencies missing or under represented in the group? Over represented?
   b) How did individuals contribute to or hinder the process of TALC?
   c) In terms of the pilot site activities, what specific qualities or resources did community partners provide?
5) Process- Learning Collaborative Process/pilot site process
   a) Did you find TALC to be a valuable use of your time? Why or why not?
   b) How did the multidisciplinary group add or detract from the group's ability to reach its goal?
   c) What would you change about the process of the learning collaborative?
      i) What lessons can be learned from this TALC experience?
   d) Regarding the pilot activities, how did the process effect the outcome?

Questions for pilot site key contributors

1) Intervention Characteristics- AAP
   a) What is your perception of asthma action plans as a tool?
      i) Is it effective, cost efficient?
      ii) Is there a better alternative to an AAP to manage asthma in schools?
   b) Describe the preferred process/path by which an AAP tool is developed and introduced to the school community.
      i) Are there specific barriers or facilitators to that process?
2) Inner Setting- Pilot Site
   a) Can you describe the goal of your pilot site activities?
      i) Do you believe that the team was successful in accomplishing its goals? Why or why not?
      ii) Was it an appropriate goal?
   b) Can you describe the setting of the pilot site activities?
      i) Where is the school located?
      ii) Describe the student population.
      iii) Describe the culture of the school.
   c) Can you describe any community or clinician support you received at your site?
3) Process- Pilot Site
   a) Can you describe the activities that you engaged in at your site?
   b) How did you decide on these activities?
   c) What lessons did you learn based on the activities related to this project?
4) Individual Characteristics
   a) Who are the key players in your site's activities?
   b) How did their actions contribute to your activities, in either a positive or negative way?
5) Outer Setting- State
   a) Can you describe the role of the state (DOH or DOE) in AAP utilization.
      i) Have there been state level changes that have helped or hindered the use of AAPs in any way?
      ii) In your opinion, what types of state level support would be beneficial to increasing the use of AAPs statewide?

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VITA

Jaime Bruce Holliman
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[redacted]

Education

Wake Forest University, Winston-Salem, NC, B.A. in Sociology 1997-2001
Mills College, Oakland, CA, M.A. in Child life 2001-2003
Boston University School of Public Health, Boston, MA, DrPH in Maternal and Child Health, 2008-2014

Clinical Child Life Experience

Monroe Carell Jr. Children's Hospital at Vanderbilt, Nashville, TN, 2005-2008, 2011-present

Provided developmentally appropriate interventions and positive coping strategies to young patients and their families admitted to the Pediatric Critical Care Unit (2005-2008) and adult hospital critical care units (2011-present)

Lucile S. Packard Children's Hospital at Stanford, Palo Alto, CA, 2003-2005

Promoted education, coping skills and compliance with pediatric patients throughout the transplant process; Collaborated with the medical team to foster patients' personal and medical success through effective treatment plans

Lucile S. Packard Children's Hospital at Stanford, Palo Alto, CA, Fall 2002

Completed 500+ hour internship in Child life department

University of San Francisco Children's Hospital, San Francisco, CA, Summer 2002

Completed 300+ hour internship in Child life department

Research Experience

Tennessee Department of Health, Maternal and Child Health Section, Nashville, TN, 2011-2014

Initiated the Tennessee Asthma Learning Collaborative (TALC) to address opportunities to improve the management of childhood asthma for TN school children; utilized Consolidated Framework for Implementation Research (CFIR) to analyze success of TALC

Boston University Medical Center, Department of Pediatrics, Boston, MA, 2009-2011

Employed as research administrator supporting efforts in recruitment, data management and collection, analysis and publication of various multi-center research projects including topics such as autism, infant prematurity, and quality indicators; Developed and administered national surveys

Boston Public Health Commission, Boston, MA, May 2009-2010

Conducted research with Bureau of Child, Adolescent and Family Health and the City of Boston on after school opportunities for school age children with Autism

Spectrum Disorder; Assessed current programs at site visits; Developed an extensive list of best practices in after school programming

Vanderbilt University Center for Child Development, Nashville, TN, 2006-2007
Enhancing Development through Family Support - Acted as primary interventionist providing support to families admitted to the Neonatal Intensive Care unit

Leadership Experience

Child Life Council FOCUS, Executive Editor, Rockville, MD, 2012-2014
Lead editorial board members to produce quarterly peer-reviewed publication; Manage review board members and author communication

Child Life Council FOCUS, Associate Editor, Rockville, MD, 2010-2012
Support editorial board members to produce quarterly peer-reviewed publication

Healing HeARTS, Palo Alto, CA, 2004
Served in leadership role on editorial board to publish collection of pediatric art and writing samples

Okizu Foundation, Novato, CA, summers 2000-2003
Acted as Program Director managing 30+ Oncology camp counselors providing support to approximately 75 teenage campers per session, 8 session per summer

Leadership Excellence Application Development program, Winston-Salem, NC, 1998-2000
Facilitated weekly leadership seminar for 100+ undergraduate students at Wake Forest University

Project Pumpkin, Winston-Salem, NC, 1997-2000
Coordinated Halloween festivities for underprivileged children in the community; organized 600+ volunteers per year to support project; Chairperson 2000

Publications

- Wang CJ, Little AA, Kamholz K, Holliman JB, et al. Improving Preterm Ophthalmologic Care in the Era of Accountable Care Organizations. Archives of Ophthalmology. 2012; 130(11):1433-1440.
- Wang CJ, Kavanagh PL, Little AA, Holliman JB, Sprinz PG. Quality-of-Care Indicators for Children With Sickle Cell Disease. Pediatrics. 2011; 128, 484-493.
- Wang CJ, Little AA, Holliman JB, et al. Communication of Urgent Public Health Messages to Urban Populations: Lessons from the Massachusetts Water Main Break. Disaster Medicine and Public Health Preparedness. 2011; 5, 235-241.
- Odom T, Holliman JB. The Child Life Alphabet: L is for listening to children with special needs. Child Life Council Bulletin, 2011; 29, 1.
- Wise MD, Little AA, Holliman JB, Wise PH, Wang CJ. Can State Early Intervention Programs Meet the Increased Demand of Children Suspected of Having Autism Spectrum Disorders? Journal of Developmental and Behavioral Pediatrics. 2010; 31, 469-476.

Presentations

- "Meeting the Needs of Patients with Young Children in a CVICU setting: a Multidisciplinary Collaboration," Poster author, Vanderbilt University Nurses Week 2014, Nashville, TN, 2014
- "Meeting the Needs of Patients with Young Children in a CVICU setting: a Multidisciplinary Collaboration," Poster presenter, American Nurses Credentialing Center Conference, San Antonio, TX, 2014
- "Increasing your Publication Potential: Editors and Reviewers Weigh In," Session presenter, Child Life Council Annual Conference, Denver, CO, 2013
- "Showcasing Student and Professional Research," Panelist member, Child Life Council Annual Conference, Washington, DC, 2012
- "Showcasing Student and Professional Research" Panelist member, Child Life Council Annual Conference, Phoenix, AZ, 2010
- "Leaders of the Pack: Three EBP Models Used in Pediatric Settings," Poster presenter, Child Life Council Annual Conference, Phoenix, AZ, 2010
- "From Child Life to Public Health: Helping Children with Special Healthcare Needs," Guest lecturer, Wheelock College, Boston, MA, 2009
- "How will I use this in the real world? Understanding and applying research in daily practice," Session presenter, Child Life Council Annual Conference, Dallas, TX, 2006

Professional Activities and Recognition

- Vanderbilt University Medical Center Credo Award recipient, 2014
- CLC Focus/Bulletin, Executive Editor (2012-2014), Associate Editor (2010-2012), Reviewer (2008-2010)
- CLC Research and Scholarship Committee, Member, 2011-2013
- CLC Evidence-based Practice Committee, Member, 2008-2010
- CLC Certification, 2002-present
- Brazelton Institute Neonatal Behavioral Observation (NBO) training participant, 2007
- Infant Massage training participant, 2007