5-12-2022

Increasing School Personnel Knowledge and Self-efficacy of Allergy Management

Sabrina Monzione
University of Massachusetts Boston, sabrina.monzione001@umb.edu

Increasing School Personnel Knowledge and Self-efficacy of Allergy Management

Sabrina Monzione, DNP, APRN, FNP-BC, NP-C

College of Nursing and Health Science, University of Massachusetts Boston

5/12/2022

Submitted in Partial Fulfillment of the Requirements for the Doctor of Nursing Practice Degree

Project Advisors

Faculty Advisor: Eileen Stuart-Shor, PhD, ANP-BC, FAHA, FAAN
Site Advisor: Carol Zichella, MSN, RN

Abstract

Introduction: School-aged children with allergies is a growing population. Allergies are a leading cause of chronic illnesses, are costly to the healthcare system, and can result in death. Allergic reactions in schools negatively impact student outcomes. The sites for this improvement project were four urban, public schools in Suffolk County, Massachusetts that did not have standardized school personnel allergy education.

Methods: The project took place in four, urban public schools in Suffolk County, Massachusetts. The four schools are comprised of three middle schools and one high school serving over 1,400 students. Over 240 teachers and supporting staff members provide instruction and guidance to students in grades 5th through 12th. The project implemented an asynchronous, web-based, allergy management education module. The school nurses administered the improvement intervention, and the process was directed and monitored by a nurse practitioner in 2021.

Results: The output measures included data from pre- and post-intervention surveys to assess change in school personnel allergy management knowledge and self-efficacy, as well as participation rate, and perceived satisfaction and ease of use. Of the 246 teachers in the four schools, 109 (44%) completed the post-educational survey; the majority were women (82%). Overall, 94% of participants reported satisfaction with the module. Pre/post measures of allergy management knowledge and self-efficacy demonstrated 28% improvement.

Summary and Recommendations: This allergy education initiative improved staff knowledge and self-efficacy. It was time- and cost-effective, web-based, and was saved to a shared drive. The allergy management education module has the potential to be sustainable and can be replicated at other schools in the district with the capability to be implemented annually. Recommendations include annual education, raising individual accountability to increase participation, and scaling to additional schools.

Keywords: Epinephrine, Massachusetts, School, Anaphylaxis, Allergy, Education

Increasing School Personnel Knowledge and Self-efficacy of Allergy Management

Introduction

Problem description

Across the United States including the Commonwealth of Massachusetts, an average of two children per classroom have allergies (*Facts and Statistics*, 2020). School-aged children are a vulnerable population that rely on others to determine their environments, exposures, and education. The United States has one of the highest rates of childhood allergies in the world with food allergies in children rising fifty percent between 1997 and 2011 (*Trends in Allergic Conditions Among Children: United States, 1997-2011*, 2013). Allergies are the sixth leading cause of chronic illnesses and cost the United States more than $18 billion annually (*Allergy Facts*, 2015).

Many children who begin school are unaware of existing allergies and up to a quarter of first-time anaphylactic events occur on school grounds (Greenhawt et al., 2018). Twenty-eight percent of anaphylactic fatalities are a result of an allergic reaction on school grounds (Chokshi et al., 2015). There is currently no national standard for allergy management education for school personnel with wide variation in education provided by school and district. Across Massachusetts and the country, many schools do not require or provide any allergy education. Others provide allergy education to staff who have homeroom students with documented medical anaphylactic allergies. Yet few provide allergy education to all school staff.

Limiting allergy education to staff who have homeroom students with a known anaphylactic allergy is not adequate to achieve the HealthyPeople2020 (n.d.) goal of increasing school safety because students do not spend most of their school days in their homeroom. All school staff who supervise students should be educated in allergy management so they can

identify allergic reactions in students and fellow staff members and know what actions to take next. An anaphylactic allergy can be lethal in less than sixty minutes (Cheng, 2017). Epinephrine is fast-acting and should be administered at the first sign of a severe allergic reaction (Jones & Wesley, 2017). School staff knowledge and education have been identified as a major barrier to timely epinephrine administration (Moritz & Schoessler, 2018). Delayed epinephrine administration is known to result in extended hospital stays and even death (Robinson et al., 2017).

Local Problem

The sites for this improvement project were four urban schools in Suffolk County, Massachusetts. The four schools are comprised of three middle schools and one high school serving over 1,400 students. Over 240 teachers and supporting staff members provide instruction and guidance to students in grades 5th through 12th. Historically, these schools did not have standardized staff allergy education. Nearly half of the students in the school system do not speak English as their primary language at home, half are economically disadvantaged, and they come from diverse racial and ethnic groups (Hispanic, 42.5%, Black, 33%; White, 14%; Asian, 9%, "Other", 1.5%) (*Facts and Figures*, n.d.). Differences have been noted in the prevalence of allergies by race/ethnicity. Compared to white children, black children and Asian children are (7% and 24% respectively) more likely than white children to have food allergies and comorbidities including asthma and eczema (West, 2020). Teachers spend more time with students than school nurses, therefore they are more likely to be the first to observe and respond to allergic reactions and should be educated on allergy management (Oriel et al., 2018). When nurses teach school staff about allergy management, allergy knowledge and epinephrine

administration increase (Wahl et al., 2015). However, teachers at the project school did not receive standardized allergy education.

Available evidence

A Prisma guided search of the available evidence was undertaken to identify the strategies that have been successful in increasing school personnel's knowledge of allergy management. The search included peer-reviewed, English language, full text, journal articles, published 2015-2020, with keywords "school AND allergy AND personnel", from CINAHL, Ovid, and PubMed databases. Seven articles identified interventions that showed an increase in school personnel knowledge of allergy management. The Summary Evidence Table (Appendix A) provides a synthesis of the literature reviewed. The studies were sorted into the two main thematic areas which emerged; 1) increased school personnel knowledge of allergy management (n=7 studies) and 2) increased school personnel self-efficacy of allergy management (n=3 studies). In addition, Level V, non-research evidence was identified from professional guidelines published by credible, national sources (n=4).

There are a variety of professional allergy guidelines and resources. Level V sources and recommendations are as follows. The American Academy of Pediatrics (AAP) developed and published an Allergy and Anaphylaxis Emergency Plan (American Academy of Pediatrics [AAP], 2017). This document includes allergy signs and symptoms to look for, and what to do. The American Academy of Allergy, Asthma, and Immunology (AAAAI) also developed and published an Anaphylaxis Emergency Action Plan (American Academy of Allergy, Asthma, and Immunology [AAAAI], 2020). This document includes symptoms of anaphylaxis and action steps. Both anaphylaxis emergency action plans have been streamlined to be efficient and effective. AAP's Allergy and Anaphylaxis Emergency Plan has been adopted by the National

Association of School Nurses (NASN) as a universal allergy action plan (Pistiner & Mattey, 2017). These action plans can be utilized to develop an allergy management education module for school personnel. Allergy education content should include an overview of allergies, definitions of key terms, how to identify signs and symptoms, and allergy strategies (*Voluntary Guidelines for Managing Food Allergies in Schools and Early Care and Education Programs*, 2020). The key information from these allergy education resources provided the strongest evidence for what specific content to include in the allergy management education module.

The studies which reported increased school personnel knowledge of food allergy management utilized a variety of interventions which varied by emphasis and time allotted for the education. All the studies included key information on food allergy guidelines including common allergens, how to identify allergic reactions, and steps to take following identification of an allergic reaction; several also focused on epinephrine administration education (Foster et al., 2015; White et al., 2015). The timing varied from 30 minutes (Canon et al., 2019; Crow, 2018; Lanser et al., 2016) to 40-minutes (Ford et al., 2017; White et al., 2015), up to 1-hour (Gonzalez-Mancebo et al., 2019; Crow, 2018). A non-peer review article was also added to the seven peer-reviewed articles.

This review of the literature supports the effectiveness of an allergy management educational intervention that includes an overview of allergies, definitions of key terms, how to identify signs and symptoms and allergies strategies and informed the educational intervention that was developed for this project.

Rationale

The studies reviewed were not explicit in identifying a theory that guided the intervention. For the purpose of this project, Knowles' adult learning theory was used to inform

the design of the educational intervention. Adult learners are different from child learners due to their psychology including habits, behaviors, and beliefs which are formed through life experience (Smith, 2003). In 1973, Knowles declared four basic assumptions of self-concept, experiences of the adult learner, readiness to learn, and orientation to learning. In 1984, he added two additional basic assumptions which included motivation to learn and need to know. Understanding these six basic assumptions facilitated engaging adult learners and guided the development and implementation of the education provided to school staff. As adult learners in a school setting, the staff have experience and exposure to children with allergies. This provides motivation to learn, need to learn, and influences readiness to learn. The implementation schedule was adjusted to accommodate their orientation to learning.

Kotter's 8 step change model guided implementation of the improvement project. The 8 steps were initially described as being applied sequentially and the model was later updated to be applied concurrently and continuously. The 8 steps include: create a sense of urgency; build a guiding coalition; form a strategic vision and initiatives; enlist a volunteer army; enable action by removing barriers; generate short-term wins; sustain acceleration; and institute change. Kotter also identified four cornerstone principles to guide the change process including the combination of leadership with management, using your head and heart to inspire others, utilizing a select few to bring many diverse individuals on board, and making the change meaningful for them to want to participate. Staff at the project schools felt a sense of urgency with children returning to school. A guiding coalition was created and met. The coalition discussed and agreed upon the type, format, and timeline of allergy education as ways to make the education meaningful and targeted to their needs. Barriers were removed by providing the education asynchronously. The

staff was provided the opportunity to present to the nursing office to exercise epinephrine administration and have additional questions answered.

Specific aims

The project purpose was to increase allergy management knowledge and self-efficacy among school personnel in four urban public schools in 2021. The overarching aim was to develop and implement an asynchronous, web-based, allergy education module.

The project objectives were as follows:

- A guiding coalition will be created and convened.
- Design an asynchronous, web-based, allergy education module.
- Embed the curriculum into the school-wide shared Google Drive.
- School personnel will demonstrate 20% improvement in allergy knowledge and self-efficacy.
- 75% of school personnel will complete the post-allergy education surveys.
- 75% of school personnel will report satisfaction of the education module.

Methods

The Plan, Do, Study, Act (PDSA) model guides the planning, implementation, evaluation, and reassessment phases of improvement projects (Langley et al., 2009). This improvement model utilizes rapid, iterative cycles. These cycles provide insight into the improvement process. This model was selected for this project because is it practical and cyclical. The data gathered from the PDSA cycle provided insight into the effectiveness and efficiency of the project.

Context

The project took place in four, urban public schools in Suffolk County, Massachusetts. In-service education is provided to staff. These offerings include quarterly emergency drills, annual

crisis response drills, and review of crisis response procedures and plans. The schools also participate in Community Eligibility Provision, which provides free breakfast, lunch, and afternoon snacks to all students. These offerings are important to keep school children safe and secure while spending one-third of each day at school. The education module and fact sheet were selected at the request of the school and will provide the same information as an educational seminar. They were saved to a Google shared drive for school personnel to access. The shared drive is utilized by all school personnel. An External Mapping Tool (Appendix B) was utilized to describe the project microsystem. This exercise revealed that the school sites rely heavily on school nurses to manage all aspects of care related to students' allergies. The school nurses communicate with primary care providers, allergy and immunology providers, parents and guardians, students, school staff, as well as nursing and union members. They communicate with external healthcare providers to ensure that up-to-date prescriptions, medication orders, and care plans are on file. The school nurse communicates with parents to ensure all paperwork, consent forms, and medications are up to date. They communicate with students to determine their level of education regarding their health conditions, awareness of signs and symptoms, as well as readiness to participate in their care. Each school nurse is responsible for providing in-service allergy education to school personnel. Currently, school personnel who do not directly supervise students including cafeteria staff, security, and custodians are not included in the nurse-led allergy education. The nurse is also tasked with communicating to administrative staff, union representatives, and nurse leaders to stay up to date on changing procedures and policies as well as advocate for new and improved policies and procedures. This demonstrates how dependent the sites are on school nurses as knowledge keepers and brokers for allergy management. While the nurses will always retain most of these responsibilities, teachers are more likely to be the first

to observe and respond to allergic reactions. For that reason, it is imperative that they be educated in allergy education and management.

After the sites were mapped, Cause and Effect Diagram (Appendix C) was constructed to examine the factors associated with school personnel allergy management education. There are many factors associated with the problem. To start, there is a chain of command which the school nurse must navigate prior to developing new education, procedures, or policies. The nurse leader and school principal must approve any new educational offerings. There was no standardized allergy management education for the sites. The second relevant issue is that teachers are most likely to be the first to observe and respond to allergic reactions but there is no standardized way to prepare them for this important role. To address this issue the project focused on tailoring the allergy education module to meet the needs of teachers for allergy education and management. The cause-and-effect diagram revealed additional factors that contribute to the problem. These include no standardized allergy action plan, emergency allergy policy, or education policy. These factors were not addressed as part of the proposed project; however, they will be addressed following intervention implementation and assessment as part of the next PDSA cycle.

Contextual factors at the site that influenced successful implementation of the project are outlined in the Force Field Analysis Diagram (Appendix D). This diagram revealed restraining and driving forces which facilitated and impeded successful implementation of the project. Driving forces included an agreed upon need for allergy management education, a need to assure basic competency to deal with allergic reactions since anaphylaxis can be fatal in less than sixty minutes, and a need for improved communication regarding allergy management among school nurses, teachers, parents, and students. The allergy education plan provided a standardized avenue for staff to communicate with the school nurse. Additional driving forces included a shift

in responsibility for allergy management from the school nurse to include other school personnel who supervise students, the possibility to save a life, and improvement as well as advancement in standard allergy education, allergy action plans, emergency allergy policies, and standard education policies.

Restraining forces included lack of time, the extra workload burden related to online learning and other Covid-19 related requirements, lack of money for development and implementation of online allergy education, and fear of change. To mitigate these restraining forces the allergy education was designed to take less than thirty minutes of participants time, be asynchronous, completed at their convenience, and was at no additional cost to the schools and participating personnel. Additional restraining forces included poor adherence and lack of buy-in among school personnel, technical issues, and poor communication. In summary, the driving forces were important, and the restraining forces were not unsurmountable, the balance of which portends successful implementation.

Intervention

The project implemented an asynchronous, web-based allergy education module at four schools. The focus of the intervention was on increasing allergy knowledge and self-efficacy among school personnel within the selected school sites. The allergy management education module was developed by the project leader, school nurse and nurse leader, and was approved by the nurse leader and school principal. The school nurse was responsible for administering the improvement intervention and the process was directed and monitored by the project leader. The school nurse implemented the intervention in 2021 as requested by the school nurse, nurse leader, and principal.

The allergy education module provided key allergy management facts for school personnel as well as proper epinephrine administration. The key facts were drawn from the professional guidelines and studies examined and focused on the following areas:

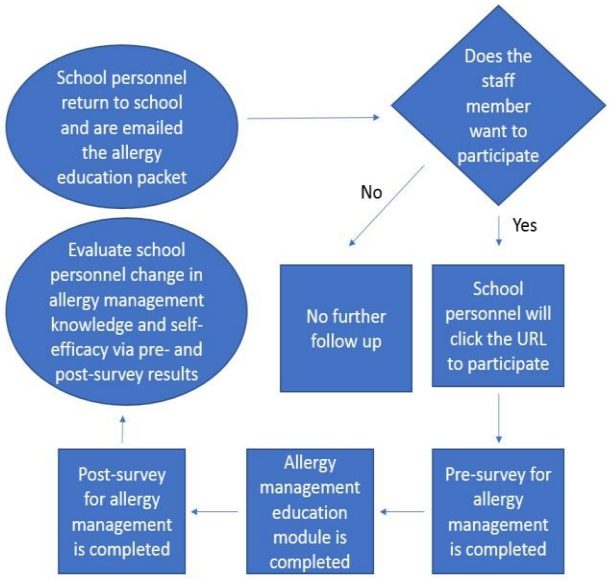
- The most common allergens that result in anaphylaxis include fish, shellfish, tree nuts, and peanuts.
- Allergen exposure reduction strategies including hand washing before and after new activities including meals and outdoor exercise, advising against sharing food and utensils, and cleaning tables before and after new activities including meals and projects.
- Signs and symptoms of an allergic reaction include mouth itching, swelling of the lips and tongue, throat itching, tightness, or closure, hoarseness of the voice, skin itch, hives, rash, redness, or swelling, vomiting, diarrhea, abdominal cramps, shortness of breath, cough, or wheeze, as well as a weak pulse, dizziness, or fainting.
- Epinephrine administration.

Implementation of the Intervention

The intervention was implemented in 2021 as requested by the school nurse, nurse leader, and principal. A Logic Model (Appendix E) illustrates the intervention plan. A coalition of stakeholders was formed to help guide the intervention. The allergy education module included key information from the available evidence including common allergens, how to reduce allergen contact, signs and symptoms of allergic reactions, steps to take after identifying an allergic reaction, and how to properly administer epinephrine. This information was formatted into an asynchronous, web-based module and was approved by the coalition. Then, the curriculum was embedded into the school-wide shared Google Drive for distribution.

The Intervention Flowchart (Appendix F) illustrates the intervention implementation. This intervention consisted of an asynchronous, web-based, educational module and fact sheet brochure, saved to a shared Google drive, distributed by email prior to the start of the school year. All school personnel received the allergy education module and surveys via email. The educational module consisted of a PowerPoint presentation and supplementary fact sheet brochure. Both the PowerPoint presentation and fact sheet contained evidence-based key allergy management information aligned with the recommendations of the relevant professional bodies.

Figure 1: Intervention Flowchart



Appendix G contains the Allergy Fact Sheet Brochure. This locally tailored brochure was developed in conjunction with the school nurse to fulfil the school's individualized needs. This fact sheet brochure was be sent by email to all school staff and was saved on a shared drive for easy access. Saving the allergy management brochure to the shared drive provides ease of access and promotes use over time.

The mandatory staff education expectations including the pre-education survey were emailed to all staff and available for four days, followed by an email containing the education module, fact sheet, and post-education survey. The post education survey was available for completion over the following 5.5 weeks. During this time, the nurse practitioner requested staff rosters to provide updated rosters demonstrating which staff members had and had not completed

the education module and survey, for the school nurse to notify staff of their pending responsibility.

Evaluation

The PDSA model guided the evaluation of the improvement project. Surveys were chosen for evaluating the process and outcomes of the intervention because they can be provided online, at no cost, and the results are easy to interpret.

Measures and Analysis

Project outcomes were identified in the Logic Model (Appendix E). Outcomes included creating a guiding coalition and conduct a coalition meeting. This outcome was measured by the completion of a coalition meeting. Second, design an asynchronous, web-based allergy education module. This outcome was measured by the approval of the module by the coalition. Third, the allergy education module was embedded into the shared Google Drive. This outcome was measured by the module being successfully saved to the Goodge Drive and available for distribution. Fourth, twenty percent of school personnel would demonstrate an improvement in allergy knowledge and self-efficacy survey scores. This outcome was measured with pre- and post-education survey results in the form of aggregated means. The fifth and sixth outcomes were that seventy-five percent of the school personnel would complete the post-education survey, and report satisfaction of the module. These outcomes were measured with pre- and post-education survey results as well as the number of school personnel who completed the surveys compared to the number of personnel emailed the module.

Measures Table (Appendix K) provides descriptions on how the aims were measured and analyzed as an outcome. Document review, frequencies, proportions, and percent improvement were calculated to evaluate the achievement of the project aims.

Table 1: Abbreviated Measures Table

Aim	How to measure
1. A guiding coalition will be created and convened.	1. A guiding coalition meeting will be conducted.
2. Design an asynchronous, web-based, allergy education module.	2. The allergy module will be approved by the coalition.
3. Embed the curriculum into the school-wide shared Google Drive.	3. The allergy module will be saved to Google Drive and available for distribution.
4. School personnel will demonstrate a 20% improvement in allergy knowledge and self-efficacy.	4. Compare pre- and post-survey knowledge and self-efficacy with multiple choice questions and self-efficacy with a 5-point Likert scale.
5. 75% of school personnel will complete the post-education survey.	5. Compare the number of school personnel who complete the post-education survey vs those emailed.
6. 75% of school personnel will report satisfaction and ease-of-use of the module.	6. Analyze post-survey multiple choice results using a 5-point Likert scale.

An outline of the survey domains and concepts measured are in Appendix H. The pre-education survey (Appendix I) and education module were emailed prior to the start of the school year. The pre-education survey was requested to be completed prior to reviewing the allergy management module. The intended recipients of this survey were school personnel who planned on reviewing the allergy management module. The concepts measured were knowledge, beliefs, attitudes, perception, confidence, and self-efficacy.

The post-education survey (Appendix J) was emailed over one week following the distribution of the pre-education survey and education module. The survey was recommended to be completed once the allergy module was reviewed. Survey questions focused on allergy management as well as ease of use and satisfaction of the education module. Surveys were a valid approach because the review of the literature supports the effectiveness of questionnaires to measure change in knowledge and self-efficacy scores related to an allergy management educational intervention. The questionnaires utilized for this project were developed by the project lead and tailored to the allergy education content. They were compromised of multiple choice and 5-point Likert scale qualitative questions aimed at measuring change in knowledge and self-efficacy after participating in the allergy management educational module. The outcome

was analyzed by comparing allergy management knowledge and self-efficacy pre- and post-participation in the education module.

The pre-education survey consisted of ten allergy management knowledge and five self-efficacy questions. Self-efficacy was measured using a 5-point Likert scale (Strongly Disagree to Strongly Agree) while knowledge questions were scored as correct or incorrect (Appendix I). The post-education survey consisted of those same fifteen questions in addition to five satisfaction questions (Appendix J). Overall knowledge was scored based on the number of correct answers in relation to the total number of questions. After individual total scored were calculated, an aggregated mean was calculated. In addition, to identify knowledge gaps more specifically, individual questions were examined to determine the proportion of participants who scored each question correctly. A total score was calculated for each participant based on the number of correct answers in relation to the ten possible correct answers.

The five questions related to self-efficacy (Appendix I and J) were measured using a 5-point Likert scale. Positive responses (agree/ strongly agree) in relation to each question was coded as Yes and neutral/ negative responses (neither agree nor disagree/ disagree, strongly disagree) were coded as No. The proportion of positive responses (agree/strongly agree) were calculated for each question in relation to the total number of responses for that question. An overall score was calculated for each participant based on the total number of positive responses (agree/strongly agree) in relation to the five questions. After individual scores were calculated an aggregated mean self-efficacy score was calculated.

Questions related to knowledge and self-efficacy were the same on the pre- and post-survey. Aggregated means, based on the proportion of correct responses for knowledge questions, or positive responses (agree/strongly agree) for self-efficacy were calculated for each

question as well as total score. These aggregated means were compared pre/post to calculate change and the percent improvement. The goal was a 20% improvement in knowledge and self-efficacy scores.

The post-survey contained five questions measured satisfaction of the education module and ease of use (Appendix J) of school personnel who completed the education module. A 5-point Likert scale was used (Strongly Disagree to Strongly Agree) to measure satisfaction and ease of use. The measurement goal was that ≥ 75% of staff would report positive satisfaction and ease of use by selecting agree or strongly agree on a 5-point Likert scale. The information was gathered through survey results.

The intended recipients of the post-survey were school personnel who completed the allergy management module. To measure staff survey response rate, the information was collected via post-survey completion numbers. Kotter's 8 step change model and Knowles' adult learning theory guided the development of the survey. One dimension of the change model included in the survey was identifying current knowledge and self-efficacy prior to the intervention. The other dimension of the change model included in the survey was that school personnel have experience and exposure to children with allergies. This contributes to a motivation to learn, need to learn, and influences readiness to learn.

Ethical considerations

This intervention was approved by site leadership. There was no formal IRB or ethics review mechanism at the site. This project paper did not include the individual school site names, nor the names of the participants.

The University of Massachusetts Quality Improvement Checklist (Appendix L) was completed and demonstrated that the proposed project met the criteria for quality improvement and not human subject research.

There were no specific ethical issues that arrived from the site or population. This allergy management project was quality improvement and did not meet the definition of human subject research because it was not designed to generate generalizable findings but rather to provide immediate and continuous improvement feedback in the local setting in which the project was carried out. The University of Massachusetts Boston IRB has determined that quality improvement projects do not need to be reviewed by the IRB.

Results

Four urban schools participated in this educational initiative. Of the 246 teachers in the four schools, 109 (44%) completed the post-educational survey. Participants were primarily female (82%, n=89). No other demographics were available due to confidentiality.

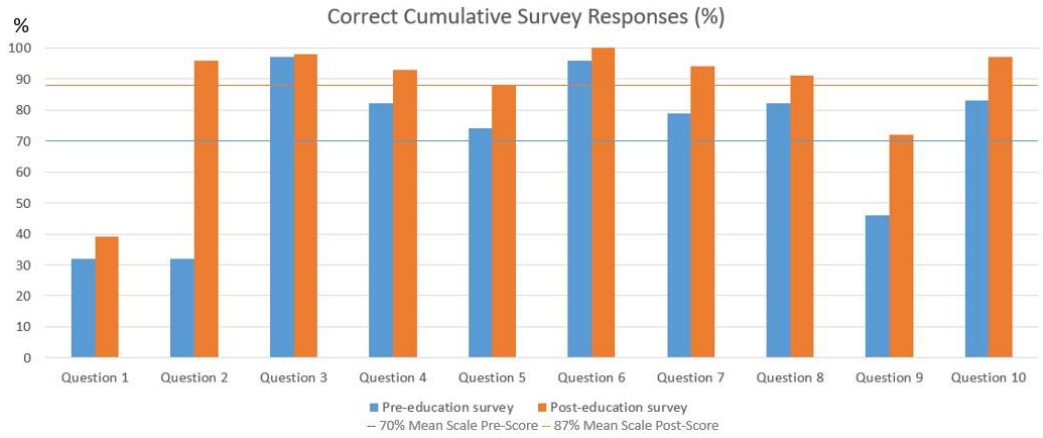
The surveys focused on measuring allergy management knowledge and self-efficacy. The overall mean knowledge score pre-educational module (70%) and post-educational module (87%) represents a change of 17 points which is 24% improvement in allergy management knowledge. The overall mean self-efficacy change score was 13 points which is 37% improvement in allergy management self-efficacy. This represents 28% improvement in allergy management and knowledge. The post-intervention survey included questions regarding satisfaction and ease of use of the allergy education module. Overall, 94% of

Figure 2: Staff Satisfaction

participants reported satisfaction with the module (see Figure 2).

In addition to the overall score increase, three individual questions (1, 2, and 9) resulted in greater than twenty percent improvements (see Figure 3) and were examined to provide insight into knowledge gaps at baseline. Question 1 reflected on identifying anaphylaxis symptoms. The pre-score and post-score were 32% and 39% respectively (23% improvement). Question 2 reflected on identifying anaphylaxis signs. The pre-score and post-score were 32% and 96% respectively (201% improvement). Question 9 reflected on epinephrine dose. The pre-score and post-score were 46% and 73% respectively (59% improvement). These results have important implications for the safety of the school children as improved knowledge is correlated with improved ability to act on that knowledge which translates to improved ability of school staff to respond to allergy related emergencies.

Figure 3: Survey Responses



The first objective was to *create a guiding coalition* and for a coalition meeting to occur. This was accomplished by reaching out to the school nurse and nurse leader to request the formation of the coalition, schedule, and conduct a meeting. The project leader was able to convene a meeting with the nurse leader following a meeting between the nurse leader and the principal where they agreed upon the project including the format and schedule. The first objective was successfully met.

The second objective was to *design an asynchronous, web-based, allergy education module*. The desired outcome was for the allergy education module to be approved by the guiding coalition. This was accomplished by developing the education module with the school nurse, requesting, and receiving approval from the coalition. An asynchronous, web-based allergy education module was proposed to and approved by leadership. The module was subsequently developed and modified according to leadership feedback. The second objective was successfully met.

The third objective was to *embed the curriculum into the school-wide shared Google Drive*. The desired outcome was to have the school nurse save the allergy module to Google Drive for it to be available for distribution. The approved allergy education module was uploaded and available on the shared Google Drive. It was additionally distributed to staff via email during the project. The third objective was successfully met.

The fourth objective was *for school personnel to demonstrate twenty percent improvement in allergy management knowledge and self-efficacy*. The survey results revealed 28% improvement in post-survey compared to pre-survey results related to knowledge and self-efficacy. The fourth objective was successfully met.

The fifth objective was for *seventy-five percent of school personnel to complete the post-education survey.* Of the total number of school staff emailed the education module (n=246), 44% (n=109) completed the post-surveys. The fifth objective was not met with a staff survey response rate of 44%.

The sixth objective was for *seventy-five percent of school personnel to report satisfaction and ease of use.* The five post-survey questions measuring reported staff satisfaction and ease of

use of the allergy management module revealed overwhelmingly positive responses. The sixth objective was met with a 94% satisfaction rate.

Discussion

Summary

The aim of this project, to increase school personnel allergy education and management knowledge and self-efficacy through an allergy education module was met. The literature review revealed allergy education increases knowledge and self-efficacy among school staff. The project result of 28% improvement in allergy management knowledge and self-efficacy were consistent with the literature review (Canon et al., 2019; Dumeier et al., 2018; Foster et al., 2015; Gonzalez-Mancebo et al., 2019; Lanser et al., 2016).

This quality improvement project revealed the importance and significance of allergy education. The pre-survey revealed limited understanding of anaphylaxis signs and symptoms as well as epinephrine dose, and the education module successfully addressed these knowledge gaps. Evidence of improvement in allergy management knowledge and self-efficacy was demonstrated during the intervention. Guidelines suggest allergy education increases knowledge resulting in an improved ability to properly respond to an allergic event. This is important because non-homeroom school staff are most likely to be present with a child who experiences an allergic reaction. By increasing their knowledge and comfort around allergy management, they are more likely to respond in an appropriate manner.

Based on the overall positive results from this improvement project, the four schools who participated in the improvement project have indicated their desire to continue to provide standardized allergy management education annually as mandatory education for school personnel. The intervention is sustainable with limited financial cost. All school participants

utilized less than a single hour to complete this educational module. Additionally, school nurses also utilized less than a single hour to email staff and launch surveys.

Future quality improvement projects may include tracking rates of allergic reactions and treatment in relation to allergy education. Tracking reaction and treatment rates will help provide additional information that will help inform continuous quality improvement around allergy education among school personnel. When school personnel are educated on allergy management, knowledge and confidence increases, resulting in potential increase of allergy prevention as well as improved allergy detection time and appropriate management. This creates a safer environment for children.

Several challenges arose during implementation of this project. Initially, this quality improvement project intervention was scheduled to take place over the course of two weeks in 2021, as requested by the guiding coalition. However, the project intervention was subsequently extended an additional five weeks due to low completion rates. The guiding coalition initially agreed the intervention would take place in a single middle school; however, the week before the intervention began, the project was extended to three additional schools. Due to the rushed expansion, there was inadequate communication of the project and responsibilities of the nursing staff which led to unclear responsibilities of the nursing staff and lack of communication from the nursing staff to the school faculty and administration regarding the education module.

Less than half of school personnel completed the education module during the intervention due to several factors. Staff were adjusting to a new school year with in-person teaching as students returned to school after summer break and significant time away from the classroom due to Covid-19. There were no consequences for staff who did not complete the mandatory education module. Additionally, there was significant staff turnover, including school

nurses, during the intervention which contributed toward poor communication and continuity. The nurse practitioner who monitored and guided the project was not a school employee and therefore did not have direct email access to staff. Staff rosters were not provided in a timely manner, three of the four school rosters were not provided; therefore, individual notices were not sent to remind staff of the pending module. In the future, it would be beneficial for staff rosters to be gathered prior to the start of the school year. This would allow school nurses to monitor progress more easily as well as provide individual notices to personnel who do not complete the allergy module in the requested time. Taken together, the combination of post-Covid-19 confusion and lack of accountability, were significant disincentives to participation.

For the next improvement cycle, ways to improve participation rates needs to be addressed. A policy requiring standardized annual allergy education would provide support for consequences if the requirement was not fulfilled. Individual staff consequences may instill personal responsibility. A synchronous allergy education module may provide a sense of unity and urgency. An in-person allergy education simulation including epinephrine administration demonstration may additionally increase self-efficacy.

The schools also lack a standardized allergy action plan, emergency allergy policy, and education policy. These plans and policies can be constructed by reviewing current practices within the schools as well as reviewing other local districts allergy plans and policies. These plans and policies are important because they provide standardized expectations and action steps.

Moving forward, this intervention will be offered to additional schools to help broaden the reach of standardized allergy management education. The tracking process can be taught to school nurses in less than 10 minutes. Following this education, school nurses will be prepared to offer this allergy education and track school personnel progress.

Conclusion

The locally tailored, asynchronous, web-based allergy education module implemented in this quality improvement initiative improved staff knowledge and self-efficacy of allergy prevention, detection, and management. This has important implications for the safety of the children with allergies who attend school. The staff who participated in this education were faculty and administration who are the most likely to be with students when they experience an allergic reaction. In summary, allergy education is instrumental in improving allergy prevention, detection, and management, in the school setting and results in increased allergy management knowledge and self-efficacy which improves safety and health outcomes for children in schools.

References

Allergy facts. (2015, January 16). American College of Allergy, Asthma, and Immunology. https://acaai.org/news/facts-statistics/allergies

American Academy of Allergy, Asthma, and Immunology. (2020). *Anaphylaxis emergency action plan*. American Academy of Allergy Asthma & Immunology. http://www.aaaai.org/Aaaai/media/MediaLibrary/PDF%20Documents/Libraries/Anaphylaxis-Emergency-Action-Plan.pdf

American Academy of Pediatrics. (2017). *AAP allergy and anaphylaxis emergency plan*. https://www.aap.org/enus/Documents/AAP_Allergy_and_Anaphylaxis_Emergency_Plan.pdf

Canon, N., Gharfeh, M., Guffey, D., Anvari, S., & Davis, C. M. (2019). Role of food allergy education: Measuring teacher knowledge, attitudes, and beliefs. *Allergy & Rhinology*, *10*, 215265671985632. https://doi.org/10.1177/2152656719856324

Cheng, J. (2017). Anaphylaxis: the underrecognized killer. *Pediatric Emergency Medicine Reports*, *22*(8), 1–21. http://ezproxy.lib.umb.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=ccm&AN=124160900&site=ehost-live

Chokshi, N. Y., Patel, D., & Davis, C. M. (2015). Long-term increase in epinephrine availability associated with school nurse training in food allergy. *The Journal of Allergy and Clinical Immunology: In Practice*, *3*(1), 128–130. https://doi.org/10.1016/j.jaip.2014.09.015

Crow, K. M. (2018). Increasing knowledge about food allergy management in the preschool setting. Increasing knowledge about food allergy management in the preschool setting, *1*. https://www-proquest-com.ezproxy.lib.umb.edu/docview/2019924516

Dumeier, H. K., Richter, L. A., Neininger, M. P., Prenzel, F., Kiess, W., Bertsche, A., & Bertsche, T. (2018). Knowledge of allergies and performance in epinephrine auto-injector use: A controlled intervention in preschool teachers. *European Journal of Pediatrics*, *177*(4), 575–581. https://doi.org/10.1007/s00431-017-3073-y

Facts and figures. (n.d.). Boston Public Schools. https://www.bostonpublicschools.org/domain/238

Facts and statistics. (2020). Food Allergy Research & Education. https://www.foodallergy.org/resources/facts-and-statistics

Ford, L., Dunn, R., Treloar, M., Tyquin, B., Hollinshead, K., Studdert, J., Mulligan, K., & Campbell, D. (2017). Differences in knowledge between school teachers and registered first aid trainers undergoing training to deliver school-based anaphylaxis education. *Internal Medicine Journal*, *47*, 5. https://doi.org/10.1111/imj.3_13578

Foster, A. A., Campbell, R. L., Lee, S., & Anderson, J. L. (2015). Anaphylaxis preparedness among preschool staff before and after an educational intervention. *Journal of Allergy*, *2015*, 1–5. https://doi.org/10.1155/2015/231862

Gonzalez-Mancebo, E., Gandolfo-Cano, M. M., Trujillo-Trujillo, M. J., Mohedano-Vicente, E., Calso, A., Juarez, R., Melendez, A., Morales, P., & Pajuelo., F. (2019). Analysis of the effectiveness of training school personnel in the management of food allergy and anaphylaxis. *Allergologia et Immunopathologia*, *47*(1), 60–63. https://doi.org/10.1016/j.aller.2018.05.005

Greenhawt, M., Wallace, D., Sublett, J. W., Maughan, E., Tanner, A., Kelley, K. J., & Kelly, K. (2018). Current trends in food allergy-induced anaphylaxis management at school. *Annals of Allergy, Asthma & Immunology*, *121*(2), 174–178. https://doi.org/10.1016/j.anai.2018.04.015

HealthyPeople2020. (n.d.). Healthy People 2020. https://www.healthypeople.gov/2020/topicsobjectives/topic/environmental-health/objectives

Jones, S. M., & Wesley, B. A. (2017). Food allergy. *The New England Journal of Medicine*, *377*(12), 1168–1176. https://doi.org/10.1056/NEJMcp1611971

Kao, L. M., Wang, J., Kagan, O., Russell, A., Mustafa, S. S., Houdek, D., & Gupta, R. (2018). School nurse perspectives on school policies for food allergy and anaphylaxis. *Annals of Allergy, Asthma & Immunology*, *120*(3), 301–309. https://doi.org/10.1016/j.anai.2017.12.019

Langley, G. J., Moen, R. D., Nolan, K. M., Nolan, T. W., Norman, C. L., & Provost, L. P. (2009). *The improvement guide* (2nd ed.). Jossey-Bass.

Lanser, B. J., Covar, R., & Bird, J. A. (2016). Food allergy needs assessment, training curriculum, and knowledge assessment for child care. *Annals of Allergy, Asthma & Immunology*, *116*(6), 533–537.e4. https://doi.org/10.1016/j.anai.2016.03.031

Moritz, S., & Schoessler, S. (2018). Steps to stock: keeping students safe with fully implemented stock epinephrine. *NASN School Nurse*, *33*(5), 268–271. https://doi.org/10.1177/1942602X18774780

Oriel, R. C., Wang, J., & Wang, J. (2018). How to manage food allergy in nursery or school. *Current Opinion in Allergy & Clinical Immunology*, *18*, 258?264. https://doi.org/10.1097/ACI.0000000000000438

Pistiner, M., & Mattey, B. (2017). A universal anaphylaxis emergency care plan: introducing the new allergy and anaphylaxis care plan from the American Academy of Pediatrics. *NASN School Nurse*, *32*(5), 283–286. https://doi.org/10.1177/1942602X17713759

Robinson, M., Greenhawt, M., & Stukus, D. R. (2017). Factors associated with epinephrine administration for anaphylaxis in children before arrival to the emergency department. *Annals of Allergy, Asthma & Immunology*, *119*(2), 164–169. https://doi.org/10.1016/j.anai.2017.06.001

Smith, M. K. (2003). *Malcolm Knowles, informal adult education, self-direction and andragogy*. The encyclopedia of pedagogy and informal education. https://infed.org/malcolmknowles-informal-adult-education-self-direction-and-andragogy/

Trends in allergic conditions among children: United States, 1997?2011. (2013). Centers for Disease Control and Prevention. https://www.cdc.gov/nchs/products/databriefs/db121.htm

Voluntary guidelines for managing food allergies in schools and early care and education programs [PDF]. (2020). Centers for Disease Control and Prevention. https://www.cdc.gov/healthyschools/foodallergies/pdf/20_316712-A_FA_guide_508tag.pdf

Wahl, A., Stephens, H., Ruffo, M., & Jones, A. L. (2015). The evaluation of a food allergy and epinephrine autoinjector training program for personnel who care for children in schools and community settings. *Journal of School Nursing*, *31*(2), 91–98. https://doi.org/10.1177/1059840514526889

West, S. (2020, November 5). *Poor and minority children with food allergies overlooked and in danger*. Health News Florida. https://health.wusf.usf.edu/health-news-florida/2020-11-05/poor-and-minority-children-with-food-allergies-overlooked-and-in-danger

White, L., Aubin, J., Bradford, C., Alix, C., Hughes, L., & Phipatanakul, W. (2015). Effectiveness of a computer module to augment the training of school staff in the management of students with food allergies. *Annals of Allergy, Asthma & Immunology*, *114*(3), 254–255.e3. https://doi.org/10.1016/j.anai.2014.11.020

Appendix A Evidence Summary Table

Studies	Intervention	Significant outcome	Level and strength of evidence, sample
a) Canon (2019) b) Crow (2018) c) Dumeier (2018) d) Ford (2017) e) Foster (2015) f) Gonzalez Mancebo (2019) g) Lanser (2016) h) White (2015) i) American Academy	Allergy management education for school personnel a) 1-hour food allergy educational session b) 1-hour food allergy and epinephrine education session c) Recognition and Management of Anaphylaxis Program (RAMOAP) d) 40-minute anaphylaxis educational seminar e) Conference program for food allergy and anaphylaxis f) 1-hour live food allergy education g) 30-minute food allergy online learning module h) 40-minute educational inservice with food allergy guidelines, emergency action plan, and epinephrine auto-injector education	Increased school personnel knowledge of allergy management a) Post-survey, the intervention group had food allergy knowledge scores 19.58% points higher than control. b) Food allergy management and recognition knowledge increased. c) Anaphylaxis recognition and management knowledge increased 46%. d) Increased recognition of anaphylaxis. e) Increase in correct chronological steps to administer epinephrine. f) Correct allergy action and treatment case study answers increased 71.4%. g) Food allergy recognition, treatment, and labeling scores improved 29%. h) Increase in food allergy and anaphylaxis management 1.57 U. Increased school personnel self-efficacy of allergy management c) Teachers who felt well-prepared for an anaphylactic emergency increased 77%. e) Increase in comfort level with recognizing anaphylaxis and administering epinephrine. f) Increase in confidence in recognition of symptoms of food allergy and treatment of allergic reactions and anaphylaxis.	a) 1A, Total Teachers N = 375, Intervention n = 302, Control n = 73 b) 5A, n = 24 preschool teachers, assistants, and two directors c) 1B, N = 75 preschool teachers d) 2A, n = 156 schoolteachers e) 2A, n = 181 preschool staff including directors, teachers, assistants, teaching aides, and home visitors f) 2B, n = 191 participants, 51% cafeteria monitors, 24% teachers, 13% cooks, and 12% other professions g) 2B, n = 73 childcare center workers h) 1A, n = 85 participants, 68% were teachers, others were administrators, secretaries, and cafeteria staff

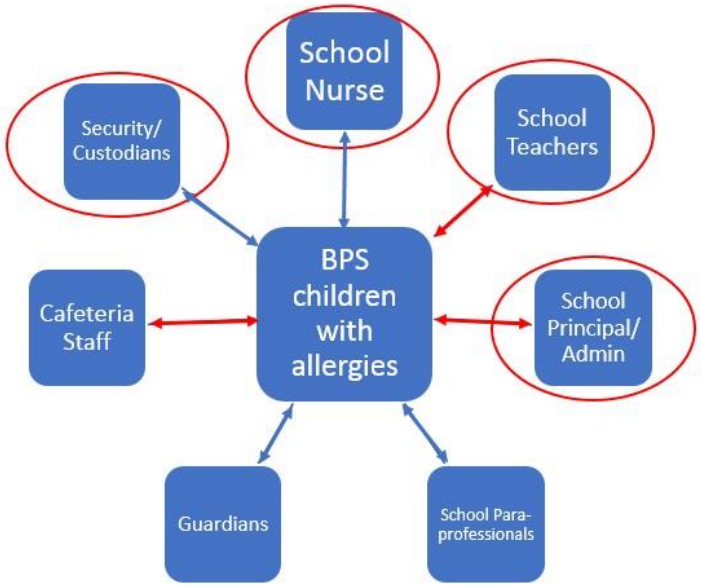
of Pediatrics [AAP] (2017) j) American Academy of Allergy, Asthma, and Immunology [AAAAI] (2020) k) Pistiner (2017) l) Voluntary Guidelines for Managing Food Allergies in Schools (2020)	i) Allergy and Anaphylaxis Emergency Plan including allergy signs and symptoms, action steps j) Anaphylaxis Emergency Action Plan including allergy signs and symptoms, action steps k) Universal allergy action plan including allergy signs and symptoms, action steps l) Allergy education including definitions of key terms, allergy signs and symptoms, action steps	Key information to include in allergy education i) allergy signs and symptoms, action steps j) allergy signs and symptoms, action steps k) allergy signs and symptoms, action steps l) allergy signs and symptoms, action steps, definitions of key terms	i) VA j) VA k) VA l) VA

Key: Deng (2018) was referenced to appraise research evidence and non-research evidence (pp. 253 – 261)

Appendix B External Mapping Tool

1. **Clinical Microsystem: City of Boston Public School**

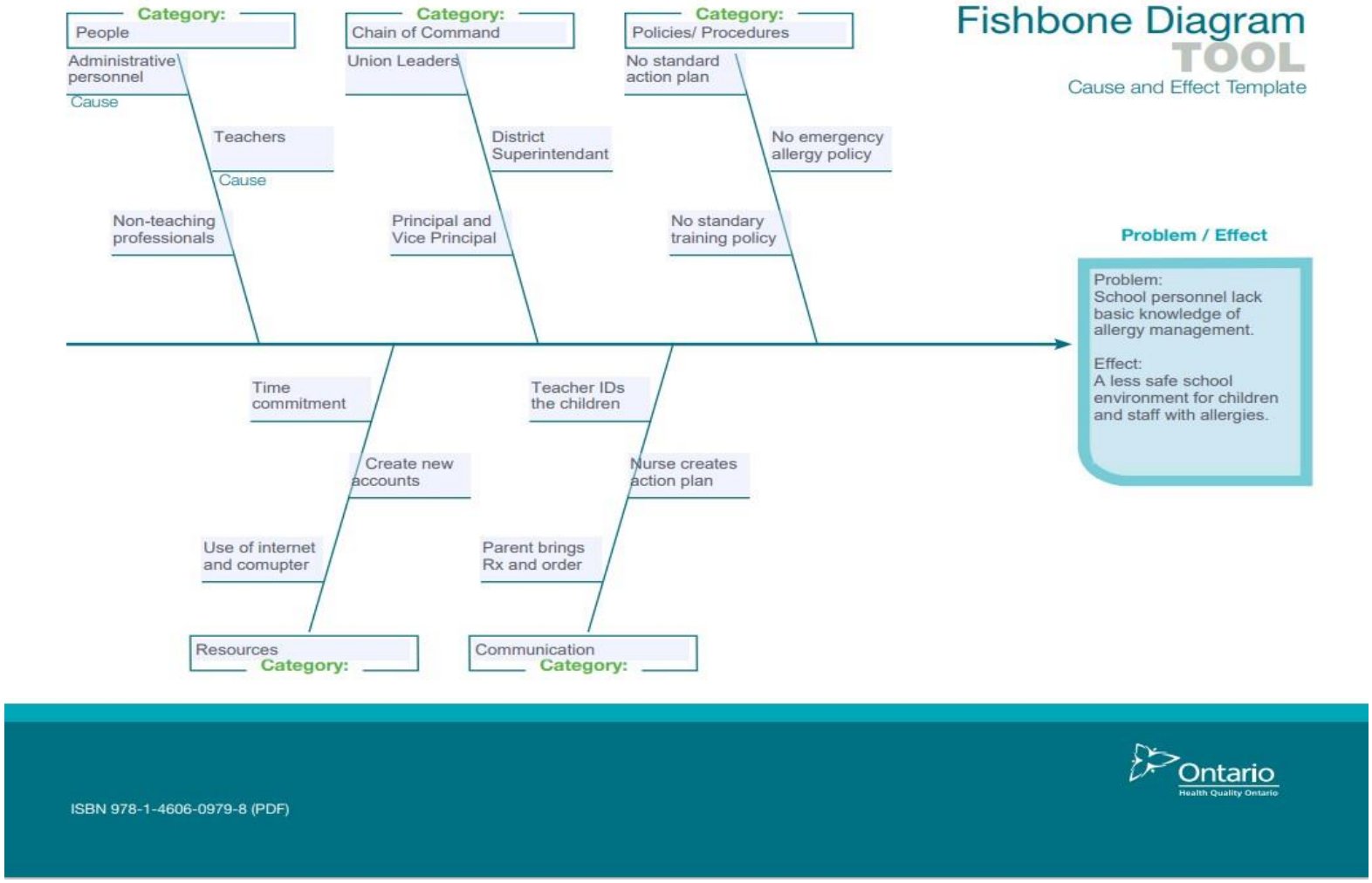
2. **Subpopulation: Boston public school children with allergies**



3. **Patient-specific health care needs:**
   a. Allergy policies
   b. Allergy procedures
   c. Allergy education
   d. Student inclusion
   e. Allergy action plans
   f. Allergy orders
   g. Allergy medication
   h. Educated parents
   i. Communication with primary care provider
   j. Appropriate allergy medication dose

Improvement Ideas: Increase allergy knowledge through educational offerings, inclusion of students with allergies, develop and implement allergy policies and procedures, standardize allergy action plans, create an organized filing system for allergy orders

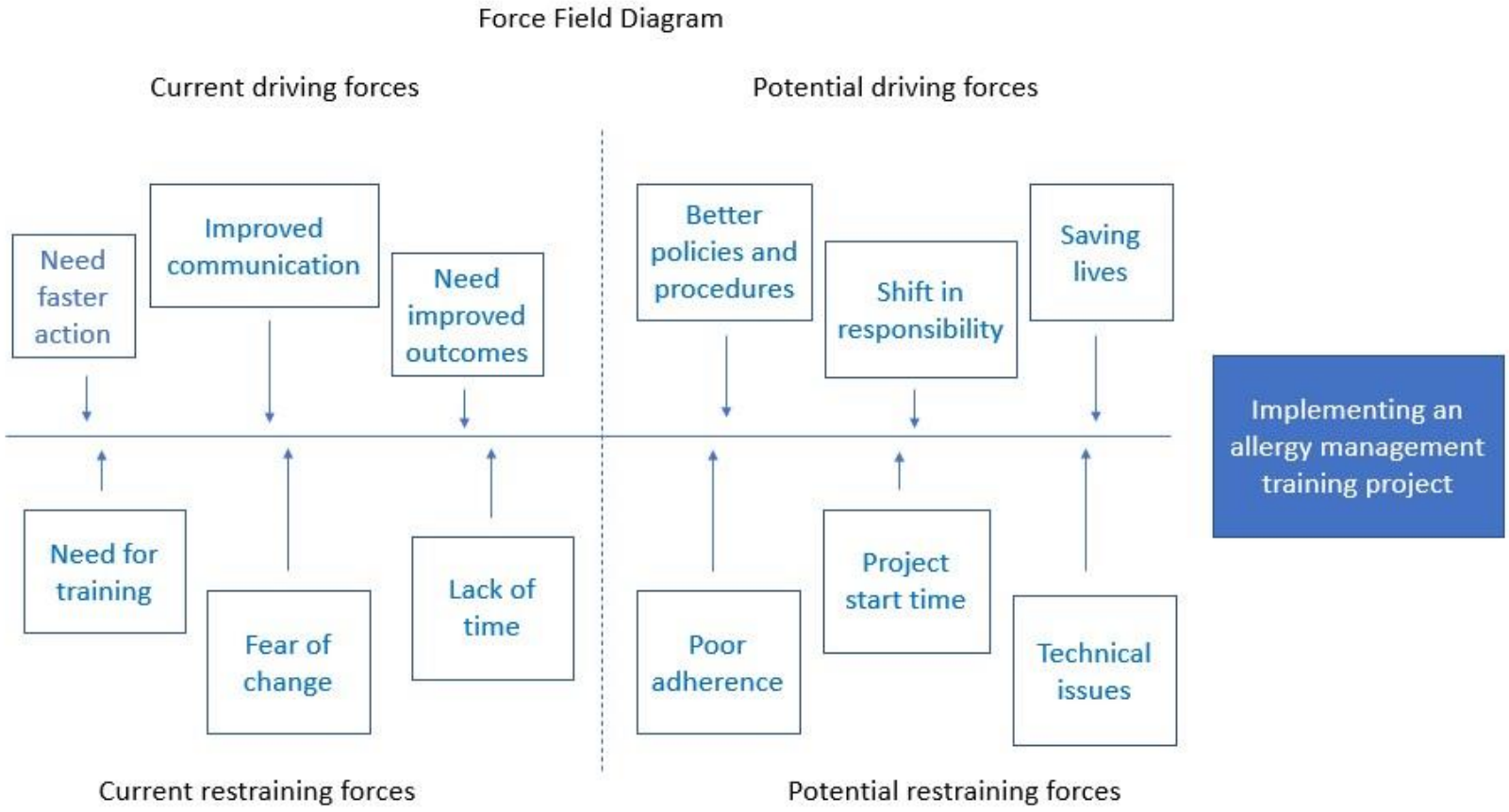
Appendix C Cause and Effect Diagram



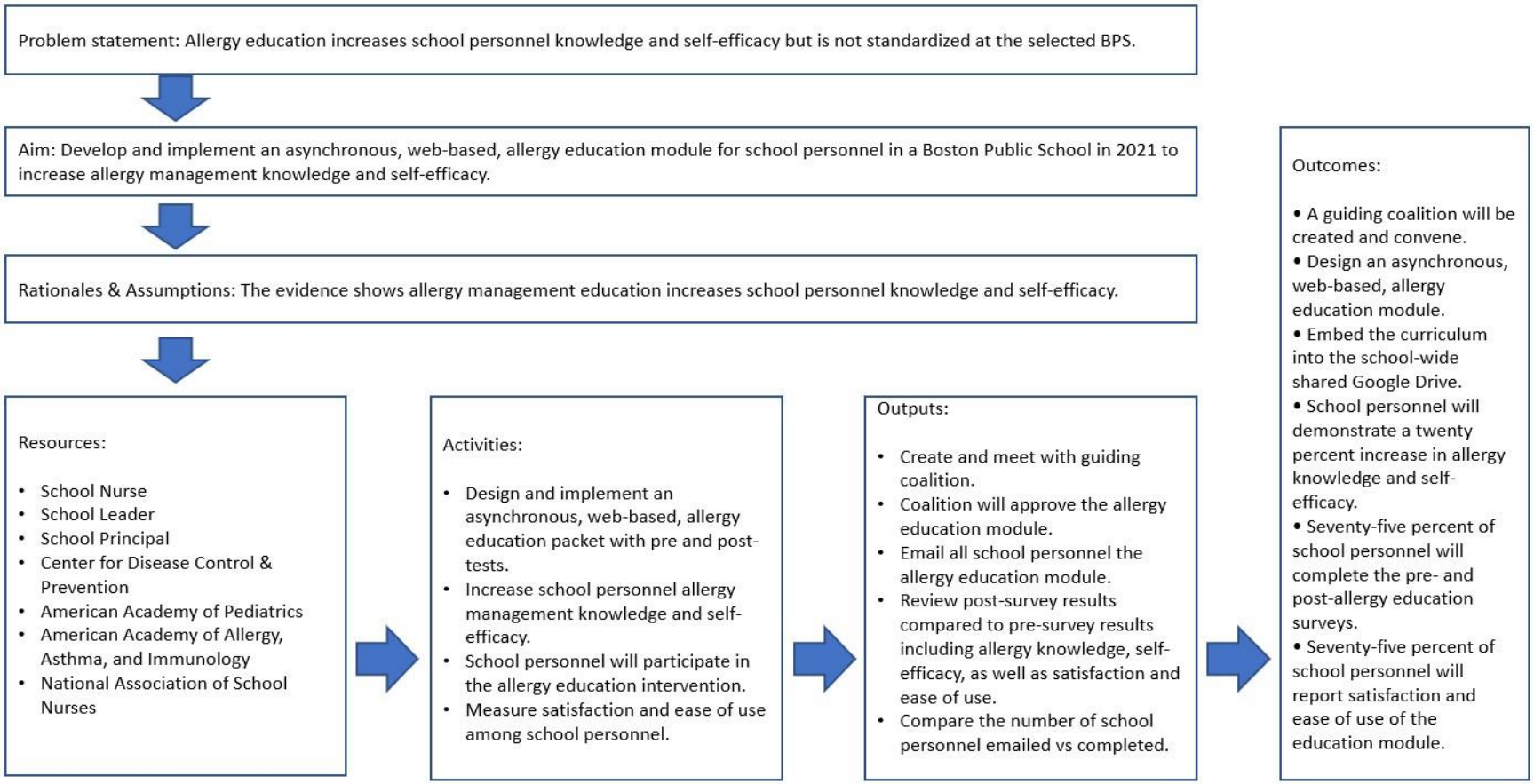
ISBN 978-1-4606-0979-8 (PDF)

Ontario
Health Quality Ontario

Appendix D Force Field Diagram



Appendix E Logic Model

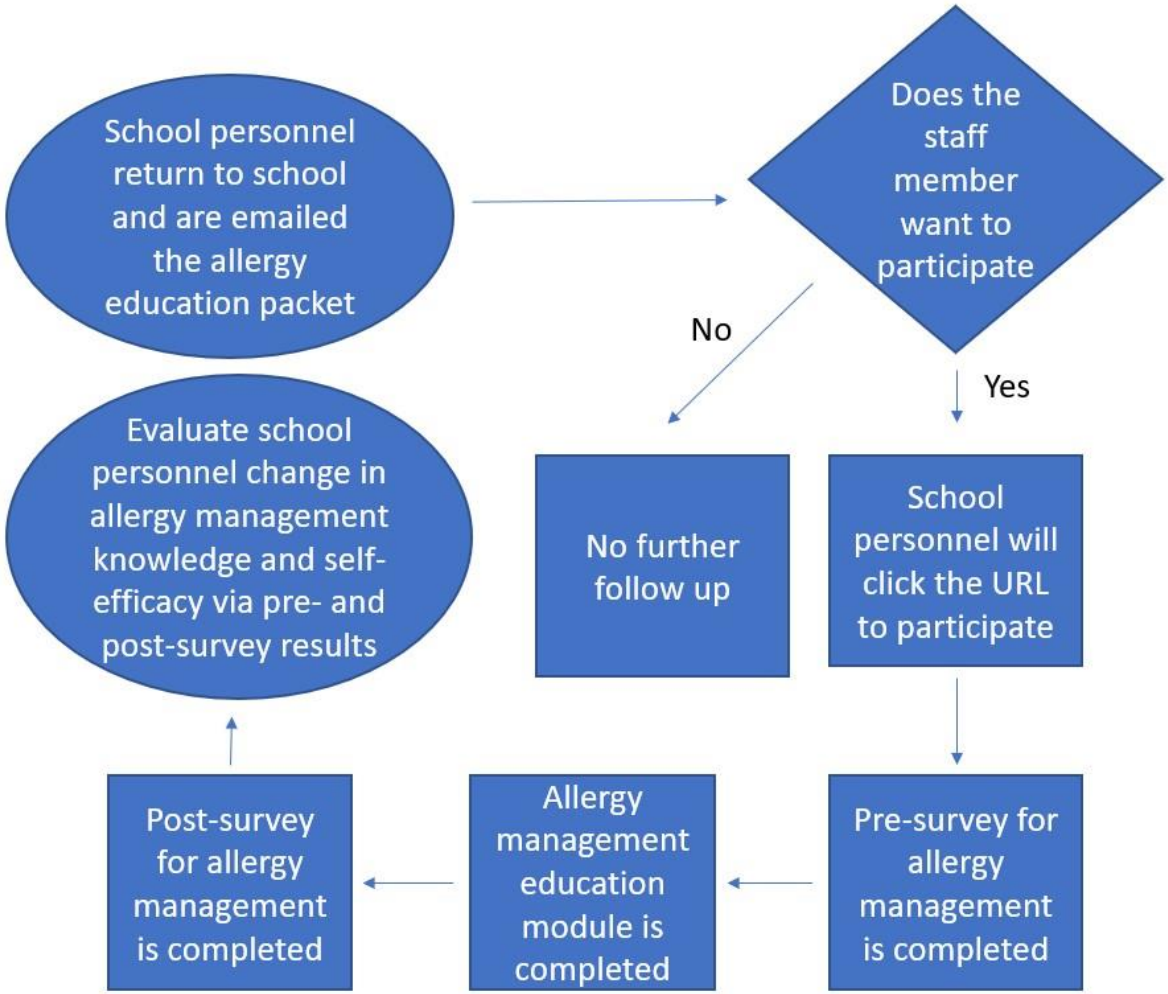


Appendix F Intervention Flowchart

This intervention will consist of an asynchronous, web-based, allergy management education module distributed by email, saved to the shared Google Drive, with a time requirement of 30 min.

The allergy management education will contain an educational module, supplementary key facts educational pdf, and in-person epinephrine administration with the school nurse.

Cumulative pre- and post-survey results will be evaluated by the school nurse.



Appendix G Allergy Fact Sheet Brochure

Dear school personnel,

Your school nurse is reaching out to educate you that like most schools in the United States, we have several students with potentially life-threatening food allergies. Please review the Allergy Policy found under Appendix C in the Student Family Handbook to help decrease students' likelihood of developing allergic reactions. It is our goal to ensure that every student in our school can learn in a safe and supportive environment.

How to reduce allergen exposure

- Hand washing before and after new activities including meals and outdoor exercise.
- Advising against sharing food and utensils.
- Cleaning tables before and after new activities including meals and projects.

Signs and Symptoms

Allergies occur when the body's immune system detects an allergen it considers harmful and reacts.

Anaphylaxis is a severe allergic reaction that is typically fatal in less than 60 minutes.

Symptoms of Mild Reaction - Call to notify the Nurse

- Itchy nose, sneezing, itchy mouth
- A few hives
- Mild stomach nausea or discomfort

Symptoms of Anaphylaxis - Administer Epinephrine

- Shortness of breath, wheeze, cough, tight throat, hoarse voice, difficulty breathing or difficulty swallowing
- Swelling of lips, tongue, or throat
- Skin is pale or blue, many hives or redness.
- Weak pulse
- Dizziness or fainting
- Confusion, altered consciousness, agitation, or feeling of "doom"
- Vomiting, diarrhea, or abdominal cramps

American Academy of Allergy Asthma & Immunology
www.aaaai.org

Symptoms of Anaphylaxis	
MOUTH	itching, swelling of lips and/or tongue
THROAT*	itching, tightness/closure, hoarseness
SKIN	itching, hives, redness, swelling
GUT	vomiting, diarrhea, cramps
LUNG*	shortness of breath, cough, wheeze
HEART*	weak pulse, dizziness, passing out

Only a few symptoms may be present. Severity of symptoms can change quickly.
**Some symptoms can be life-threatening. ACT FAST!*

Treatment

Response for a mild reaction

- Call the school nurse to notify them so they may come to your location and evaluate the student

Response for a severe reaction/ anaphylaxis

- Administer epinephrine
- Call 911
- Call to notify the school nurse

How to give EpiPen® or EpiPen®Jr adrenaline (epinephrine) autoinjectors

1. Form fist around EpiPen® and PULL OFF BLUE SAFETY RELEASE.

2. Hold leg still and PLACE ORANGE END against outer mid-thigh (with or without clothing).

3. PUSH DOWN HARD until a click is heard or felt and hold for 3 seconds

REMOVE EpiPen®

Note: All EpiPen®s should be held in place for 3 seconds regardless of instructions on device label

Appendix H Survey Domains H1: Pre-education survey H2: Post-education survey

Survey 1

Who is the intended recipient of your questionnaire?	The intended recipients of this survey are school personnel who plan on completing the allergy management module
When will you administer the questionnaire?	Pre intervention
What outcome are you measuring?	Improved knowledge and self-efficacy
What concepts/ domains/ attributes are you measuring?	Confidence, knowledge, beliefs, attitudes, perception, self-efficacy
What is your change theory?	Kotter's 8 step change model
What dimensions from your change model are relevant to be included in your questionnaire?	Institute change is relevant to be included by asking their current knowledge and self-efficacy prior to the intervention

Survey 2

Who is the intended recipient of your questionnaire?	The intended recipients of this survey are school personnel who completed the allergy management module
When will you administer the questionnaire?	Post intervention
What outcome are you measuring?	Improved knowledge and self-efficacy Ease of use and satisfaction
What concepts/ domains/ attributes are you measuring?	Confidence, knowledge, beliefs, attitudes, perception, satisfaction, self-efficacy
What is your change theory?	Kotter's 8 step change model Knowles' adult learning theory
What dimensions from your change model are relevant to be included in your questionnaire?	School personnel have experience and exposure to children with allergies. This is a motivation to learn, need to learn, and influences readiness to learn.

Appendix I Pre-education survey

Select the answer you agree with most.

1. Anaphylaxis must have which of the following symptoms?
   A. Difficulty breathing
   B. Hives
   C. Vomiting
   D. None of the above

2. What are signs of anaphylaxis?
   A. Difficulty breathing or swallowing
   B. Abdominal pain, vomiting or diarrhea
   C. Confusion or anxiety
   D. All of the above

3. What is anaphylaxis?
   A. A life-threatening allergic reaction
   B. A mild allergic reaction
   C. Asthma
   D. The flu

4. What is the most common way to trigger anaphylaxis?
   A. Inhalation (breathing in an allergen)
   B. Ingestion (eating an allergen)
   C. Skin contact (touching an allergen)
   D. Odor (smell an allergen)

5. When should you administer an epinephrine autoinjector?
   A. After calling the parents
   B. After calling the nurse
   C. After noticing severe allergy symptoms
   D. After calling 911

6. Where should you administer the epinephrine autoinjector?
   A. In the outer arm
   B. In the outer thigh
   C. In the lower leg
   D. In the abdomen

7. What angle should you administer an epinephrine autoinjector?
   A. 90 degrees
   B. 45 degrees
   C. 180 degrees
   D. 15 degrees

8. When should you call 911?
   A. After noticing the severe allergy symptoms
   B. After administering the epinephrine autoinjector
   C. After calling the nurse
   D. After calling the parents

9. How much epinephrine is delivered in an epinephrine autoinjector?
   A. 3.0 mg
   B. 5.0 mg
   C. 0.3 mg
   D. 0.5 mg

10. What color should the fluid in the epinephrine autoinjector be?
    A. Brown
    B. Orange
    C. Yellow
    D. Clear

Please answer the following questions on a scale from 1-5

1- Strongly disagree
2- Disagree
3- Neither agree nor disagree
4- Agree
5- Strongly agree

11. I feel knowledgeable about anaphylaxis.
12. I feel confident in identifying signs of anaphylaxis.
13. I feel knowledgeable about causes of anaphylaxis.
14. I feel confident in the proper administration of anaphylaxis.
15. I feel knowledgeable about how to reduce student exposure to allergens.

Appendix J Post-education survey

Select the answer you agree with most.

1. When should you administer an epinephrine autoinjector?
   A. After calling the parents
   B. After noticing severe allergy symptoms
   C. After calling the nurse
   D. After calling 911

2. How much epinephrine is delivered in an epinephrine autoinjector?
   A. 0.3 mg
   B. 0.5 mg
   C. 3.0 mg
   D. 5.0 mg

3. Anaphylaxis must have which of the following symptoms?
   A. Difficulty breathing
   B. Vomiting
   B. Hives
   D. None of the above

4. What color should the fluid in the epinephrine autoinjector be?
   A. Clear
   B. Yellow
   C. Orange
   D. Brown

5. What are signs of anaphylaxis?
   A. Abdominal pain, vomiting or diarrhea
   B. Difficulty breathing or swallowing
   C. Confusion or anxiety
   D. All of the above

6. What angle should you administer an epinephrine autoinjector?
   A. 45 degrees
   B. 90 degrees
   C. 180 degrees
   D. 15 degrees

7. When should you call 911?
   A. After noticing the severe allergy symptoms
   B. After calling the nurse
   C. After administering the epinephrine autoinjector
   D. After calling the parents

8. What is anaphylaxis?
   A. A mild allergic reaction
   B. A life-threatening allergic reaction
   C. Asthma
   D. The flu

9. What is the most common way to trigger anaphylaxis?
   A. Odor (smell an allergen)
   B. Inhalation (breathing in an allergen)
   C. Skin contact (touching an allergen)
   D. Ingestion (eating an allergen)

10. Where should you administer the epinephrine autoinjector?
    A. In the outer thigh
    B. In the outer arm
    C. In the lower leg
    D. In the abdomen

Please answer the following questions on a scale from 1-5
1- Strongly disagree
2- Disagree
3- Neither agree nor disagree
4- Agree
5- Strongly agree

11. I feel knowledgeable about anaphylaxis.
12. I feel confident in identifying signs of anaphylaxis.
13. I feel knowledgeable about causes of anaphylaxis.
14. I feel confident in the proper administration of epinephrine.
15. I feel knowledgeable about how to reduce student exposure to allergens.

16. I believe the allergy education provided increased my allergy knowledge.
17. I believe the allergy education provided increased my confidence in allergy management.
18. I believe the allergy education provided was worth my time.
19. I believe the allergy education provided should be administered annually.
20. I believe the allergy education provided was easy to use and navigate.

Appendix K Measures Table

Aim or Objectives	Outcomes/ outputs	How to measure	Where will you get the information	Will you have a comparison	Analysis
A guiding coalition will be created and convene.	Guiding coalition will be formed and meet spring 2021.	The coalition will be formed and a meeting will be conducted.	Coalition meeting.	No.	A guiding coalition meeting will be conducted.
Design an asynchronous, web-based, allergy education module.	Allergy education module will be developed.	The allergy education module will be completed.	Coalition meeting.	No.	The allergy module will be approved by the coalition.
Embed the curriculum into the school-wide shared Google Drive.	The allergy module will be saved to Google Drive.	The school nurse will save the allergy module to Google Drive to be available for distribution.	Google Drive.	No.	The allergy module will be saved to Google Drive and available for distribution.
School personnel will demonstrate twenty percent improvement in allergy knowledge and self-efficacy.	Allergy management knowledge and self-efficacy will increase among school personnel.	Pre- and post-intervention survey results will be analyzed to determine a change in allergy knowledge and self-efficacy.	Survey results.	Yes, post-education survey vs pre-education survey results.	Compare pre- and post-survey knowledge with multiple choice questions and self-efficacy with a 5-point Likert scale.
Seventy-five percent of school personnel will complete the post-education survey.	School personnel will complete the post-education survey.	The number of school personnel who were emailed will be compared to the number who completed the post-survey.	Number of school personnel who complete the post-education survey vs those emailed.	No.	Compare the number of school personnel who complete the post-education survey vs those emailed.
Seventy-five percent of school personnel will report satisfaction and ease of use of the module.	School personnel will report satisfaction and ease of use of the module.	Pre- and post-intervention survey results will be analyzed to determine a change in satisfaction and ease of use of the module.	Survey results.	No.	Analyze post-survey multiple choice results using a 5-point Likert scale.

Appendix L Quality Improvement Checklist

CLINICAL QUALITY IMPROVEMENT CHECKLIST		
Date: 4/2/2021	**Project Leader: Sabrina Monzione**	
Project Title: Allergy Management Education in a Boston Public School		
Institution where the project will be conducted: Boston Public School		
Instructions: Answer YES or NO to each of the following statements about QI projects.	**YES**	**NO**
The specific aim is to improve the process or deliver of care with established/ accepted practice standards, or to implement change according to mandates of the health facilities' Quality Improvement programs. There is no intention of using the data for research purposes.	**X**	
The project is **NOT** designed to answer a research question or test a hypothesis and is **NOT** intended to develop or contribute to generalizable knowledge.	**X**	
The project does **NOT** follow a research design (e.g. hypothesis testing or group comparison [randomization, control groups, prospective comparison groups, cross-sectional, case control]). The project does **NOT** follow a protocol that over-rides clinical decision-making.	**X**	
The project involves implementation of established and tested practice standards (evidence based practice) and/or systematic monitoring, assessment or evaluation of the organization to ensure that existing quality standards are being met. The project does **NOT** develop paradigms or untested methods or new untested standards.	**X**	
The project involves implementation or care practices and interventions that are consensus-based or evidence-based. The project does **NOT** seek to test an intervention that is beyond current science and experience.	**X**	
The project has been discussed with the QA/QI department where the project will be conducted and involves staff who are working at, or patients/clients/individuals who are seen at the facility where the project will be carried out.	**X**	
The project has **NO** funding from federal agencies or research-focused organizations, and is not receiving funding for implementation research.	**X**	
The clinical practice unit (hospital, clinic, division, or care group) agrees that this is a QI project that will be implemented to improve the process or delivery of care.	**X**	
The project leader/DNP student has discussed and reviewed the checklist with the project Course Faculty. The project leader/DNP student will **NOT** refer to the project as research in any written or oral presentations or publications.	**X**	
ANSWER KEY: If the answer to **ALL** of these questions is **YES**, the activity can be considered a Clinical Quality Improvement activity that does not meet the definition of human research. **UMB IRB review is not required. Keep a dated copy of the checklist in your files.** If the answer to ANY of these questions is NO, the project must be submitted to the IRB for review.		