

THE IMPLEMENTATION AND EVALUATION OF A COUNTY-WIDE STOCK INHALER  
FOR SCHOOLS PROGRAM IN PIMA COUNTY, ARIZONA

by

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## **Dedication**

This thesis is gratefully dedicated to my children *William “Matthew” Dodds* and *Adelyn Grace Dodds*.

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## ABSTRACT:

**Objective:** Professional guidelines specify that children with asthma should always have access to quick relief medication. However, few children have access to such medication while at school. Stock inhaler programs allow schools to have a single, rescue inhaler that can be used by any child who experiences respiratory distress. The Pima County Stock Inhaler for Schools Program was developed by a stakeholder coalition after passage of Arizona H.B. 2208, “Stock Inhalers for Schools” in March 2017. The program provided schools with medication, a standardized protocol for respiratory distress, and technical support for implementation. The objective of this study was to evaluate the implementation of the program among schools across Pima County, Arizona during 2017-2018.

**Methods:** A stakeholder coalition developed program materials including a standardized protocol that instructed trained personnel how to recognize and respond to respiratory distress. Additional template resources were created including a stock inhaler documentation log, a web-based training, and school enrollment forms. All 364 public, charter and private/parochial schools in Pima County, Arizona were invited to participate in the 2017-2018 Pima County Stock Inhaler for Schools Program. Outreach occurred during the summer of 2017 using various methods to inform schools of the program. Schools that enrolled in the program received a program toolkit including the following supplies: (1) 60-dose albuterol inhaler, supply of valved-holding chambers (LiteAire®), signed standing medical order by the Chief Medical Officer of Pima County, standardized protocol for albuterol administration, online training curriculum, template resources and on-going technical support from the program manager. The RE-AIM Framework was used to evaluate the county-wide intervention.

**Results:** We examined program implementation among ( $n=230$ ) public, charter, private/parochial schools who participated in the 2017-2018 Pima County Stock Inhaler for Schools Program. The program reached 82% of students in Pima County, Arizona. The stock inhaler was administered 1,032 times in 152 schools during the 2017-2018 school year. Eighty-four percent of children returned to class after albuterol administration. Trained personnel reported high confidence with administering the stock inhaler and using the standardized protocol during a respiratory event. Furthermore, 94.3% of trained personnel would recommend this program to other schools and 93.2% felt the stock inhaler program was beneficial to their school indicating high satisfaction with the program.

**Discussion:** The Pima County Stock Inhaler for Schools Program demonstrated feasibility among schools that participated in the program. These findings provide evidence that after the successful

passage of stock inhaler legislation, stakeholder coalitions can implement large-scale stock inhaler programs.

#### What's New: The Pima County Stock Inhaler for Schools Program

- Demonstrates the success of a county-wide stock inhaler program targeting public, charter & private/parochial schools near Tucson, Arizona
- Addresses a critical gap with providing children with access to rescue medication for emergency respiratory distress post passage of H.B. 2208
- Contributes to limited research examining the implementation process of school stock inhaler programs

## BACKGROUND:

Asthma is a chronic, inflammatory lung disease that often begins during childhood. In the United States, approximately 10% of children have asthma and these children often experience chronic respiratory symptoms such as coughing, chest tightness, or struggling to breathe. These chronic symptoms inhibit children from learning in the classroom and lead to missed school, chronic absenteeism and respiratory-related emergencies.<sup>1-4</sup> Because children spend much of their time at school, access to quick relief medication (i.e., albuterol) is essential for quickly relieving symptoms of respiratory distress. Several well-respected organizations including the National Asthma Education Prevention Program (NAEPP) have proposed optimal asthma care practices for school settings which recommend children have access to rescue medication. These guidelines specify that schools should allow students to possess and self-administer asthma medications when appropriate.<sup>5</sup> Despite these recommendations, less than 30% of asthmatic students have access to their personal rescue inhaler while at school.<sup>6,7</sup>

Regardless of socioeconomic status, race or ethnicity, gender or age, children with asthma are prone to experiencing respiratory distress and breathing problems at school. Children with asthma may misplace or forget to bring their prescribed rescue inhaler; the rescue inhaler may become clogged, expired or run out of medication; or school policies may inhibit children from quickly accessing a rescue inhaler during a respiratory distress event. Schools can implement an innovative and practical solution for any child experiencing respiratory distress. A single albuterol inhaler (e.g., stock inhaler) can be administered to any child experiencing acute respiratory distress or an asthma exacerbation. The stock inhaler can be safely used by any child when paired with a one-way valved-holding chamber specific to each child. Children who have access to a stock inhaler can quickly relieve their symptoms and most children can return to class.<sup>6,8</sup> Therefore, such programs can potentially avert a medical emergency.<sup>6</sup>

School stock inhaler programs can lead to positive benefits, but without state stock inhaler laws schools must overcome several barriers to implementation. The National Coordinating Council for Medication Error Prevention and Reporting (NCCMEPR) has provided recommendations for non-health care settings (e.g., schools) which specify the documentation of a medication order from a licensed provider.<sup>9</sup> While standard policies for medication administration are important for safety and reducing errors, these same policies prevent the emergency administration of rescue medication to a child who lacks the necessary documentation on file with the school.<sup>10</sup> Another important challenge to implementing stock inhaler policies is the shortage of full-time, licensed nurses in schools. Since nurses

are required to implement standing orders, a nurse must be present at the school for stock inhalers to be used. Although the recommended nurse-to-student ratio is 1:750, many schools are unable to meet this recommendation,<sup>11,12</sup> and in Arizona the nurse-to-student ratio is 1:1217.<sup>12</sup> Charter, private and parochial schools often do not hire a registered nurse (RN) to manage student health needs and the individuals responsible for medication administration in these schools often are administrative personnel or office staff.<sup>11</sup> Gaps in state- and national-level policy for the administration of emergency medication leave many schools and personnel unprotected from civil liability if they were to implement stock inhaler programs.<sup>13</sup> Asthma symptoms can be easily identified by a RN, LPN or a trained, unlicensed person, but without stock inhaler legislation, the only option schools may have when a child presents with respiratory distress is to call the child's parents/guardians to come pick them up, or if the attack is severe enough, call 9-1-1 and have Emergency Medical System (EMS) treat and transport the child to the nearest emergency department (ED). Delays in albuterol administration were reported in one-third of the 38 asthma-related deaths that occurred at school in the past 3 decades,<sup>14</sup> and access to rescue medication for children at school is imperative to reducing unnecessary asthma deaths.

In March 2017, Arizona became the 9<sup>th</sup> state to pass stock inhaler legislation. H.B. 2208 allows Arizona schools to procure, stock and administer quick relief medication to any individual experiencing emergency respiratory distress and indemnifies trained school personnel for their good faith use.<sup>15</sup> After passage of H.B. 2208, a stakeholder coalition developed the Pima County Stock Inhaler for Schools Program and provided schools which enrolled with a program toolkit and technical support for implementation. The toolkit contained the following supplies: (1) 60-dose albuterol inhaler, supply of valved-holding chambers (LiteAire®), signed standing medical order by the Chief Medical Officer of Pima County or another licensed physician, standardized protocol for albuterol administration, online training curriculum, template resources and on-going support from a program manager. The objective of this study was to evaluate the implementation of the program among schools across Pima County, Arizona during 2017-2018.

## METHODS:

**Program Design & Setting:** The Pima County Stock Inhaler for Schools Program was a longitudinal, mixed methods implementation study that enrolled schools during the 2017-2018 academic year. All charter, private/parochial and public schools in Pima County, Arizona were eligible for enrollment. Schools which enrolled received a program tool kit and technical support for implementation.

Institutional Review Board (IRB) approval was obtained from the University of Arizona and independent research approval was obtained from each participating school that enrolled in the program.

Program Description: After passage of H.B. 2208, a stakeholder coalition developed program materials including a standardized protocol that instructed trained personnel how to recognize and respond to respiratory distress. The protocol (**Appendix A**) instructed trained personnel to administer a fixed number of albuterol puffs to the child experiencing respiratory distress depending on the severity of their initial presentation. The stakeholder group also created a stock inhaler documentation log which detailed each stock inhaler use including: a) information on the school name, b) date of event, c) child's name, d) date-of-birth, e) gender, f) ethnicity, g) race, h) whether or not the child had a known asthma diagnosis, i) location where symptoms developed, j) name of the trained school personnel who administered the stock inhaler, k) time-of-day of administration, l) number of albuterol puffs administered, and m) disposition status. State of Arizona law requires that schools retain the stock inhaler documentation log for a minimum of 3 years (**Appendix A**).

In order to comply with H.B. 2208, schools must train a minimum of 2 individuals to administer the stock inhaler. The University of Arizona Asthma & Airway Disease Research Center partnered with the American Lung Association – Tucson and the Western Regional Public Health Training Center (WRPHTC) to develop a free, web-based training curriculum that could be easily accessed by school personnel thereby assisting schools in meeting this requirement. After the training was completed, school personnel took a brief 5-question knowledge assessment. A score of 80% or higher was required to obtain a completion certificate.

Outreach to schools occurred during the summer of 2017, and a systematic approach using various methods was employed to inform schools of the program. A letter co-authored by the Pima County District Superintendent, the Chief Medical Officer of Pima County, AZ, the Pima County Health Department, and the Asthma & Airway Disease Research Center was sent to every school in the county (**Appendix A**). Additionally, the program manager attended several community events including charter schools' monthly luncheons and school resource fairs. Direct outreach via telephone and in-person trainings were also conducted. District-specific trainings provided background information on the program, addressed concerns regarding trained personnel's liability and elements of the H.B. 2208, delivered asthma education, and provided training on use of the stock inhaler protocol and administration of albuterol sulfate. All schools volunteered their enrollment and completed a school enrollment form (**Appendix A**). All participating schools received a program toolkit including the

following supplies: (1) 60-dose albuterol inhaler, supply of valved-holding chambers (LiteAire®), signed standing medical order by the Chief Medical Officer of Pima County or another licensed physician, standardized protocol for albuterol administration, online training curriculum, template resources and on-going technical support from the program manager. Enrollment was on-going during the 2017-2018 academic year. Post-implementation, schools were instructed to keep all program supplies but to dispose of expired drug in accordance with the school/district policy.

Data Collection Methods and Analyses: All school enrollment forms, stock albuterol documentation logs, staff training form & checklists, and training completion certificates were collected post-implementation by the program manager. Trained personnel were sent a link through e-mail and asked to complete a brief, web-based, post-program evaluation survey consisting of a 22-item survey. Respondents were asked questions about their nursing licensure status, satisfaction with the training, details on use of the stock inhaler during the year, complaints from school administration or parents and whether they would recommend the program for their school again next year (**Appendix A**).

Chi squared was used to determine differences between groups at baseline among schools that participated in the program. We further examined differences in stock inhaler events among schools enrolled in the program. One-way analysis of variance (ANOVA) was used to determine whether there were any statistically significant differences between the means of groups (**Tables 3-5**). All statistical analyses were conducted in Stata 15.0, College Station, Texas (**Appendix C**).<sup>16</sup>

Qualitative methods included one-on-one telephone interviews to solicit feedback from trained personnel who used the stock inhaler during the 2017-2018 academic year. Personnel were identified to participate in the interview through the post-evaluation e-mail survey which asked if the individual administered the stock inhaler during the past year. Trained personnel who provided their consent to be interviewed were asked 7 open-ended questions regarding their experiences with implementing the program and to gain knowledge regarding any program barriers and facilitators. (**Appendix A**) The questions were guided by phenomenology,<sup>17</sup> which relied on the participant's own experiences and perspectives to provide insight on how the stock inhaler program impacted their school. We used a structured approach for interviewing and recorded each interview with the participant's consent. Interviews were transcribed verbatim, and we explored each transcript for emerging themes and variations in experiences. All responses were de-identified, and aggregate data were used to identify common themes. Throughout the qualitative research process, we used bracketing, a qualitative method that allowed the researcher to set aside any preconceived notions, biased interpretations of the

data (e.g., reflexivity) or knowledge of previous research findings. The researcher carefully assessed any personal biases before program implementation and assessed the researcher's personal notes throughout the research process.

## Program Evaluation

RE-AIM measures: We selected the RE-AIM framework to guide the evaluation. The RE-AIM framework focused on five dimensions: Reach, Effectiveness, Adoption, Implementation and Maintenance, aimed to improve the translation of research into evidence-based interventions. RE-AIM is specifically designed to be used in real-world, diverse settings and is appropriate for the dynamic resources and structures of schools located in Pima County, Arizona.<sup>18,19</sup>

Program Reach: Program reach was determined by the percentage of children enrolled in the program and divided by the total number of children who attended schools in Pima County, Arizona during 2017-2018. Representativeness was an additional measure of program reach that compared the characteristics (i.e., mean % of minority enrollment and mean % of children that qualified for the National School Lunch Program (NSLP)) of enrolled schools versus the characteristics (i.e., mean % of minority enrollment and mean % of children that qualified for the NSLP) of non-participating schools across Pima County.

Program Effectiveness: The effectiveness of this program was evaluated by the number of stock inhaler events, and the final disposition status (i.e., "Returned to class", "Sent home with caregiver", "Called 9-1-1 and no EMS transport", and "Called 9-1-1 and transported via EMS") recording by the trained person during the 2017-2018 academic year. We further assessed stock inhaler events by grades served (pre-K through 5<sup>th</sup>/6<sup>th</sup>, 6<sup>th</sup>-8<sup>th</sup>, 9<sup>th</sup>-12<sup>th</sup>, and other), school type (charter, private/parochial and public) and nursing licensure (nurse, nurse-supervised and unlicensed). We also assessed the demographic characteristics of the students to whom the stock inhaler was administered.

Program Adoption: The adoption of the program was determined by the percentage of eligible schools that enrolled in the program. We further described the percentage of public, private and charter schools across Pima County who adopted the program during the 2017-2018 academic year.

Program Implementation: The implementation of this program was measured by identification of the changes made to program materials, including template resources through stakeholder engagement. Implementation barriers and facilitators were determined through the e-mail survey and one-on-one interviews with trained personnel who used the stock inhaler during the academic year. We further assessed the total program cost, the program cost per school, and the number of school personnel that completed the online training curriculum. We assessed program fidelity by examining the completion rate of the Stock Inhaler Training for School Personnel training curriculum. A list of e-mail addresses that were used by school personnel to enroll in the online training program were provided by the WRPHTC were examined. These emails were matched to the completion certificates provided by enrolled schools.

Program Maintenance: The maintenance of this program was determined from the post-program evaluation survey and the one-on-one interviews. The e-mail survey contained semi-structured questions with fill-in-the-blank qualitative questions that inquired about the participant's intentions to continue a stock inhaler program and their recommendations for program improvement.

## RESULTS:

### RE-AIM measures

Program Reach: A master list of 364 schools was provided to the research team by the Pima County Superintendent's Office. Schools that did not have a physical campus (e.g., transportation districts ( $n=2$ ), online schools( $n=6$ )), and schools that were closed at the beginning of the 2017-2018 academic year ( $n=16$ ) were not eligible for enrollment. Therefore, 340 schools serving 163,664 children were eligible for enrollment. Two-hundred-thirty schools (67.6%) serving 134,251 children (82%) enrolled in the program during 2017-2018. **Figure 1 in Appendix B** illustrates the flow of participating schools through the Pima County Stock Inhaler for Schools Program. **Table 1 in Appendix B** further describes school characteristics of the ( $n=340$ ) eligible schools across Pima County and compares participating ( $n=230$ ) versus non-participating ( $n=110$ ) schools. Non-participating schools were significantly more likely to be private or charter schools, K-12 schools and small schools with enrollments of less than or equal to 250 students.

Program Effectiveness: One-hundred-and-fifty-two schools (66.1%) used the stock inhaler at least one time and reported a total of  $n=1,032$  stock inhaler events. **Table 2** describes stock inhaler events among schools enrolled in the program. Approximately 52.6% of stock inhaler events occurred among male students while 41% of uses were to white students and 69.8% of administrations were to Hispanic/Latino students. Most times the stock inhaler was used by an individual with a previously known asthma diagnosis ( $n=810$ , 82.0%). The average number of puffs administered per event was 2.7 ( $SD=1.9$ ). Overall, 84.0% of uses resulted in students returning to their classroom, 15.4% of uses the child was sent home with their caregiver, and 0.6% of uses resulted in activating the EMS system.

The standardized mean rate of stock inhaler events among all schools was 8.9 ( $SD=13.7$ ) events per 1,000 students per academic year (**Tables 3-5**). **Table 3** describes the stock inhaler events by grades served among those schools which reported at least one use. There were no statistically significant differences in the mean rate of stock inhaler events observed by grades served (e.g., PreK-5<sup>th</sup>/6<sup>th</sup>, 6<sup>th</sup>-8<sup>th</sup>, 9<sup>th</sup>-12<sup>th</sup> or other); however, the lowest mean rate of stock inhaler events occurred among “other” schools (mean rate=7.1 (10.4)) and the highest mean rate of stock inhaler events occurred among 6<sup>th</sup>-8<sup>th</sup> graders (mean rate=10.8 (9.9)). Statistically significant differences in disposition status among grades served were observed ( $p=0.04$ ) such that students who experienced events at elementary schools and other schools were less likely to return to class and more likely to be sent home.

**Table 4** describes the stock inhaler events by type of school (charter, private/parochial or public) among schools that reported at least one stock inhaler event. The mean rate of events was lowest among charter schools (mean rate=4.6 (7.8)); however, no statistical differences were found by school type. In addition, no statistical differences were found in disposition status among school type. **Table 5** describes the stock inhaler events by nursing licensure (e.g., nurse, nurse-supervised or unlicensed) among schools that reported at least one use. The lowest number of stock inhaler events were reported by unlicensed personnel (mean rate=3.8 (9.1)) and the highest number of stock inhaler events were reported by nurse-supervised personnel (mean rate=11.8 (14.0)). These differences were statistically significant ( $p=0.001$ ). However, there were no statistically significant differences in disposition status by nursing licensure.

To further assess program effectiveness, qualitative interviews were conducted. One-hundred-ninety-four school staff reported using the stock inhaler at least once in the on-line survey. The program manager contacted each district office to gain approval for a qualitative interview with school staff using the list of ( $n=194$ ) individuals that reported a stock inhaler event. Of the 194 trained individuals that reported a stock inhaler event, 25 were identified by the schools’ district office or district-level nurse to

participate in the one-on-one telephone interview. After contacting the 25 individuals, 15 trained personnel agreed to be interviewed and were consented (trained school nurses ( $n=8$ ) and unlicensed personnel ( $n=7$ )). One-hundred percent of trained personnel reported they felt confident administering the stock inhaler during an event. Participants explained the stock albuterol protocol & action plan was concise, easy-to-follow and a useful tool for managing a respiratory distress event. Common themes among responses revealed that the presence of the stock inhaler provided trained personnel with “relief” and “peace of mind”. Further feedback from trained personnel highlighted the anxiety they felt before the stock inhaler program was implemented in their school. Trained personnel explained that respiratory events were “stressful” and “scary”, and many respondents had much uncertainty as to how they should proceed when a child presented with respiratory distress before the stock inhaler program was implemented in their school. One school nurse described her experience as, “a long journey waiting for the parents to show up without being able to medicate the child. I knew that if I called 9-1-1 the child was really in distress. . . After the stock inhaler program, I was reassured that I could help this child. It is night and day comparing when you have the inhaler here to help as compared to having nothing.” Interestingly, several trained personnel referred to fearing “liability” and “personal responsibility” for the child’s welfare during the year before the program implementation. However, they never referred to concerns of liability or legal consequences as a result of administering the stock inhaler to a child after program implementation. Qualitative feedback further revealed that key program barriers included problems with accessing the online training curriculum from the school’s computer, identifying a second person to complete the online training, and the necessity for providing information and education on the stock inhaler program before implementation. Further discussion regarding the challenges trained personnel experienced with accessing the online training curriculum revealed that many schools have firewalls or slow internet access which made creating an online account and then re-accessing the online training difficult. Some schools did not receive an e-mail password instantaneously which resulted in the staff having to come back to the training to complete it later. Key program facilitators included the on-going program support from the program manager, the delivery of all program supplies directly to the school, and the support of the school’s district-level administration and school board.

Program Adoption: Overall, 67.6% ( $n=230$ ) of public, private and charter schools across Pima County, Arizona participated in the Pima County Stock Inhaler for Schools Program. Of the schools that adopted the program, 85.7% ( $n=197$ ) were public schools, 8.7% ( $n=20$ ) were private schools, and 5.7% ( $n=13$ )

were charter schools. Non-participating schools were more likely to be charter or private/parochial schools ( $p=0.007$ ).

Program Implementation: As shown in **Table 6**, the total program cost was \$42,780 and the total cost per school was approximately \$156. To calculate total program cost, we accounted for one, half-time staff position including employee-related expenses (ERE) as well as marketing materials. Therefore, the total program cost includes overhead and does not reflect the actual cost a school would need to pay to independently acquire a stock inhaler for the school. For schools to adopt this program without program overhead, approximately \$78.00 per school would cover all necessary supplies (i.e, (1) albuterol inhaler, valved-holding chambers, copies of program materials).

We assessed program fidelity by examining the completion rate of the Stock Inhaler Training for School Personnel. A list of e-mail addresses of trained personnel who completed the online training and provided their respective school were examined. Since 230 schools participated in the program, we expected a minimum of 460 individuals to complete the online training curriculum. However, only 206 individuals from participating schools completed the mandatory online training during the 2017-2018 school year. While this number was lower than expected, many individuals may have used e-mail addresses that could not be matched to their respective school using the list that was provided by the WRPHTC. Furthermore, the list we examined was limited to the individuals that completed the optional demographic questions before completing the online training curriculum.

Program Maintenance: **Table 7** summarizes the demographic characteristics of trained personnel who completed the web-based post-evaluation survey at the end of the school year. A total of  $n=267$  individuals completed the survey (survey response rate=77.6%). Most respondents identified as 46-65 years-of-age ( $n=160$ , 60.4%), female ( $n=252$ , 95.5%), and white ( $n=218$ , 81.7%). Approximately 40.8% of survey respondents ( $n=108$ ) identified as Hispanic/Latino. Overall, most respondents worked at a public school ( $n=250$ , 94.7%) and were unlicensed personnel ( $n=186$ , 70.5%). Trained personnel were asked to rate aspects of the training curriculum, their level of confidence with administering the stock inhaler and overall satisfaction with the program (**Table 8**). Overall, 95.3% of respondents reported they had “high confidence” or “very high confidence” with administering the stock inhaler, and 94.8% felt they had “high confidence” or “very high confidence” with using the stock inhaler protocol & action plan. Lastly, 94.3% of participants reported they would recommend this program to other schools. Additional survey responses revealed that 22.4% of trained personnel did not have an emergency protocol in place at their

school before the stock inhaler program. During the 2017-2018 school year, 73.5% of respondents had administered the stock inhaler to an individual. Overall, 93.2% of trained personnel felt the stock inhaler program was beneficial to their school indicating high satisfaction with the program. We further assessed school personnel's continued commitment to continue the stock inhaler program and only 9.5% ( $n=25$ ) respondents specified they would have their school continue the program if medication and supplies were not donated at no cost (**Table 9**). E-mail surveys also inquired about participant's overall satisfaction with the program. When asked, "Do you feel the Stock Inhaler for Schools Program was beneficial to your school?" 93.2% of participants responded, "Yes" to this question. Overall, 89.7% of respondents planned on continuing the program if supplies were available to this school (**Table 10**).

## DISCUSSION:

Children spend approximately two-thirds of their time in school<sup>20</sup> and access to rescue medication is necessary for quickly relieving symptoms of respiratory distress. Yet, most children lack access to this life-saving drug as many families are unable to provide a secondary, back-up inhaler for their child to leave at the school, the child's medication is expired, the child forgets to bring their inhaler with them, or the school does not have proper documentation of an asthma diagnosis.<sup>6,7</sup> The Pima County Stock Inhaler for Schools Program helps fill this gap by providing important feasibility and preliminary effectiveness data of stock inhaler usage among unlicensed but trained personnel. A major strength of this program was the proportion of children reached by the program. Across Pima County, AZ, the program reached 134,251 children in 230 schools which accounted for 97.5% of public-schools inside the county boundaries and 82% of children enrolled in schools across the county. Pima County schools are dispersed throughout a large, geographic area (9,189 mi<sup>2</sup>) which presented unique challenges for a implementing a large-scale stock inhaler program such as delivery of program supplies and educational program components. Another important component of this program was the on-going logistical support provided by the program manager. This support included consistent communication with schools and support with questions, inquiries for supplies, and problem-solving. During the first 6 months of this program, one public school experienced push back from an urgent care facility that saw a child who had been administered the stock inhaler from an unlicensed, trained person. The urgent care facility was unaware of the law and questioned the school as to why an unlicensed person had administered albuterol sulfate to the child. Another school experienced similar issues when EMS was

dispatched to the school for a child who was experiencing respiratory distress. Paramedics questioned the school health aide as to why the child had been administered medication and were unaware of the law. Following these events, continuing education and community outreach were conducted to provide pharmacists, emergency responders and urgent care facilities with information regarding H.B. 2208. Furthermore, we continued consistent education with all schools enrolled in the program. We estimate that in the first two months of program implementation approximately 50 phone calls were either placed or received regarding the program and 100 e-mails were fielded from various program participants (e.g., district-level school nurses, school administration and trained personnel). During the following 6 months of implementation, e-mail and phone correspondence slowed to approximately 5-10 emails and/or calls per month. Given the broad implementation of this county-wide program among schools, technical support and delivery supplies assisted with program uptake among schools.

The implementation of this program among diverse school structures which included non-public school structures such as charter and private/parochial schools, various ages of students served, and the availability of student health services such as a licensed nurse on campus illustrated the importance of developing programs that are practical in all school systems regardless of resources and structure. Across Pima County, most schools are not provisioned with a full-time licensed nurse who is responsible for student health care and is reflective of schools across the U.S.<sup>21,22</sup> While our findings suggest there are differences in the mean rate of stock albuterol events among nursing licensure, differences in disposition status were not statistically significant suggesting that a standardized protocol for emergency respiratory distress directs school personnel when to activate the EMS system appropriately. Furthermore, these program findings demonstrated that stock inhaler programs can be easily implemented in schools with alternative health models while keeping children in their learning environment.

Perhaps the most notable finding of this program was that 83.9% of stock inhaler events<sup>23</sup> resulted in the child returning to their classroom. This outcome supports prior findings that stock inhaler programs returned children back to their learning environment, reduced EMS usage and provided important cost-savings benefits.<sup>6</sup> While most children returned to the classroom, one notable finding was the large percentage of stock inhaler uses that were documented in African American/Black children. Approximately 11.7% of stock inhaler uses were documented in African American/Black children which was much higher than expected given that only 4% of children in Pima County are African American/Black.<sup>23</sup> These findings suggest a need for identifying populations such as African American/Black children that may benefit from a stock inhaler at their school.

Currently, limited evidence exists examining the implementation of large-scale stock inhaler programs in schools. In Omaha Nebraska, an emergency rescue medication protocol was implemented in  $n=78$  Omaha Public Schools reaching 45,000 students. Over a 5-year period, 99 students were treated with the protocol, and 90% of these students were treated with albuterol only indicating asthma-related respiratory distress and not allergic anaphylaxis. Two-thirds of students treated via the protocol lacked either an asthma action plan or a personal inhaler.<sup>24</sup> While this study demonstrated the necessity of rescue medication in the school setting, the protocol included the administration of epinephrine for anaphylaxis and did not focus on respiratory distress only. In Tucson, Arizona, a stock inhaler program in a large, public-school district demonstrated a 20% reduction in asthma-related 9-1-1 calls and a 40% reduction in asthma-related EMS transports but focused on children with an asthma diagnosis only.<sup>6</sup> However, this study provided the pilot data essential for passing H.B. 2208 and informed the implementation of the current county-wide program.

There were a few limitations regarding the current stock inhaler program. Schools were required to redact all personal-identifiers such as student name and date-of-birth (DOB) to ensure Family Education Rights and Protection Act (FERPA) regulations were followed.<sup>25</sup> Therefore, all data obtained from the stock albuterol documentation logs could not be examined for repeated measurement by child and characteristics of the individual stock inhaler uses were not determined, necessitating analyses by schools rather than the individual student. The potential bias resulting from these limitations may be strengthened through an enhanced collaboration with public health departments who can systematically collect and house stock inhaler events data from schools.

## Conclusion:

As efforts continue to increase access to rescue medication in schools, it is important to examine stock inhaler events at the student-level and determine which children necessitate the administration of rescue medication at school. Such analyses may inform future research on children who may disproportionately rely on EMS usage for respiratory distress in the school setting. Necessary program components include effective legislation similar to H.B. 2208 that protect and indemnify schools and trained personnel from civil liability when participating in stock inhaler programs. Future programs should determine if such programs are feasible in similar settings and populations and examine the program's effect on EMS usage.

## **APPENDIX A**

### **Nomenclature:**

(In order of appearance.)

NAEPP: National Asthma Education Prevention Program

NCCMEPR: National Coordinating Council for Medication Error Prevention and Reporting

RN: Registered nurse

ED: Emergency department

EMS: Emergency medical system

IRB: Independent Review Board

WRPHTC: Western Region Public Health Training Center

ANOVA: One-way Analysis of Variance

NSLP: National School Lunch Program

ERE: Employee related expenses

DOB: Date-of-birth

FERPA: Federal Education Rights and Privacy Act

### **Additional Materials:**

(In order of appearance.)

- I. Additional Materials:
- II. (In order of appearance.)
- III. Stock Albuterol Protocol & Action Plan
- IV. Stock Albuterol Documentation Log
- V. Staff Training Form & Checklist
- VI. Letter from the Pima County Superintendent, Pima County Health Department, and Asthma & Airway Disease Research Center sent to schools during July 2017.
- VII. School Enrollment Form
- VIII. Web-based, post-evaluation e-mail instrument
- IX. Qualitative instrument

# STOCK ALBUTEROL INHALER PROTOCOL & ACTION PLAN

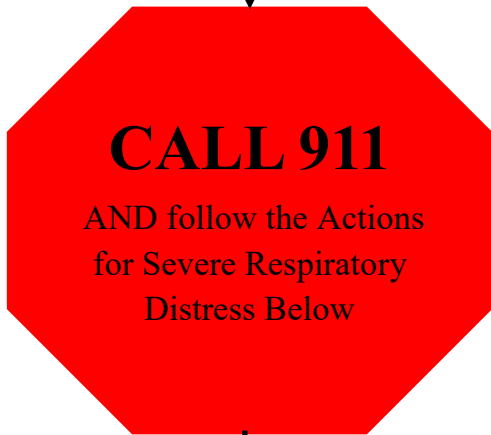
## For Treating Emergency Respiratory Distress

### Is this **SEVERE** Respiratory Distress?

- Struggling to breathe / Shortness of breath
- Coughing, wheezing, tightness in the chest
- Difficulty speaking
- Blueness around the lips or fingernails (might look gray or “dusky”)
- Chest retractions (chest/neck are pulling in)
- Use of accessory muscles (stomach muscles are moving up and down)
- Fast pulse (e.g., tachycardia)
- Agitation

YES

NO



### For **Mild-to-Moderate** Respiratory Distress:

1. Administer 4 puffs of albuterol with valved holding chamber, each 15-30 seconds apart.
2. Restrict physical activity & allow the individual to rest. **DO NOT LEAVE THE INDIVIDUAL UNATTENDED!**
3. Instruct office staff to notify parent/caregiver AND school nurse and/or principal.
4. Observe individual again after 10-15 minutes.

1. **Immediately administer 8 puffs of albuterol with valved holding chamber, each puff 15-30 seconds apart.**
  2. Document the time 911 was called.
  3. Restrict physical activity, encourage slow breaths & allow individual to rest. **DO NOT LEAVE THE INDIVIDUAL UNATTENDED!**
  4. Instruct office staff to contact parent/caregiver AND school nurse and/or principal.
  5. Document the time EMS services arrived AND the name of the EMS provider.
  6. Observe individual after 15 minutes if EMS has not yet arrived.
- \*\*\*If the individual shows improvement, wait for EMS to arrive & assess the individual.**

NO IMPROVEMENT

IMPROVEMENT

### If there is no improvement:

1. Administer 4 more puffs of albuterol with valved holding chamber, each 15-30 seconds apart.
2. If there is still no improvement, **immediately call 911 AND follow actions for Severe Respiratory Distress.**

IMPROVEMENT

Individual should demonstrate the following:

- No more chest tightness or shortness of breath
- Can walk & talk easily

### If the individual shows improvement:

1. Keep him/her in the health office under supervision until their breathing returns to normal AND the office staff has contacted the student's parent/caregiver.
2. Follow the post-incident instructions on the back of this form.

NO IMPROVEMENT AFTER 15 MINUTES & EMS HAS NOT YET ARRIVED

1. **Repeat 8 puffs of albuterol with valved holding chamber, each 15-30 seconds apart.**

# STOCK ALBUTEROL INHALER PROTOCOL & ACTION PLAN

## For Treating Emergency Respiratory Distress

This protocol is intended for use by trained personnel to respond to respiratory distress. It is not intended to replace an individual's personal Asthma Action Plan. Instead, it should be used when an Asthma Action Plan and/or prescribed short-acting bronchodilator inhaler (e.g., albuterol inhaler) are not available or easily accessible.

Possible signs/symptoms of respiratory distress may include ANY of the following symptoms:

- *Struggling to breathe, coughing, wheezing, noisy breathing, decreased breath sounds, whistling in the chest, chest pain, chest tightness, shallow breathing, breathing hard or fast, shortness of breath, nasal flaring, difficulty speaking, blueness around the lips or fingernails, chest retractions, and/or use of accessory muscles*

### **STEPS FOR POST-INCIDENT DOCUMENTATION:**

1. Document the incident using the "Stock Albuterol Documentation Log".
2. Follow-up with the school nurse and/or principal.
3. If the individual is a student, document the student's personal school health record.
4. If the individual is a student, follow-up with the student's parent/caregiver.

**\*\*\*The "Stock Albuterol Documentation Log" shall remain on file with the school for a minimum of 3 years.**

School Name: \_\_\_\_\_

### STOCK ALBUTEROL DOCUMENTATION LOG

Date:     /     /

Student's Name (Last, First)

DOB:     /     /

Gender:      Male      Female      Other

Ethnicity:      Hispanic / Latino  
                  non-Hispanic / non-Latino

Race:      American Indian / Alaska Native  
           Asian  
           Black / African American  
           Native Hawaiian / Pacific Islander  
           White

Did the student have a known diagnosis of asthma before this day?

Yes            No            Do not know

Trained Staff's Name (Last, First)

Location where symptoms developed

\_\_\_\_\_  A.M.    P.M.

Time of day albuterol was administered

\_\_\_\_\_ (Puffs)

Number of puffs of albuterol administered

Disposition Status:

- Returned to class
- Sent home with caregiver
- Called 911 and NO EMS transport
- Called 911 and transported via EMS

Standing Order Authority (Physician Name)

EMS Agency Name (If applicable)

\_\_\_\_\_  A.M.    P.M.

Time 911 was called (If applicable)

\_\_\_\_\_  A.M.    P.M.

Time EMS arrived (If applicable)

Name of hospital student was transported to

Comments:

Date:     /     /

Student's Name (Last, First)

DOB:     /     /

Gender:      Male      Female      Other

Ethnicity:      Hispanic / Latino  
                  non-Hispanic / non-Latino

Race:      American Indian / Alaska Native  
           Asian  
           Black / African American  
           Native Hawaiian / Pacific Islander  
           White

Did the student have a known diagnosis of asthma before this day?

Yes            No            Do not know

Trained Staff's Name (Last, First)

Location where symptoms developed

\_\_\_\_\_  A.M.    P.M.

Time of day albuterol was administered

\_\_\_\_\_ (Puffs)

Number of puffs of albuterol administered

Disposition Status:

- Returned to class
- Sent home with caregiver
- Called 911 and NO EMS transport
- Called 911 and transported via EMS

Standing Order Authority (Physician Name)

EMS Agency Name (If applicable)

\_\_\_\_\_  A.M.    P.M.

Time 911 was called (If applicable)

\_\_\_\_\_  A.M.    P.M.

Time EMS arrived (If applicable)

Name of hospital student was transported to

Comments:

## STOCK INHALER FOR SCHOOLS PROGRAM

### TRAINING FOR SCHOOL STAFF FORM | 2017-2018 SCHOOL YEAR

**THE FOLLOWING INDIVIDUALS WILL BE RESPONSIBLE FOR ADMINISTRATION OF STOCK ALBUTEROL MEDICATION (A MINIMUM OF 2 INDIVIDUALS IS REQUIRED):**

TRAINED STAFF MEMBER 1			
Trained Staff Member Last Name:		Trained Staff Member First Name:	
Title:			
Email Address:			
Phone Number:	(      )		

TRAINED STAFF MEMBER 2			
Trained Staff Member Last Name:		Trained Staff Member First Name:	
Title:			
Email Address:			
Phone Number:	(      )		

TRAINED STAFF MEMBER 3			
Trained Staff Member Last Name:		Trained Staff Member First Name:	
Title:			
Email Address:			
Phone Number:	(      )		

<b>TRAINED STAFF MEMBER 4</b>			
Trained Staff Member Last Name:		Trained Staff Member First Name:	
Title:			
Email Address:			
Phone Number:	(      )		

## CHECKLIST FOR PROGRAM PARTICIPATION

*Please complete the following checklist to ensure all requirements for program participation have been met. Check each step that has been completed and return the completed enrollment form to the program coordinator (contact information is provided below).*

- Received copy of the Stock Inhalers for Schools protocol
- Received supply of albuterol inhalers
- Received supply of spacers (e.g., Thayer LiteAire® spacers)
- Designated a minimum of 2 individuals as school's trained staff members to administer albuterol
- Attached 2 copies of trained staff members' stock inhaler training certificates

\*\*\*We acknowledge that we have received the appropriate training, supplies, and have designated a minimum of two trained staff members to administer albuterol medication at this school.

**REQUIRES A MINIMUM OF 2 TRAINED STAFF MEMBERS' SIGNATURES:**

		/   /
<b>TRAINED STAFF MEMBER 1</b>	<b>SIGNATURE</b>	<b>DATE</b>
		/   /
<b>TRAINED STAFF MEMBER 2</b>	<b>SIGNATURE</b>	<b>DATE</b>

July 1<sup>st</sup>, 2018

Dear Pima County Schools,

On March 27<sup>th</sup>, 2017, Governor Doug Ducey signed HB2208 “Stock Inhalers for Schools”. This legislation allows schools to purchase, store, and administer albuterol sulfate, a short-acting bronchodilator. This medication can be safely given by trained school personnel to any student who experiences sudden respiratory distress while at school or a school-sanctioned event. When given promptly, albuterol can open narrowed airways and avert a potential medical emergency.

This year the Pima County Health Department, Thayer Medical Corporation, the University of Arizona Western Public Health Training Center, the University of Arizona Mel and Enid Zuckerman College of Public Health, and the University of Arizona Asthma & Airway Disease Research Center are working collaboratively to ensure that all Pima County schools can implement their own stock inhaler program. This collaboration will provide all schools who register and agree to share information regarding their stock albuterol use with the following:

- Medication (albuterol sulfate metered dose inhaler)
- Disposable valved holding chambers (e.g., LiteAire<sup>®</sup> spacers) for use with the inhaler
- Standing Medical Order to enable trained school personnel to administer albuterol
- Stock Albuterol Protocol & Action Plan (e.g., for the recognition and management of respiratory distress)
- Stock Albuterol Documentation Logs (e.g., to comply with State of Arizona requirements)
- Online training curriculum (e.g., Stock Inhaler Training for School Personnel)

This training program provides school health personnel with the ability to recognize and respond to respiratory distress. As you are aware, asthma is a common chronic disease of childhood and is a leading cause of school absenteeism. When a child with asthma has a breathing problem at school, the school's health team can quickly respond if the child has a personal inhaler. Unfortunately, most children with asthma do not have a personal inhaler at school. In these cases, school health personnel must call the child's caregiver or 9-1-1 if the episode worsens. Delays in treatment lead to additional time away from class, unnecessary absences, 9-1-1 calls, and in rare situations, emergent transport to the hospital. Having a stock inhaler can reduce these events by enabling prompt treatment of these episodes.

If you would like to participate in this program, more information is available at <http://lungresearch.arizona.edu/stockinhaler>. You can also e-mail us directly at <mailto:stockinhaler@emailarizona.edu>. We are excited about this opportunity to improve the health and well-being of your students with asthma and hope that your school(s) will participate.

Sincerely,

Dustin Williams  
Superintendent  
Pima County Schools

Francisco Garcia, MD, MPH  
Assistant County Administrator  
Pima County Health Department

Lynn B. Gerald, PhD, MSPH  
Associate Director, Clinical Research  
Asthma & Airway Disease Research Center

## STOCK INHALER FOR SCHOOLS PROGRAM

SCHOOL ENROLLMENT FORM | 2017-2018 SCHOOL YEAR

SCHOOL INFORMATION					
School Name:					
School Address:					
City:		State:	AZ	Zip Code:	
Main Phone Number:	(    )	Fax Number:	(    )		
School Type:	<i>Please check the appropriate box:</i> <input type="checkbox"/> Public <input type="checkbox"/> Charter <input type="checkbox"/> Private / Parochial				
School District:					
Grades Served:					

PRIMARY HEALTH OFFICE CONTACT			
Health Personnel Last Name:		Health Personnel First Name:	
<i>If Applicable:</i> Licensure / Certification:			
Email Address:			
Phone Number:	(    )		

HEALTH OFFICE INFORMATION HERE	
Type of Health Office Personnel:	Select all that apply: <input type="checkbox"/> NP <input type="checkbox"/> RN <input type="checkbox"/> LPN <input type="checkbox"/> CN <input type="checkbox"/> Health Assistant <input type="checkbox"/> Other

AS OF THE BEGINNING OF THE PAST SCHOOL YEAR (2016-2017)	
No. of Students:	% Students that Qualify for Free & Reduced Lunch Assistance: %
% of Hispanic / Latino Students:	%
No. of Asthmatic Students:	
No. of Students with a Personal Rescue Inhaler at School:	
No. of 911 Calls Last School Year (2016-2017):	
No. of Asthma-related 911 Calls Last School Year (2016-2017):	
No. of EMS Transports Last School Year (2016-2017):	
No. of Asthma-related EMS Transports Last School Year (2016-2017):	

**\*The program coordinator will contact each participating school at the end of the 2017-2018 school year to ask these same questions about this school year. Collecting information about your school before and after the Stock Inhaler for Schools program will allow our team to evaluate the program. Such evaluations may help secure additional funding and ensure program sustainability. If you have any questions about data collection, please e-mail the program coordinator at [stockinhaler@email.arizona.edu](mailto:stockinhaler@email.arizona.edu).**

# Evaluation of the 2017-2018 Pima County Stock Inhaler for Schools Program

We appreciate your time with completing this survey. Because you are the experts that have used this program during the 2017-2018 academic year, we value your feedback with helping us improve this program for future use. The survey should only take 5-10 minutes to complete. Please give as much detail as you would like.

## The following questions are basic demographic questions.

Email Address

(If possible, please use the same e-mail address that was used to access the Stock Inhaler for School Personnel online training curriculum.)

Age Range

- 18-30 years  
 31-45 years  
 46-65 years  
 65+ years  
(Please select your current age range in years.)

Gender

- Male  
 Female  
 [X] Other

Ethnicity

- Hispanic/Latino  
 Non-Hispanic/Non-Latino  
(Please select the primary ethnicity that you identify with.)

Race

- American Indian / Alaska Native  
 Asian  
 Black or African American  
 Hawaiian / Pacific Islander  
 White or Caucasian  
 Other  
(Please select the primary race(s) that you identify with.)

If other, please specify

(If other is selected, please state any other race that you identify with.)

**The following questions are about your school.**

What type of school do you work at?

- Public  
 Charter  
 Private / Parochial  
 (Please select the type of school.)

Public School District

- Amphitheater School District  
 Catalina Foothills Unified School District  
 Continental Elementary District  
 Flowing Wells Unified District  
 Marana Unified School District  
 Sahuarita Unified School District  
 Sunnyside Unified School District  
 Tanque Verde Unified School District  
 Tucson Unified School District  
 Vail Unified School District  
 (Which public school district do you work for in Pima County, Arizona?)

What is the name of the school in which you spend the majority of time working at?

\_\_\_\_\_

What grade levels does the school serve?

\_\_\_\_\_

Do you spend your time working at multiple schools?

- Yes  
 No

What is your position / title at the school(s)?

\_\_\_\_\_

Do you have a current nursing license?

- Yes  
 No  
 ((i.e., LPN, RN, DNP))

If yes, please specify:

- Doctor of Nursing Practitioner or Nurse Practitioner (DNP or NP)  
 Registered Nurse (RN)  
 Licensed Practical Nurse (LPN)  
 Other

If other, please specify:

\_\_\_\_\_

How many years of school nursing experience do you have as of May 2018?

- Less than 1 year  
 2-5 years  
 5-10 years  
 Over 10 years

Were you designated as one of the school personnel trained to administer the stock inhaler at your school during the 2017-2018 academic year?

- Yes  
 No  
 Do not know / Declined to answer

**The following set of questions are about the Stock Albuterol Inhaler Training:**

Did you complete the Stock Inhaler for School Personnel Training?

- Yes
- No
- Do not know / Declined to answer

**For the following question, please rate your level of agreement with that statement (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree) regarding the Stock Albuterol Inhaler Training.**

Gaining access to the Stock Albuterol Inhaler Training was easy.

(1) Strongly Disagree    (2) Disagree    (3) Neutral    (4) Agree    (5) Strongly Agree

Enrolling in the Stock Albuterol Inhaler Training was easy.

(1) Strongly Disagree    (2) Disagree    (3) Neutral    (4) Agree    (5) Strongly Agree

The length of time it took to complete the Stock Albuterol Inhaler Training was appropriate.

(1) Strongly Disagree    (2) Disagree    (3) Neutral    (4) Agree    (5) Strongly Agree

Did you feel that the Stock Albuterol Inhaler Training adequately prepared you for recognizing the signs and symptoms of respiratory distress?

Yes  
 No  
 Do not know / Declined to answer

If no, or do not know / declined to answer, please explain:

Did you feel that the Stock Albuterol Inhaler training adequately prepared you for administering the stock inhaler to an individual experiencing respiratory distress?

Yes  
 No  
 Do not know / Declined to answer

If no, or do not know / declined to answer, please explain:

**For the following question, please rate your level of confidence with that statement (1 = No Confidence, 2 = Slight Confidence, 3 = Moderate Confidence, 4 = High Confidence, and 5 = Very High Confidence) regarding the Stock Albuterol Inhaler Training.**

How confident are you with managing a respiratory emergency after completing the Stock Albuterol Inhaler Training?

- (1) No confidence    (2) Slight Confidence    (3) Moderate Confidence    (4) High Confidence  
 (5) Very High Confidence

---

Do you have any suggestions on how to improve the Stock Albuterol Inhaler Training?

**The last section will ask you questions about the Stock Albuterol Inhaler for Schools Program.**

During the 2017-2018 academic year, did you administer the Stock Albuterol Inhaler to a child who was experiencing respiratory distress?

- Yes
- No

**For the following questions, please rate your level of confidence with that statement (1 = No Confidence, 2 = Slight Confidence, 3 = Moderate Confidence, 4 = High Confidence, and 5 = Very High Confidence) regarding the Stock Albuterol Inhaler Training.**

Using the 5-point Likert scale, please rate how confident you felt with administering the Stock Albuterol Inhaler during the 2017-2018 academic year.

- (1) No confidence    (2) Slight Confidence    (3) Moderate Confidence    (4) High Confidence  
 (5) Very High Confidence

Using the 5-point Likert scale, please rate how confident you felt with following the Stock Inhaler Protocol & Action Plan.

- (1) No confidence    (2) Slight Confidence    (3) Moderate Confidence    (4) High Confidence  
 (5) Very High Confidence

During the 2017-2018 academic year, did you administer the Stock Albuterol Inhaler to an adult (person 18-years or older and who is NOT a student), who was experiencing respiratory distress?

- Yes  
 No  
 Do not know / Declined to answer

During the 2017-2018 academic year, were there any situation(s) or times that 9-1-1 or Emergency Medical Services (EMS) were contacted because a child or adult experienced respiratory distress?

- Yes  
 No  
 Do not know / Declined to answer

If yes, please describe any details regarding this situation and why 9-1-1 or EMS was called:

Do you feel that the Pima County Stock Inhaler for Schools program was beneficial during the 2017-2018 academic year?

- Yes  
 No  
 Do not know / Declined to answer

Did the Stock Albuterol Inhaler program make any positive difference for you or your school?

- Yes  
 No  
 Do not know / Declined to answer

If yes, please describe any positive difference the Stock Inhaler for Schools program provided you or your school:

Did the Stock Albuterol Inhaler program make any negative difference for you or your school?

- Yes  
 No  
 Do not know / Declined to answer

If yes, please describe any negative difference the Stock Inhaler for Schools program provided you or your school:

---

During the 2017-2018 academic year, were there any complaints from parents, other school staff, students, EMS providers or other health care providers regarding the Stock Inhaler for Schools program?

- Yes
- No
- Do not know / Declined to answer

---

If yes, please provide as much detail as possible regarding any complaints received as a result of the Stock Inhaler for Schools program in your school.

---

What recommendations do you have for improving this program in future years?

**For the following question, please rate your level of agreement with that statement (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree) regarding the Stock Albuterol Inhaler Training.**

I would recommend this program at my school or other schools for the 2018-2019 academic year?

(1) Strongly Disagree    (2) Disagree    (3) Neutral    (4) Agree    (5) Strongly Agree

Before the 2017-2018 Pima County Stock Inhaler for Schools program, did your school have an official emergency protocol for children with asthma or individuals experiencing respiratory distress?

Yes  
 No  
 Do not know / Declined to answer

Do you think the presence of the Stock Albuterol Inhaler in your school reduced the number of children who brought their personal inhaler to school?

Yes  
 No  
 Do not know / Declined to answer

Did you notify parents about the Stock Inhaler for Schools program?

Yes  
 No  
 Do not know / Declined to answer

Do you plan to continue the Stock Inhaler for Schools program in future years?

Yes, if medication and supplies are provided at no cost  
 Yes, will continue even if medication and supplies are NOT provided  
 No

If no, why not?

**Qualitative Questions for One-on-one /telephone interviews | Pima County Stock Inhaler for Schools Program**

---

**Record ID:** \_\_\_\_\_

*This is the source documentation that will be included with the consent form.*

**Demographic Information:**

1. First Name: \_\_\_\_\_

2. Middle Initial: \_\_\_\_\_

3. Last Name: \_\_\_\_\_

4. E-mail Address: \_\_\_\_\_

5. Age Range:

18-30 years

31-45 years

46-65 years

65+ years

6. Gender:

Male

Female

Other (X)

7. Ethnicity:

Hispanic / Latino

Non-Hispanic / Non-Latino

8. Race:

American Indian / Alaska Native

Asian

Black or African American

Native Hawaiian / other Pacific Islander

White or Caucasian

Other

8a. [Branching logic] If other please specify: \_\_\_\_\_

**School Information:**

1. Type of school:

Public

[Branching logic] If Public, please specify which public-school district you spent the majority of your time working at during the 2017-2018 academic year:

- Amphitheater School District
- Catalina Foothills Unified School District
- Continental Elementary District
- Flowing Wells Unified School District
- Marana Unified School District
- Sahuarita Unified School District
- Sunnyside Unified School District
- Tanque Verde Unified School District
- Tucson Unified School District
- Vail Unified School District

Charter

Private / Parochial

2. What is the name of the school in which you spend the majority of your time working at?

\_\_\_\_\_

2a. What are the grades served at this school? \_\_\_\_\_

3. Did you spend your time working at multiple schools?

Yes       No

4. What is your position/title at the school(s)?

\_\_\_\_\_

5. Do you have a current nursing license?

Yes       No

5a. [Branching logic] If yes, please specify:

- Doctor of Nursing Practitioner or Nurse Practitioner (i.e., DNP or NP)
- Registered Nurse (e.g., RN)
- Licensed Practical Nurse (e.g., LPN)
- Other

5b. [Branching logic] If other, please specify:

---

## **Pima County Stock Inhaler for Schools program Interview guide for school personnel:**

### **1. Introduce self and interview objective:**

*A. My name is Ashley Lowe and I am a doctoral student at the University of Arizona College of Public Health. My focus of study is improving the health of children and increasing access to life saving drugs such as albuterol (which is used to treat respiratory distress). Because children spend the majority of their time in the school setting, schools provide a logical place to accomplish these goals. Currently, I am evaluating the 2017-2018 Stock Inhaler for Schools program which provided each school in Pima County, Arizona with a stock inhaler and program resources to treat emergency respiratory distress.*

*B. The objective of this study is to interview trained school staff (i.e., school administrators, office staff, health assistants, & nurses) to understand the perspectives of the school staff with implementing the 2017-2018 Stock Inhaler for Schools program.*

### **2. Set expectation:**

*A. I have 7 main open-ended questions that I will ask you. In addition, I may ask you some questions that expand on these 7 main questions. The additional questions will be used to help facilitate a deeper understanding of your perspective regarding the Stock Inhaler for Schools program. In order to reflect on the answers you provide me, I will be recording our conversation and analyzing your responses to each question, along with the responses from other school personnel in other school districts across Pima County, Arizona. Our intent is to publish what we learn regarding this program so that we can create greater knowledge in the scientific literature regarding the stock inhaler program in order to inform the fields of public health, school nursing and education. This information may impact future programs and policies aimed at improving access to quick relief medication (e.g., albuterol) for children and adults in the school setting. Importantly, your personal information and the responses that you provide me will be protected. I will not personally identify any of your personal information or the personal information of your fellow co-workers, students and their families. First, I will ask you some basic background information and then I will continue on to the main questions.*

**Qualitative Interview Questions:**

1. Have you ever experienced any situation where a child was having respiratory distress? What was that like?

1a. In the past, has there been any problems or issues of a child or adult having respiratory distress at your school? What was that like? (Probe – Why was that a problem/issue?)

1b. Did any of these situations prompt the administration of rescue inhaler medication to the affected individual? If so, what happened?

1c. What about calling 9-1-1 or having the individual transported to the nearest hospital via EMS? If so, what happened?

2. How did you first find out about the Stock Inhaler for Schools program?

2a. What were your first thoughts/concerns about the program?

3. What challenges did you experience with implementing this program during the 2017-2018 academic year?

3a. What things made starting this program and using the stock inhaler easy?

3b. How has the Stock Inhaler for Schools program affected your care of students with asthma/breathing problems? (Probe -- Before the program/After the program.)

4. Would you describe yourself as confident with administering the stock inhaler to a child who is experiencing respiratory distress? Why or why not?

5. What were your personal experiences with administering the stock inhaler to a child/individual?

5a. What were your personal experiences with following the Stock Inhaler Protocol & Action Plan? (i.e., was it easy or hard to use?)

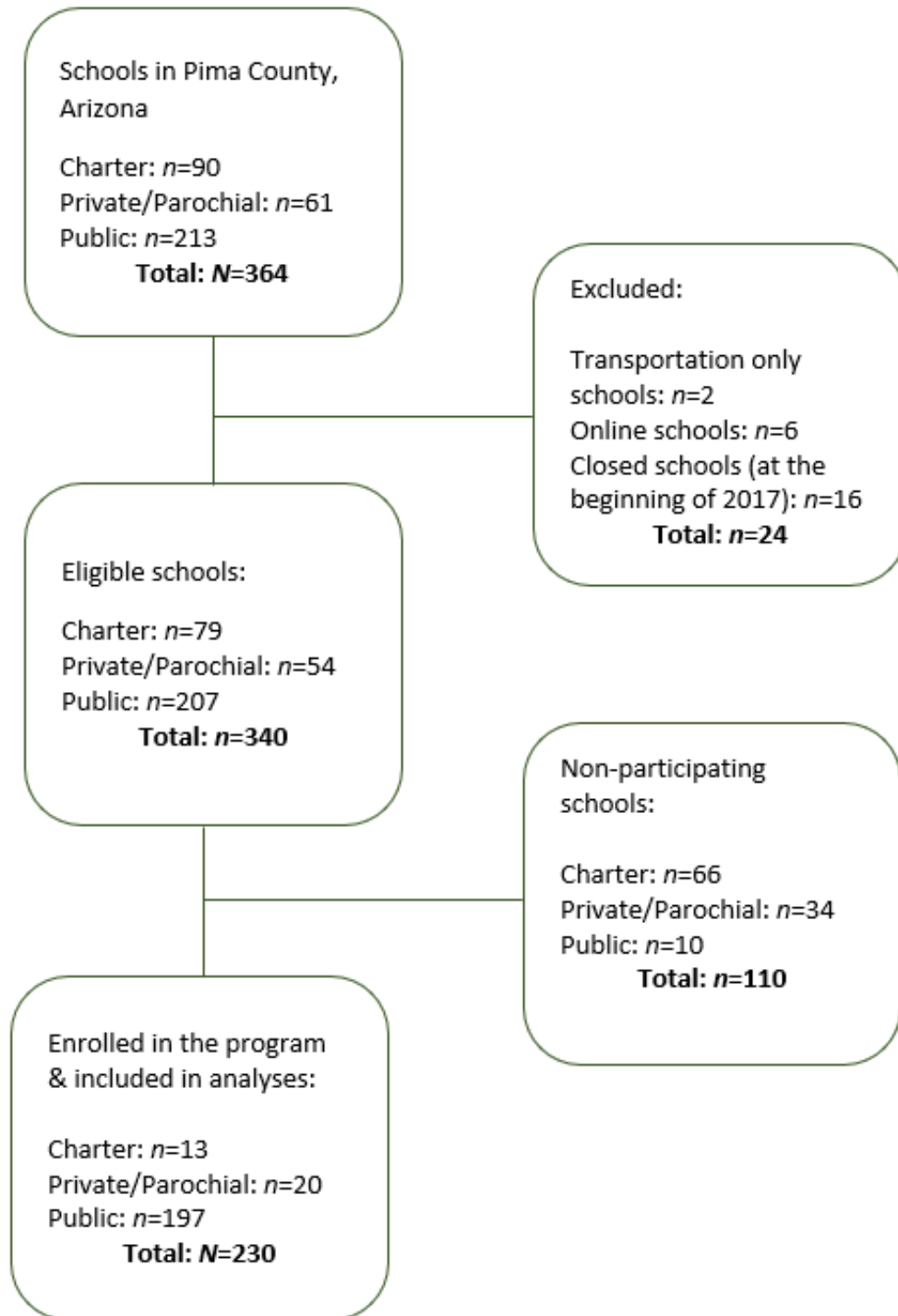
5b. Do you feel you were able to properly document the stock inhaler usages in the documentation log? Why or why not?

6. What are your recommendations for improving this program in future years?

7. Is there anything else regarding the Pima County Stock Inhaler for Schools program you would like to add?

**APPENDIX B**

*(Additional Figures and Tables)*



**Figure 1.** Flow of participants through the Pima County Stock Inhaler for Schools Program, 2017-2018.

**Table 1.** Baseline characteristics of eligible schools in Pima County, Arizona, 2017-2018.

School Characteristic	Total N=340	Participating Schools n=230	Non-participating Schools n=110	P Value
<b>School Type, n%</b>				0.007
Charter	79 (23.2)	13 (5.7)	66 (60.0)	
Private/Parochial	54 (15.9)	20 (8.7)	34 (30.9)	
Public	207 (60.9)	197 (85.7)	10 (9.1)	
<b>Grades Served<sup>b,c</sup>, n%</b>				0.000
Elementary: Pre-Kindergarten-5 <sup>th</sup> /6 <sup>th</sup>	163 (47.9)	111 (48.3)	52 (47.3)	
Middle: 6 <sup>th</sup> -8 <sup>th</sup>	29 (8.5)	27 (11.7)	2 (1.8)	
High School: 9 <sup>th</sup> -12 <sup>th</sup>	52 (15.3)	36 (15.7)	16 (14.5)	
Other: Pre-Kindergarten-12 <sup>th</sup>	96 (28.2)	56 (24.4)	40 (36.4)	
<b>Enrollment Total<sup>b,c</sup>, n%</b>				0.000
≥750 students	50 (14.7)	43 (18.9)	7 (6.4)	
501-749	80 (23.5)	74 (32.2)	6 (5.5)	
251-500 students	100 (29.4)	81 (35.2)	19 (17.3)	
≤250 students	110 (32.4)	32 (13.9)	78 (70.9)	
<b>Ethnicity<sup>b,c</sup>, mean %, SD</b>				
Hispanic/Latino	-	51.6 (23.9)	41.1 (27.4)	-
<b>National School Lunch Program (NSLP)<sup>b,c</sup>, mean %, SD</b>				
	-	56.3 (26.8)	75.5 (22.0)	-
<b>Number of Students Served, Total, n%</b>	163,664	134,251	29,413	-

<sup>a</sup>National School Lunch Program: Federally assisted meal program operating in public and non-profit private schools which served as a proxy measure for socio-economic status (SES).

<sup>b</sup>Percentages may not equal zero as a result of rounding.

<sup>c</sup>Missing Data: Ethnicity (Non-participating): n=36 (29.3%); NSLP (Non-participating): n=84 (68.3%); NSLP (Participating): n=19 (8.3%); All other missing data =<5%.

**Table 2.** Stock inhaler events among schools enrolled in the Pima County Stock Inhaler for Schools Program, 2017-2018.

Stock Inhaler Events	<i>n</i> % <sup>a,b</sup>	
<b>Total student enrollment (Dec. 1<sup>st</sup>, 2017), <i>n</i></b>	134,251	
<b>Total schools that reported using the stock inhaler, <i>n</i>%</b>	152	(66.1)
<b>Number of stock albuterol events, <i>n</i></b>	1,032	
<b>Gender, <i>n</i>%</b>		
Male	521	(52.6%)
Female	469	(47.4%)
<b>Race, <i>n</i>%</b>		
American Indian / Alaska Native	32	(3.1%)
Asian	10	(1.0%)
Black or African American	121	(11.7%)
Native Hawaiian / Pacific Islander	6	(0.6%)
White	426	(41.0%)
<b>Ethnicity, <i>n</i>%</b>		
Hispanic/Latino	480	(69.8%)
Non-Hispanic / Non-Latino	209	(30.3%)
<b>Asthma Diagnosis, <i>n</i>%</b>		
Known asthma diagnosis	810	(82.0%)
No known asthma diagnosis	121	(12.2%)
Do not know / Declined to answer	58	(5.8%)
<b>Puffs administered, Mean (SD)</b>	2.7	(1.9)
<b>Disposition Status, <i>n</i>%</b>		
Returned to class	772	(84.0%)
Sent home with caregiver	142	(15.4%)
Called 9-1-1 and no EMS transport	1	(0.1%)
Called 9-1-1 and transported via EMS	5	(0.5%)

<sup>a</sup>Percentages may not add up to 100% as a result of rounding.  
<sup>b</sup>Missing data: All missing data <5% except: Race: *n*=437 (57.7%); Ethnicity: *n*=343 (33.2%); Disposition: *n*=114(11.4)%.

**Table 3.** Stock inhaler events by grades served among schools that reported a stock inhaler use, 2017-2018.

Stock Inhaler Events	Total N=152	Grades Served at Schools				P Value
		Pre-K-5 <sup>th</sup> /6 <sup>th</sup> n=79	6 <sup>th</sup> -8 <sup>th</sup> n=19	9 <sup>th</sup> -12 <sup>th</sup> n=22	Other n=32	
No. of stock albuterol events, <i>n</i>	1,032	443	219	196	174	-
No. of stock albuterol events per 1,000 students, per school year, mean, <i>SD</i>	8.9 (13.7)	9.5 (14.3)	10.8 (9.9)	8.3 (15.4)	7.1 (10.4)	0.60
Disposition Status <sup>a,b</sup> , <i>n</i> %	915	400	196	176	143	0.04
Returned to class	769 (84.0)	329 (72.5)	176 (89.8)	152 (86.4)	112 (78.3)	-
Sent home with caregiver	140 (15.3)	68 (17.0)	19 (9.7)	23 (13.1)	30 (21.0)	-
Called 9-1-1 and no EMS transport	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.7)	-
Called 9-1-1 and transported via EMS	5 (0.5)	3 (0.8)	1 (0.5)	1 (0.6)	0 (0.0)	-

<sup>a</sup>Percentages may not add up to 100% as a result of rounding.

<sup>b</sup>Missing data: Disposition Status: PreK-5<sup>th</sup>/6<sup>th</sup>: *n*=43 (9.7%); 6<sup>th</sup>-8<sup>th</sup>: *n*=23 (10.5%); 9<sup>th</sup>-12<sup>th</sup>: *n*=20 (10.2%); Other: *n*=31 (17.8%).

**Table 4.** Stock inhaler events by type of school among schools that reported a stock inhaler use, 2017-2018.

Stock Inhaler Events	Total N=152	School Type			P Value
		Charter n=5	Private/Parochial n=7	Public n=140	
No. of stock albuterol events <sup>a</sup> , <i>n</i>	1,032	16	25	991	-
No. of stock albuterol events per 1,000 students, per school year, mean, <i>SD</i>	8.9 (13.7)	4.6 (7.8)	5.6 (12.1)	9.5 (13.5)	0.24
Disposition status <sup>a,b</sup> , <i>n</i> %	915	13	23	879	0.59
Returned to class	769 (84.0%)	10 (76.9%)	21 (91.3%)	738 (84.0%)	-
Sent home with caregiver	140 (15.3%)	3 (23.1%)	2 (8.7%)	135 (15.4%)	-
Called 9-1-1 and no EMS transport	1 (0.1%)	0 (0%)	0 (0%)	1 (0.1%)	-
Called 9-1-1 and transported via EMS	5 (0.5%)	0 (0%)	0 (0%)	5 (0.6%)	-

<sup>a</sup>Percentages may not add up to 100% as a result of rounding.

<sup>b</sup>Missing data: Disposition status: Charter: *n*=3 (23.1%); Private/Parochial: *n*=2 (8.7%); Public: *n*=112 (11.3%).

**Table 5.** Stock inhaler events by nursing licensure among schools that reported a stock inhaler use, 2017-2018.

Stock Inhaler Events	Total N=152	Nurse Licensure at Schools			P Value
		Nurse n=16	Nurse-supervised n=114	Unlicensed n=22	
No. of stock albuterol events, <i>n</i>	1,032	180	757	95	-
No. of stock albuterol events per 1,000 students, per school year, mean, <i>SD</i>	8.9 (13.7)	7.0 (13.8)	11.8 (14.0)	3.8 (9.1)	0.0001
Disposition Status, <i>n</i> %	915	166	667	82	0.65
Returned to class	769 (84.0)	136 (81.9)	559 (83.8)	74 (90.2)	-
Sent home with caregiver	140 (15.3)	29 (17.5)	103 (15.4)	8 (9.6)	-
Called 9-1-1 and no EMS transport	1 (0.1)	0 (0.0)	1 (0.1)	0 (0.0)	-
Called 9-1-1 and transported via EMS	5 (0.5)	1 (0.6)	4 (0.6)	0 (0.0)	-

<sup>a</sup>Percentages may not add up to 100% as a result of rounding.  
<sup>b</sup>Missing data: Nurse: *n*=14 (7.8%); Nurse-supervised: *n*=90 (11.9%); Unlicensed *n*=13 (13.7%).

**Table 6.** Itemized program cost for the Pima County Stock Inhaler for Schools Program, 2017-2018.

Supplies	Quantity	Cost per Unit	Total Cost
60-dose albuterol	275	\$22.00	\$6,050.00
LiteAires®	2,500	\$2.95	\$7,375.00
Marketing materials	250	\$1.85	\$135.50
Business cards	1 Box	-	\$11.00
Travel	-	-	\$405.00
(Mileage reimbursement <sup>a</sup> )	-	-	\$100.00
Postage	-	-	\$100.00
School kits	275	\$14.50	\$3,986.49
Copy services (Letters <sup>b</sup> )	275	\$4.79	\$1,317.25
Staffing (.5FTE <sup>c</sup> & 30% ERE <sup>d</sup> included)	1	-	23,400.00
<b>Total Program Cost:</b>			<b>\$42,780.24</b>
<b>Total Program Cost Per School:</b>			<b>\$155.56</b>

<sup>a</sup>Mileage Reimbursement was 44.5 cents per mile in accordance with the Arizona Department of Administration.

<sup>b</sup>Outreach letters sent to each school in Pima County, Arizona during July 2017.

<sup>c</sup>FTE: Full-time equivalent (.5FTE is 20 hours per week).

<sup>d</sup>ERE: Employee related expenses.

**Table 7.** Demographic characteristics of trained personnel who completed the web-based post-evaluation survey after participation in the Pima County Stock Inhaler for Schools Program, 2017-2018.

Demographic Characteristics	<i>n</i> <i>n=267</i>	<i>%</i>
<b>Age Range, Years</b>		
18-30 years	18	(6.8%)
31-45 years	80	(30.2%)
46-65 years	160	(60.4%)
>65 years	7	(2.6%)
<b>Gender</b>		
Male	10	(3.7%)
Female	252	(95.5%)
Non-binary (e.g., X)	2	(0.8%)
<b>Race</b>		
American Indian / Alaska Native	7	(2.6%)
Asian	4	(1.5%)
Black or African American	6	(2.3%)
Pacific Islander / Native Hawaiian	3	(1.1%)
White	218	(81.7%)
Other	29	(10.9%)
<b>Ethnicity</b>		
Hispanic / Latino	108	(40.8%)
<b>Type of School</b>		
Public	250	(94.7%)
Charter	3	(1.1%)
Private / Parochial	11	(4.2%)
<b>Nursing License</b>		
Current License (e.g., DNP, FNP, RN, LPN)	78	(29.6%)
Unlicensed	186	(70.5%)
<b>Nursing Experience, Years<sup>a</sup></b>		
<1 year	8	(10.3%)
1-5 years	25	(32.1%)
5-10 years	18	(23.1%)
>10 years	27	(34.6%)

<sup>a</sup>Percentages may not add up to 100% as a result of rounding.  
<sup>b</sup>Missing data: All missing data <5%.

**Table 8.** Web-based post-evaluation survey administered to trained personnel who participated in the Pima County Stock Inhaler for Schools Program, 2017-2018.

Question	Mean (SD) n=267 <sup>b</sup>	
<b>Online training<sup>a</sup></b>		
Gaining access to the online training curriculum was easy.	3.86	(1.03)
Enrolling in the Stock Albuterol Inhaler Training for School Personnel was easy.	3.85	(1.02)
The length of time the online training to complete was appropriate.	4.02	(0.87)
How confident are you with managing a respiratory emergency after completing the stock inhaler training?	4.21	(0.70)
<b>Confidence</b>		
Please rate how confident you felt administering the stock inhaler during the 2017-2018 academic year.	4.41	(.58)
Please rate how confident you felt using the stock inhaler protocol & action plan	4.37	(.60)
<b>Overall satisfaction</b>		
I would recommend this program at my school or other schools for the next academic year.	4.54	(.76)

<sup>a</sup>Online training curriculum: Stock Inhaler Training for School Personnel developed by the Western Region Public Health Training Center and the American Lung Association - Tucson.

<sup>b</sup>Missing data: All missing data <5%.

**Table 9.** Web-based post-evaluation survey administered to trained personnel who participated in the Pima County Stock Inhaler for Schools Program, 2017-2018.

Question	n%
<b>Online training<sup>a</sup>, n%</b>	
<i>Do you feel the stock inhaler training adequately prepared you for recognizing the signs &amp; symptoms of respiratory distress?</i>	
Yes	253 (98.8%)
<i>Did you feel the stock inhaler training adequately prepared you for administering the stock inhaler to an individual experiencing respiratory distress?</i>	
Yes	252 (98.1%)
<b>Confidence, n%<sup>b</sup></b>	
<i>Did you administer the stock inhaler to a child experiencing respiratory distress?</i>	
Yes	194 (73.5%)
<i>Before the 2017-2018 Stock Inhaler for Schools Program, did your school have an official emergency protocol for children or individuals experiencing respiratory distress?</i>	
Yes	158 (60.1%)
No	59 (22.4%)
Do not know / Declined to answer	46 (17.5%)
<i>Do you think the Stock Inhaler for Schools Program reduced the number of children who brought their personal rescue inhaler from schools?</i>	
Yes	34 (12.9%)
No	196 (74.5%)
Do not know / Declined to answer	33 (12.6%)
<i>Did you notify parents about the stock inhaler program?</i>	
Yes	93 (35.4%)
No	129 (49.1%)
Do not know / Declined to answer	41 (15.6%)

<sup>a</sup>Online training curriculum: Stock Inhaler Training for School Personnel developed by the Western Region Public Health Training Center and the American Lung Association - Tucson.

<sup>b</sup>Percentages may not add up to 100% as a result of rounding.

<sup>c</sup>Missing data: All missing data <5%.

<sup>d</sup>Questions based on "Yes", "No", & "Do not know / Declined to answer".

**Table 10.** Web-based post-evaluation survey administered to trained personnel who reported their satisfaction with the Pima County Stock Inhaler for Schools Program, 2017-2018.

Question	n%
<b>Overall Satisfaction, n%</b>	
<i>Do you feel the Stock Inhaler for Schools Program was beneficial to your school?</i>	
Yes	264 (93.2%)
No	4 (1.5%)
Do not know / Declined to answer	14 (5.3%)
<i>Did the stock inhaler make any positive difference in your school?</i>	
Yes	204 (77.3%)
No	19 (7.2%)
Do not know / Declined to answer	41 (15.5%)
<i>Did the stock inhaler make any negative difference in your school?</i>	
Yes	34 (12.9%)
No	196 (74.5%)
Do not know / Declined to answer	33 (12.6%)
<i>Were there any complaints from parents', other school staff, students, EMS providers or health care providers regarding the Stock Inhaler for Schools program that you are aware of?</i>	
Yes	5 (1.9%)
No	247 (93.6%)
Do not know / Declined to answer	14 (4.6%)
<i>Do you plan on continuing the Stock Inhaler for Schools Program in future years?</i>	
Yes	235 (89.7%)
No	25 (9.5%)
Do not know / Declined to answer	2 (0.8%)

<sup>a</sup>Percentages may not add up to 100% as a result of rounding.

<sup>b</sup>Missing data: All missing data <5%.

<sup>c</sup>Questions based on "Yes", "No", & "Do not know / Declined to answer".

## **Appendix C Relevant STATA Code**

```
import excel "C:\Users\aaray\Desktop\Non Participating
Schools_MSPHThesis_Lowe_20190305.xlsx", sheet("Sheet1") firstrow clear

tabulate gradesserved

summarize nostudents, detail

drop if othertype=="Online"
drop if othertype=="Closed"

egen nostudents_n=cut (nostudents), at (0,250,251,500,501,750,751,9999)
tab nostudents_n

summarize percentminority, detail

import excel
"C:\Users\aaray\Desktop\BaselineEnrollmentForm_Clean_MSPHThesis_Lowe_20190305.xlsx",
sheet("BaselineEnrollmentForm_Clean_MS") firstrow clear

describe

mdesc

tabulate schooltype

g prek_n = .
replace prek_n = 0 if prek=="Unchecked"
replace prek_n = 1 if prek=="Checked"

g kinder_n=.
replace kinder_n=0 if kinder=="Unchecked"
replace kinder_n=1 if kinder=="Checked"

g first_n=.
replace first_n=0 if first=="Unchecked"
replace first_n=1 if first=="Checked"

g second_n=.
replace second_n=0 if second=="Unchecked"
replace second_n=1 if second=="Checked"

g third_n=.
replace third_n=0 if third=="Unchecked"
replace third_n=1 if third=="Checked"

g fourth_n=.
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replace fourth_n=1 if fourth=="Checked"

g fifth_n=.
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replace fifth_n=1 if fifth=="Checked"

g sixth_n=.
replace sixth_n=0 if sixth=="Unchecked"
replace sixth_n=1 if sixth=="Checked"
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g seventh_n=.
replace seventh_n=0 if seventh=="Unchecked"
replace seventh_n=1 if seventh=="Checked"

g eighth_n=.
replace eighth_n=0 if eighth=="Unchecked"
replace eighth_n=1 if eighth=="Checked"

g ninth_n=.
replace ninth_n=0 if ninth=="Unchecked"
replace ninth_n=1 if ninth=="Checked"

g tenth_n=.
replace tenth_n=0 if tenth=="Unchecked"
replace tenth_n=1 if tenth=="Checked"

g eleventh_n=.
replace eleventh_n=0 if eleventh=="Unchecked"
replace eleventh_n=1 if eleventh=="Checked"

g twelfth_n=.
replace twelfth_n=0 if twelfth=="Unchecked"
replace twelfth_n=1 if twelfth=="Checked"

gen g=prek_n
gen g0=kinder_n
gen g1=first_n
g g2=second_n
g g3=third_n
g g4=fourth_n
g g5=fifth_n
g g6=sixth_n
g g7=seventh_n
g g8=eighth_n
g g9=ninth_n
g g10=tenth_n
g g11=eleventh_n
g g12=twelfth_n

egen allgrades = concat(g g0 g1 g2 g3 g4 g5 g6 g7 g8 g9 g10 g11 g12)

tab allgrades

tab schoolname if allgrades=="00000000000011" //ok
tab1 schoolname recordid if allgrades=="00000000001101"
replace g11=1 if recordid==163
replace g11=1 if recordid==90
tab1 schoolname recordid if allgrades=="01011110000000"
replace g1=1 if recordid==105
tab1 schoolname recordid if allgrades=="01110111110000"
replace g3=1 if recordid==98
tab1 schoolname recordid if allgrades=="00000011110000"
replace g5=0 if recordid==204
tab1 schoolname recordid if allgrades=="00000000001110"
replace g12=1 if recordid==21
tab1 schoolname recordid if allgrades=="00000111110000"
tab1 schoolname recordid if allgrades=="00001111110000"
tab1 schoolname recordid if allgrades=="00011111110000"
tab1 schoolname recordid if allgrades=="00011111110000"
tab1 schoolname recordid if allgrades=="00000000000000"

drop allgrades
egen allgrades = concat(g g0 g1 g2 g3 g4 g5 g6 g7 g8 g9 g10 g11 g12)

```

```

tab allgrades

g allgradesr=.
replace allgradesr=4 if allgrades=="00000000000000"
replace allgradesr=3 if allgrades=="00000000000001"
replace allgradesr=3 if allgrades=="00000000000101"
replace allgradesr=3 if allgrades=="00000000000110"
replace allgradesr=3 if allgrades=="00000000000111"
replace allgradesr=2 if allgrades=="00000000011000"
replace allgradesr=2 if allgrades=="00000001110000"
replace allgradesr=4 if allgrades=="00000001111111"
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replace allgradesr=4 if allgrades=="01111111110000"
replace allgradesr=4 if allgrades=="01111111111111"
replace allgradesr=1 if allgrades=="10000000000000"
replace allgradesr=1 if allgrades=="11100000000000"
replace allgradesr=1 if allgrades=="11110000000000"
replace allgradesr=1 if allgrades=="11111100000000"
replace allgradesr=1 if allgrades=="11111110000000"
replace allgradesr=4 if allgrades=="11111111000000"
replace allgradesr=4 if allgrades=="11111111100000"
replace allgradesr=4 if allgrades=="11111111111111"
lab def allgradesr 1"PreK-5th/6th"2"6th-8th"3"9th-12th"4"Other"
lab val allgradesr allgrades
lab var allgradesr "Type of school"
tab allgradesr

tabi 11 52 \ 27 2 \ 36 16 \ 56 40, chi2 exact

egen nostudents_n=cut (nostudents), at (0,250,251,500,501,750,751,9999)
tab nostudents_n

summarize minoritypercent, detail
summarize nslppercent, detail

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use "C:\Users\aaray\Desktop\Run_BaselineEnrollment_2019.03.20.dta", clear

import excel
"C:\Users\aaray\Desktop\StockAlbuterolDocumentationLog_WithDOB_MSPHThesis_Lowe_2019030
5.xlsx", sheet("StockAlbuterolDocumentationLog_") firstrow clear

reshape wide schoolname - Complete, i(recordid) j(repeatinstance)

sort recordid

merge 1:1 recordid using

```

```
save "C:\Users\aaray\Desktop\Merged_Run_Baseline Enrollment & Documentation MSPH
Thesis_Lowe_2019.03.20.dta"
use "C:\Users\aaray\Desktop\Merged_Run_Baseline Enrollment & Documentation MSPH
Thesis_Lowe_2019.03.20.dta", clear
```

```
use "C:\Users\aaray\Desktop\Merged_Run_Baseline Enrollment & Documentation MSPH
Thesis_Lowe_2019.03.20.dta", clear
```

```
drop if recordid==231
```

```
tab1 disp*
```

```
tab disposition1,m
```

```
tab allgrades
```

```
drop allgradesr
```

```
g allgradesr=allgrades
```

```
tab allgradesr
```

```
replace allgradesr="11-12" if allgrades=="00000000000011"
replace allgradesr="9-12" if allgrades=="00000000001111"
replace allgradesr="7-8" if allgrades=="00000000110000"
replace allgradesr="6-8" if allgrades=="00000001110000"
replace allgradesr="4-8" if allgrades=="00000111110000"
replace allgradesr="3-8" if allgrades=="00001111110000"
replace allgradesr="2-8" if allgrades=="00011111110000"
replace allgradesr="K-3" if allgrades=="01111000000000"
replace allgradesr="K-4" if allgrades=="01111100000000"
replace allgradesr="K-5" if allgrades=="01111110000000"
replace allgradesr="K-6" if allgrades=="01111111000000"
replace allgradesr="K-7" if allgrades=="01111111100000"
replace allgradesr="K-8" if allgrades=="01111111110000"
replace allgradesr="K-12" if allgrades=="01111111111111"
replace allgradesr="PK-1" if allgrades=="11100000000000"
replace allgradesr="PK-5" if allgrades=="11111110000000"
replace allgradesr="PK-6" if allgrades=="11111110000000"
replace allgradesr="PK-7" if allgrades=="11111111100000"
replace allgradesr="PK-12" if allgrades=="11111111111111"
```

```
list allgradesr if recordid==148
```

```
g recodedgrade148=allgradesr
```

```
replace recodedgrade148="K-8" if recordid==148
```

```
tab allgradesr
```

```
g allgradesnum=.
```

```
replace allgradesnum=1 if allgradesr== "PK-1"
replace allgradesnum=2 if allgradesr== "PK-5"
replace allgradesnum=3 if allgradesr== "PK-6"
replace allgradesnum=4 if allgradesr== "PK-7"
replace allgradesnum=5 if allgradesr== "K-3"
replace allgradesnum=6 if allgradesr== "K-4"
replace allgradesnum=7 if allgradesr== "K-5"
replace allgradesnum=8 if allgradesr== "K-6"
replace allgradesnum=9 if allgradesr== "K-7"
replace allgradesnum=10 if allgradesr== "K-8"
replace allgradesnum=11 if allgradesr== "2-8"
replace allgradesnum=12 if allgradesr== "3-8"
replace allgradesnum=13 if allgradesr== "4-8"
replace allgradesnum=14 if allgradesr== "6-8"
replace allgradesnum=15 if allgradesr== "7-8"
```

```

replace allgradesnum=16 if allgradesr== "9-12"
replace allgradesnum=17 if allgradesr== "11-12"
replace allgradesnum=18 if allgradesr== "PK-12"
replace allgradesnum=19 if allgradesr== "K-12"
lab def allgradesnum ///
1 "PK-1" ///
2 "PK-5" ///
3 "PK-6" ///
4 "PK-7" ///
5 "K-3" ///
6 "K-4" ///
7 "K-5" ///
8 "K-6" ///
9 "K-7" ///
10 "K-8" ///
11 "2-8" ///
12 "3-8" ///
13 "4-8" ///
14 "6-8" ///
15 "7-8" ///
16 "9-12" ///
17 "11-12" ///
18 "PK-12" ///
19 "K-12"
lab val allgradesnum allgradesnum
tab allgradesnum

g recodedgrades=4
replace recodedgrades=1 if allgradesnum==1 | allgradesnum==2 | allgradesnum==3
|allgradesnum==5 |allgradesnum==6 |allgradesnum==7 |allgradesnum==8
replace recodedgrades=2 if allgradesnum==14 | allgradesnum==15
replace recodedgrades=3 if allgradesnum==16 | allgradesnum==17
lab def rg 1"PK-5th/6th"2"6th-8th"3"9th-12th"4"Other"
lab val recodedgrades rg
tab recodedgrades
tab allgradesnum recodedgrades

tab recodedgrades disposition1,r col chi

list schoolname disposition1 disposition2 disposition3 disposition4 disposition5
tab disposition1

tabulate schooltype

tab1 disposition*
order disposition*
ds disposition1 - disposition32
foreach var in `r(varlist)'{
g `var'_num=.
replace `var'_num=1 if `var'=="Returned to class"
replace `var'_num=2 if `var'=="Sent home with caregiver"
replace `var'_num=3 if `var'=="Called 9-1-1 and transported via EMS"
replace `var'_num=4 if `var'=="Called 9-1-1 and NO transport"
}

tab1 disposition*_num

*Returned to class
egen byte rtc = anycount(disposition1_num - disposition32_num), values(1)
list rtc disposition1 - disposition32

```

```

*Sent home
egen byte sh = anycount(disposition1_num - disposition32_num), values(2)

*called 911
egen byte c911 = anycount(disposition1_num - disposition32_num), values(3)

*called 911 not transported
egen byte c911not = anycount(disposition1_num - disposition32_num), values(4)
tab1 rtc sh c911 c911not

tab rtc
tab sh

tab c911

tab c911not

sum disposition*
order disposition*
ds disposition1 - disposition32
foreach var in `r(varlist)'{
g `var'_num=.
replace `var'_num=1 if `var'=="Returned to class"
replace `var'_num=2 if `var'=="Sent home with caregiver"
replace `var'_num=3 if `var'=="Called 9-1-1 and transported via EMS"
replace `var'_num=4 if `var'=="Called 9-1-1 and NO transport"
}

tab1 disposition1_num,m

sum disposition*

bysort recodedgrades:summ rtc,detail
bysort recodedgrades: summ sh, detail
bysort recodedgrades: summ c911, detail

bysort schooltype: tab rtc

bysort schooltype: tab sh
bysort schooltype: tab c911

bysort schooltype: tab c911not

g nursetype=.
replace nursetype=1 if recordid==21 | recordid==23 | recordid==65 | recordid==69 |
recordid==74 | recordid==96 | recordid==97 | recordid==107 | recordid==109 |
recordid==152 | recordid==154 | recordid==156 | recordid==163 | recordid==164 |
recordid==171 | recordid==213
replace nursetype=2 if recordid==14 | recordid==15 | recordid==18 | recordid==19 |
recordid==20 | recordid==24 | recordid==25 | recordid==26 | recordid==27 |
recordid==29 | recordid==30 | recordid==70 | recordid==72 | recordid==75 |
recordid==77 | recordid==78 | recordid==99
replace nursetype=2 if recordid==81 | recordid==82 | recordid==83 | recordid==84 |
recordid==86 | recordid==89 | recordid==100 | recordid==102 | recordid==103 |
recordid==104 | recordid==105 | recordid==106 | recordid==110 | recordid==111 |
recordid==112 | recordid==114 | recordid==101 | recordid==108
replace nursetype=2 if recordid==115 | recordid==116 | recordid==117 | recordid==118 |
recordid==119 | recordid==121 | recordid==122 | recordid==123 | recordid==124 |

```

```

recordid==125 | recordid==126 | recordid==127 | recordid==128 | recordid==129 |
recordid==113 | recordid==120 | recordid==131
replace nursetype=2 if recordid==130 | recordid==132 | recordid==133 | recordid==134 |
recordid==135 | recordid==136 | recordid==138 | recordid==139 | recordid==140 |
recordid==141 | recordid==142 | recordid==143 | recordid==144 | recordid==145 |
recordid==146 | recordid==148 | recordid==157
replace nursetype=2 if recordid==147 | recordid==149 | recordid==150 | recordid==153 |
recordid==155 | recordid==158 | recordid==159 | recordid==165 | recordid==166 |
recordid==167 | recordid==170 | recordid==172 | recordid==175 | recordid==176 |
recordid==161 | recordid==162 | recordid==168 | recordid==169
replace nursetype=2 if recordid==178 | recordid==179 | recordid==180 | recordid==181 |
recordid==182 | recordid==183 | recordid==193 | recordid==199 | recordid==200 |
recordid==201 | recordid==202 | recordid==204 | recordid==205 | recordid==206 |
recordid==173 | recordid==174 | recordid==177
replace nursetype=2 if recordid==207 | recordid==208 | recordid==209 | recordid==210 |
recordid==211 | recordid==217 | recordid==224 | recordid==226 | recordid==228 |
recordid==230
replace nursetype=3 if recordid==1 | recordid==2 | recordid==4 | recordid==8 |
recordid==9 | recordid==43 | recordid==44 | recordid==46
replace nursetype=3 if recordid==50 | recordid==52 | recordid==54 | recordid==56 |
recordid==57 | recordid==93 | recordid==94 | recordid==98
replace nursetype=3 if recordid==151 | recordid==187 | recordid==192 | recordid==222 |
recordid==45 | recordid==51

```

```
bysort nursetype: tab rtc
```

```

save "C:\Users\aaray\Desktop\Ready for Total Usage_Run_Merged_MSPH
Thesis_2019.03.20.dta"
use "C:\Users\aaray\Desktop\Ready for Total Usage_Run_Merged_MSPH
Thesis_2019.03.20.dta", clear

```

```

import excel "C:\Users\aaray\Desktop\Stock Inhaler Rates_MSPH
Thesis_Lowe_2019.03.28.xlsx", sheet("Sheet1") firstrow clear

```

```

tab gradesserved
tab gradesserved if noevents~=0

```

```

summ noper1000
bysort gradesserved: summ noper1000
**Let's calculate a p-value for each the rate per 1,000 students, per school year.
**We will run a one-way analysis of variance.**

```

```

oneway noperstudent gradesserved, tabulate
oneway noper1000 gradesserved, tabulate

```

```
kwallis noperstudent, by(gradesserved)
```

```
tab schooltype
```

```
tab schooltype if noevents~=0
```

```

summ noper1000
bysort schooltype: summ noper1000

```

```
oneway noperstudent schooltype, tabulate
```

```
oneway noper1000 schooltype, tabulate
```

```
tab nursetype
tab nursetype if noevents~=0
summ noper1000
bysort nursetype: summ noper1000
oneway noperstudent nursetype, tabulate
oneway noper1000 nursetype, tabulate
```

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