Introduction

Seasonal Influenza, commonly known as “the flu”, is caused by influenza viruses, which infect the respiratory tract. In the United States, on average, 5% to 20% of the population becomes ill with the flu and more than 200,000 people are hospitalized from seasonal influenza-related complications each year (Seasonal Influenza Q&A, 2014). Populations at the highest risk for serious flu complications include children under five, pregnant women, adults over 65, and those with certain health conditions including asthma, diabetes, lung disease, heart disease, and those with weakened immune systems due to HIV and cancer (People at High Risk of Developing Flu-Related Complications, 2015). Flu seasons are unpredictable and can be severe. The number of flu-associated deaths from 1976 to 2007 ranged from a low of 3,000 to a high of 49,000 people annually (Estimating Seasonal Influenza-Associated Deaths in the United States: CDC Study Confirms Variability of Flu, 2015). Influenza illness can be costly, not just in direct medical costs, but also in lost time from work and/or school. The best way to prevent seasonal flu is by getting vaccinated each year (CDC Says “Take 3” Actions To Fight The Flu, 2014).

One way to protect the community at large, including those at high risk for flu complications, is to vaccinate school-aged children. The Advisory Committee on Immunization Practices (ACIP) recommends that all children ages six months and older be vaccinated against influenza every year. School-aged children are the prime source of influenza transmission in a community, and although they are not at high risk of influenza complications, influenza illness rates are high in this age group (M. Elizabeth Halloran, 2006). School-aged children foster the transmission of infections due to their physical environment. Students are in close contact with one another, share supplies and equipment, and may not adhere to the good health habits that help prevent the spread of infectious diseases to others. The Community Preventive Services Task Force recommends school-located vaccination programs based on strong evidence of effectiveness in increasing vaccination rates, and in decreasing rates of vaccine-preventable diseases and associated morbidity (Increasing Appropriate Vaccination: Vaccination Programs in Schools and Organized Child Care Centers, 2009). This model removes a barrier for families who might not otherwise be able to take time off work to have their children vaccinated against influenza, and provides an efficient, convenient way for school-aged children to be vaccinated.
The Columbia/Boone County Department of Public Health and Human Services (PHHS) has provided school-located influenza vaccination (SLIV) clinics since the 2009 H1N1 flu pandemic. In the program’s first year, the federal government provided funding for the H1N1 vaccine, staff and supplies as part of the pandemic flu response. Vaccinations were provided to kindergarten through 12th grade students in all public schools and participating private schools in Boone County. Secondary visits were made to elementary schools to provide second doses of flu vaccine to children age eight and younger, per Centers for Disease Control and Prevention (CDC) recommendations.

In 2010 funding provided by the Missouri Department of Health and Senior Services, and the American Recovery and Reinvestment Act (ARRA) covered the cost of the program. With decreased funding, the decision was made to focus on elementary schools (kindergarten through 5th grade). No return visits were made to provide second doses to children age eight and younger, but parents were encouraged to seek guidance from their healthcare provider or PHHS to determine if a second dose was needed.

No state or federal funding was available for the SLIV program in 2011, and PHHS believed the program would not be possible that year. Due to a generous donation from the David B. Lichtenstein Foundation, however, the program was fully funded and vaccinations were again offered to elementary students in all public and participating private schools in Boone County.

In 2012, PHHS again partnered with the David B. Lichtenstein Foundation to provide SLIVs. In addition, PHHS sought and received funding from Boonslick Kiwanis and Boone Electric Cooperative. Public Health and Human Services also began a partnership with MU Children’s Hospital which provided Live Attenuated Influenza Vaccine (LAIV), the nasal spray flu vaccine. The program expanded to include middle school students. Columbia Public Schools middle schools consisted of 6th and 7th grade students. All other participating middle schools consisted of 6th through 8th grade students.

In 2013, PHHS continued their partnership with the David B. Lichtenstein Foundation and MU Children’s Hospital. The donation from the David B. Lichtenstein Foundation was utilized to purchase injectable flu vaccine and to pay for staffing, supplies and transportation. MU Children’s Hospital again provided LAIV. Due to the restructuring of middle schools in Columbia, the school-based efforts were expanded to include Columbia Public Schools 8th grade students as well.

Vaccines for Children (VFC) vaccine has also been utilized for the SLIV program each year for children who qualify. Children who have Medicaid, are uninsured or underinsured, qualify for vaccine through the VFC program.
Process

An increase in support from the David B. Lichtenstein Foundation and MU Children’s Hospital was requested for 2014 in order to expand the program to include students of all ages (kindergarten through 12th grade) in Boone County and to universally provide quadrivalent vaccine. Flu vaccine provides protection against three (trivalent) or four (quadrivalent) strains of influenza, depending on the type of vaccine used. The quadrivalent vaccine protects against two Influenza A viruses, and two Influenza B viruses. Public Health and Human Services decided to utilize all quadrivalent vaccine for the 2014-2015 flu season to provide students protection against as many strains of influenza as possible.

A Health Alert to local providers, pharmacies, and schools was sent out in late spring 2014 to inform them that the SLIV program would be offered in the fall of 2014.

Initial letters (Appendix A) were sent home to parents early in the 2014-2015 school year, to inform them that the school-based flu vaccination program would be offered later in the fall. Copies for all enrolled students were provided to the school. Consent forms (Appendix B) for all enrolled students were also provided to the schools and were sent out at a later date with a second letter providing more detail about each school’s clinic. This second letter was provided as a template (Appendix C) to the schools so they would have the ability to customize with school flu clinic information (date, time, location, etc.). Most schools sent consent forms and letters home with students. Other distribution methods used included e-mails to parents and announcements on school websites. Unlike previous years, Vaccine Information Statements (VIS) were not sent out with consent forms due to the late availability of updated versions. Instructions for how to access the VIS were included in the letter that went home with the consent form. The program was an opt-in program, requiring parents to return the completed consent forms to school in order for their child to participate. In general, consent forms were accepted and reviewed in advance of the school clinic. Late forms were also accepted and reviewed on the school’s clinic day. Parents were given the option to select Live-Attenuated Influenza Vaccine (LAIV) which is administered intranasally or Inactivated Influenza Vaccine (IIV) which is administered by injection. Parents also had the option to select “either vaccine method is fine”. If parents selected “either vaccine” the student was given a choice between LAIV and IIV. Based on ACIP recommendations, LAIV was encouraged for children through age eight who had no contraindications. The recommendation stated a preference for administration of LAIV over IIV when possible because of improved efficacy of LAIV.

In previous years, LAIV was not recommended for children with asthma or a history of wheezing episodes. Because of this, PHHS had a strict policy of not using LAIV for these children. A 2014 review of the literature regarding the safety of LAIV in children with mild asthma or history of wheezing, led to a revision in PHHS protocol allowing for the use of LAIV in children over the age of five with those issues.

Clinic scheduling was coordinated between PHHS, school nurses, administrators and clerical support staff. Efforts were made to avoid scheduling conflicts with school trips, special events, lunch, end of day, etc.

Permanent PHHS nursing staff were utilized at the school clinics to provide supervision of temporary staff, coordinate clinic logistics, provide technical assistance, and ensure vaccinations were administered safely and efficiently. Nine of the temporary nurses utilized in previous years were re-hired to provide flu vaccinations at school. The use of nursing staff experienced in providing flu vaccinations in the school setting decreased the need for extensive training and improved overall efficiency of the clinics.
Two hours were allotted for each clinic site. The number of nurses scheduled to work each clinic was determined by a formula. This formula was based on the conservative estimate that each nurse could administer 25 immunizations per hour. Assumptions were also made regarding anticipated participation rates. In schools that participated in previous years, past participation rates were used to predict 2014 participation rates. For high schools and other schools that had not participated previously, an estimated participation rate of 40% was used.

\[
a = \text{total school enrollment} \\
b = \text{estimated participation rate} \\
n = \text{number of nurses needed} \\
a \times b / 50 = n
\]

Example: 500 students with 40% participation rate

\[
500 \times (0.4) / 50 = \text{four nurses needed}
\]

School staff (nurses, clerical and administrators) were instructed to review consent forms for completeness (name, DOB, parental signature, screening questions answered, etc.). Consent forms were picked up by PHHS nursing staff 2-3 days prior to the flu clinic for review. Phone calls were made by PHHS permanent nursing staff to parents for any clarifications and to discuss medical concerns that might make a child ineligible for vaccination.

Schools were required to provide sufficient space for the clinic along with a table, two chairs and a trash can for each vaccination station. Clinics were held in various locations based on the needs of the school. Locations included: media centers, cafeterias, gymnasiums, hallways, conference rooms and nurses’ offices. PHHS provided: sharps boxes, alcohol pads, band-aids, tissues, hand sanitizer, table covers, cotton balls and quadrivalent flu vaccine.

Many schools utilized parent volunteers, nursing students and other school staff to escort students to the vaccination area and to manage students who were waiting in line. Elementary students were typically brought to the vaccination area by classroom. Middle and high school students were more challenging to coordinate because of the need for them to change classrooms during the clinic time frame. Some schools chose to call the older students down in alphabetical groups while others provided passes for all participating students and used runners to deliver passes to different hallways or classroom clusters within the building.

Identification of students by nursing staff was made utilizing name and student number, when available, or first and last name, and date of birth when student numbers were not available. At times, the very young students were not able to state name or date of birth. In these instances, positive identification was provided by the school nurse, teacher, or administrative staff.
Results

There were 57 schools that participated in the 2014 SLIV program. In addition to adding high schools to the program this year, one additional private school chose to participate. Due to vaccine delays, return visits were provided to 24 schools. The vaccine delay is discussed further in the Limitations section. Twenty-two schools had pre-school programs and fourteen of those required a morning and an afternoon clinic to accommodate the class schedules. A total of 95 separate clinic visits were provided between September 22 and November 12, 2015, a 57% increase over 2013.

During the 2014-2015 flu season, PHHS nursing staff delivered a total of 8,959 doses of flu vaccine in the school setting (7,304 doses of nasal spray flu vaccine and 1,635 doses of injectable flu vaccine). This represents 35.4% of the total population of the schools served and an increase of 1,398 students vaccinated compared to 2013 (Table 1). High school students had an overall participation rate of 17.5% compared to 47% for elementary students and 34% for middle school students (Table 2). High school students represented over 1,200 of the additional 1,398 doses of flu vaccine that was administered this year in schools.

In addition, nursing staff delivered 1,465 doses of flu vaccine to children in our clinic setting and other community outreach venues resulting in a total of 10,424 children vaccinated.
Results

For the first time, a program evaluation was undertaken to determine school satisfaction with the program and to identify possible areas for improvement. On February 25, an on-line survey was sent to 49 contacts encompassing the 57 schools that participated in the SLIV program. Of the 49 surveys sent, 37 responses were received for a response rate of 75%. The results were overwhelmingly positive with 100% of respondents strongly agreeing or agreeing that they were satisfied with the school-based flu clinics (Table 3), and 100% strongly agreeing or agreeing that offering flu vaccine in the school is a benefit to the students and parents (Table 4). Some improvements were recommended for next year and will be discussed in the Conclusions section of this report. Survey results were shared with internal staff for quality improvement and planning purposes.
Discussion

Limitations

Several limitations were identified for the 2014-2015 SLIV program. One of the factors was a delay in receiving the injectable vaccine from the manufacturer. This delay required nursing staff to contact parents who requested injectable vaccine to determine if they would be willing to have their child vaccinated with LAIV. Not all parents wanted their child to receive LAIV instead of IIV, and some students were not eligible for LAIV due to medical issues. Return visits were made to some schools once additional IIV was received to accommodate those issues. This required additional coordination and extended the school-based flu clinics.

Over the last several years, we have administered approximately 74% LAIV and 26% IIV annually in the school setting. The average this year was 80% LAIV and 20% IIV (Table 5). The percentage of LAIV use to IIV use was affected by several factors including a delay in receiving injectable vaccine which caused some parents to elect to switch their preference to LAIV rather than wait for injectable vaccine. Another factor that influenced the percentages was our ability to administer LAIV to children with a history of mild asthma or wheezing.

The effectiveness of influenza vaccine in 2014 was another complicating factor. The CDC determined that one of the predominant circulating influenza A strains (H3N2) was a drifted H3N2 strain. This means that the circulating virus was different enough from the virus included in the vaccine that it did not provide a high level of protection, and was not a good match for the H3N2 strain in this year’s flu vaccine (CDC Presents Updated Estimates of Flu Vaccine Effectiveness for the 2014-2015 Season, 2015). This led to an increase in flu cases compared to the last few seasons (Table 6).
The SLIV program in Boone County has changed, adapted and grown each year since 2009. Data collection and evaluation methods for the program have also changed. One of the limitations of this report is the inability to provide a direct overall comparison of the program by year. Data collection this year included a breakdown of participation by vaccination method and by grade. With consistent data collection and provision of vaccination to all grades going forward, a more meaningful comparison can be made to evaluate program improvements and determine success.

Another gap in data is the lack of availability of absenteeism data. General absenteeism data and surveillance data from school nurses is submitted to PHHS weekly by the schools. However, this data does not include the symptoms and/or diagnosis of children who are absent from school due to illness.
Discussion

Conclusion

School-based flu clinics are an efficient way to immunize large numbers of students (Harry F Hull, 2011) and have been found to lower incidence of influenza in schools and therefore reduce absenteeism (Pia S. Pannaraj, 2014). These programs have also been found to provide a cost-savings (Jordana Schmier, 2008). Furthermore, studies indicate that SLIV programs can provide indirect protection of other members of the community (Mollie M. Davis, 2008). The participating schools recognize the value and importance of providing school-based influenza vaccinations to students.

In the coming year, PHHS hopes to continue the school-based flu vaccination program by offering quadrivalent flu vaccinations to students in kindergarten through 12th grade in Boone County. Based on results of our program evaluation, we plan to streamline paperwork resulting in fewer papers sent home. We plan to increase participation particularly for middle school and high school students by having the letter and consent form available in late spring 2015. This will allow schools to include them in summer mailings and/or at schedule pick-up and back-to-school nights planned at most schools.

A recent study found that vaccinating at least 25% of students in a school decreased the incidence of influenza by more than 30% and vaccinating nearly 50% of the student population provided 54% indirect protection to unvaccinated children (Pia S. Pannaraj, 2014). Short-term goals for the 2015 program are: increase participation in high school students from 17.5% to 20%, increase middle school participation from 34% to 37%, and increase elementary school participation from 47% to 50%. Our long-term goal is to increase the overall participation rate from 35.4% to 40%.

Program Information Dissemination

A copy of this report will be provided to both funding agencies with additional data available upon request. A copy of this report will also be provided to each participating school district and private school with additional data specific to the school district or private school. This report and additional data will also be available on the PHHS website at gocolumbiamo.com/Health/
Appendix A: Initial Letter
September 2014

Dear Parents/Guardians:

Subject: Free Flu Vaccine Will be Offered at School

Thanks to generous support from MU Children’s Hospital and the David B. Lichtenstein Foundation, we are again able to offer this year’s flu vaccine free of charge at Boone County schools. This year, flu vaccine will be available for all children in preschool through 12th grade.

Every flu season, thousands of children become ill from the flu, some very seriously. Getting the vaccine every year is the best way to protect your child from this potentially serious disease. The Centers for Disease Control and Prevention’s (CDC) Advisory Committee on Immunization Practices recommends all persons over six (6) months of age be vaccinated.

We are working with your child’s school to give this year’s seasonal flu vaccine to children at their school. Vaccination clinics will be held this fall and you will be notified by your school of the dates once the clinics are scheduled. Prior to the clinics, you will receive a permission form to complete. If you decline, or if you do not return the required permission form to the school, the free seasonal flu vaccine will not be given to your child at school.

Most children will only need one dose of flu vaccine this fall. If your child is age 8 or younger and has never received a flu vaccine before, or has not received two doses of flu vaccine since fall 2010, a second dose of flu vaccine should be given this year. We cannot provide second doses in the schools. Please contact the health department at 573.874.7356 or your child’s health care provider for more information.

The opportunity to get your child vaccinated is encouraged but not mandatory. There is no cost for this vaccine. If your child already received the flu vaccine this school year (this fall), he or she is not eligible for vaccination at school.

If you have questions about the vaccine or the vaccination clinics, contact your school nurse or the Columbia/Boone County Department of Public Health and Human Services at 573.874.7356. You can also learn more at http://www.cdc.gov/flu/.

Beginning later this month, all Boone County children (6 months – 18 years old) can receive free flu vaccine at our clinic, located at 1005 West Worley in Columbia, Monday – Friday from 8 a.m. – 4:30 p.m. Walk-ins are welcome; no appointment is needed.

Sincerely,

Stephanie K. Browning, Director
Columbia/Boone County Department of Public Health and Human Services
Appendix B: Immunization Consent Form
## SECTION 1: INFORMATION ABOUT THE CHILD TO RECEIVE VACCINE (PLEASE PRINT)

<table>
<thead>
<tr>
<th>STUDENT’S NAME (Last)</th>
<th>(First)</th>
<th>(M.I.)</th>
<th>STUDENT’S DATE OF BIRTH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>month______ day______ year______</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SCHOOL NAME/GRADE/TEACHER</th>
<th>STUDENT’S AGE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IS THE STUDENT:</th>
<th>STUDENT’s GENDER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STUDENT’s ADDRESS</th>
<th>STUDENT NUMBER</th>
</tr>
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<tbody>
<tr>
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</tr>
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</table>

<table>
<thead>
<tr>
<th>DOES YOUR CHILD LIVE INSIDE THE CITY LIMITS OF COLUMBIA?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PARENT/LEGAL GUARDIAN’S NAME (Last)</th>
<th>(First)</th>
<th>(M.I.)</th>
<th>PARENT/LEGAL GUARDIAN’s EMAIL ADDRESS (Optional)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

## SECTION 2: SCREENING FOR VACCINE ELIGIBILITY

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
</tr>
</tbody>
</table>

## SECTION 3: SCREENING FOR FLUMIST (NASAL SPRAY) ELIGIBILITY

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
</tr>
</tbody>
</table>

## SECTION 4: VACCINE PREFERENCE

There are two different ways we can give the 2014 influenza vaccine (a shot or a nasal spray). Please mark your preferred vaccine method, keeping in mind that if you marked “YES" anywhere in section 3, your child may not be eligible for FluMist (nasal spray):

- FluMist (nasal spray)
- Flu shot (injectable)
- Either vaccine method is fine

Comments: _________________________________________________________________________________________________________
___________________________________________________________________________________________________________________
--- SIGN BELOW: VACCINATION WILL NOT BE GIVEN WITHOUT PARENT/LEGAL GUARDIAN’S SIGNATURE ---

## SECTION 5: CONSENT FOR CHILD’S VACCINATION

I GIVE CONSENT to the Columbia/Boone County Department of Public Health and Human Services and its staff for my child named on this form to be vaccinated with the 2014 influenza vaccine. I have read or had explained to me the 2014-2015 Vaccine Information Statement (8/19/2014 version) for the 2014 influenza vaccine and understand the risks and benefits.

Signature of Parent/Legal Guardian _______________________________ Date: month______ day______ year___________

☐ Check here if you want to be present when your child receives the vaccination.

## SECTION 6: VACCINATION RECORD - FOR ADMINISTRATIVE USE ONLY

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Date Dose Administered</th>
<th>Route</th>
<th>Dosage</th>
<th>VIS Given</th>
<th>Vaccine Manufacturer</th>
<th>Lot Number</th>
<th>Name and Title of Vaccine Administrator</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014 Influenza</td>
<td>/ /</td>
<td>IM RD LD</td>
<td>0.5 cc</td>
<td>IIV4</td>
<td>LAIV4 8/19/2014</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intranasal</td>
<td>0.2 cc</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
The school-based flu clinic program is provided through a partnership between the Columbia/Boone County Department of Public Health and Human Services, MU Children’s Hospital, and the David B. Lichtenstein Foundation. In 2013, more than 7,500 Boone County students were vaccinated against influenza as a result of this program. The organizations are committed to working together in order to keep students healthy.
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Dear Parents/Guardians:

The 2014-15 Influenza Vaccine (flu vaccine) will be given free of charge to students at SCHOOL NAME on DATE 2014 from TIME-TIME. The Columbia/Boone County Department of Public Health and Human Services will be onsite to administer the vaccine in ROOM. This opportunity to have your child vaccinated is strongly encouraged, but it is NOT mandatory. Parents are welcome to accompany their child, but it is not required that you be present. The point of the school-based vaccination is to make it easier on parents for their child to receive this important vaccine.

For your child to be vaccinated, the attached pink consent form must be:

- FULLY completed and SIGNED by the parent or legal guardian
- Completed for EACH CHILD (you must return a separate form for each child you want vaccinated)
- Returned to your school nurse by DATE.

The vaccine is available in two forms: injectable (the flu shot) and FluMist, which is given as a nasal spray. The Advisory Committee on Immunization Practices recommends children ages 2-8 years of age receive Flu Mist (nasal spray) instead of injectable vaccine, if possible, because of its superior effectiveness in this age group. Both types of vaccine are free. You may indicate your vaccine preference on the consent form. Please be aware that some children with underlying health conditions (asthma, diabetes, immune-compromised, etc.) may not be able to receive FluMist. Vaccine Information Statements for each type of vaccine can be found at: http://www.immunize.org/vis/. You may also contact your school nurse or the Columbia/Boone County Department of Public Health and Human Services for Vaccine Information Statements.

If you decline, or do not return the required permission form to the school, the free flu vaccine will not be given to your student at school. If you return this form, and your child receives the flu vaccine elsewhere, it is important that you notify your school nurse immediately. This will prevent your child from receiving an unnecessary second dose of vaccine.

Most children only need one dose of flu vaccine this fall. If your child is age eight or younger, a second dose might be necessary, depending on his or her vaccination history. We will not provide second doses in the schools. Please contact the health department at 573.874.7356 or your child’s health care provider for more information.

Boone County’s free flu vaccine program is made possible by these generous partners:

- MU Children’s Hospital
- David B. Lichtenstein Foundation

These organizations are funding free flu vaccine for all Boone County children age 6 months – 18 years of age. Children who do not get the vaccine at school may receive free flu vaccine at the health department clinic, 1005 West Worley, Monday – Friday from 8 am – 4:30 pm. No appointment is needed.

If you have any further questions please contact your school nurse, NAME, RN at PHONE NUMBER.
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References


