Influenza Vaccination in Children with Asthma: A Retrospective Chart Review

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Abstract

Introduction: Asthma exacerbation during influenza infection may result in pneumonia, hospitalization and death (CDC, 2013). The ACIP (Advisory commission of immunization policy) (2014) now recommends cautious use of LAIV (live attenuated influenza vaccine) for children over 5 years, with a diagnosis of asthma, and remains a contraindication for children ages 2-4 years who have had asthma symptoms or wheeze within the last 12 months. It is critical to determine if the rate of influenza vaccination has changed since implementation of these new guidelines.

Methods: A retrospective electronic health records review of 6,730 of children was conducted to compare the September 1st 2013-January 1st 2014 influenza season to the September 1st 2014-January 1st 2015 influenza season at a rural pediatric practice. Focus groups with providers were conducted to determine if barriers or facilitators to vaccination could be identified in their practice.

Results: 6,730 children ages 2-18 years of ago were included. This rural pediatric practice was predominantly Hispanic or Latino population (73%) with the majority of patients (56%) having Medicaid insurance. Data revealed in the 2013-2014 influenza season that a total of 82.8% of children (2998 out 3620 children seen) received influenza vaccination. A total of 675 children were seen with a diagnosis of asthma and 504 children received an influenza vaccine (74.6%). Of these children 17.6% of children with asthma received the Flumist or trivalent intranasal preparation and 40.9% with Flumist and the trivalent nasal prep. Following implementation of the new guidelines in the 2014-2015 influenza season total vaccination for all children seen was 91.9% with 32.7% of children with a diagnosis of asthma received the Flumist and 52.6% of all

patients seen received Flumist vaccination. Focus group data revealed that health care providers found that the practice of vaccination outreach thru flu clinics, vaccine tracking and VFC (vaccine for children) designation to be facilitators to vaccination. The use of the Flumist vaccine and the media were identified as both facilitators and barriers to vaccination. Additional limiting factors identified by the providers included: access to vaccination, time and changing vaccination policies and practices. The providers identified the need for a standardized vaccine alert system for patients, increased access to the electronic health record and increased outreach and education to high-risk populations.

Conclusion:

Overall this rural health practice had higher rates compared to national and state averages with total children seen in consecutive influenza seasons at 82.8% and 91.9% for all children compared to all persons in Oregon at 42.2% for the 2013-2014 influenza season (CDC, 2014). Children with asthma also had higher rates of vaccination compared to national averages at 74.6% and 76.7% in 2013-2014 and 2014-2015 compared to 52.8% at the national level (CDC, 2012). Following implementation of the new guidelines for use of Flumist in children with asthma there was there was a 15% increase in children with asthma vaccinated using the Flumist preparation. There was an overall increase in vaccination rates between influenza seasons, vaccination rates increased by approximately 9% for all children seen during September 1st thru January 1st.

Children in age groups 2-5 years and 14-18 years had the lowest rates of vaccination in two consecutive influenza seasons. Children with a diagnosis of asthma had lower overall rates of influenza vaccination compared to children without a diagnosis of asthma. Children under 5 years of age and children with asthma are at higher risk for morbidity and mortality associated

with influenza. More research is needed to understand the gaps in practice and patient/family preference that contribute to lower levels of vaccination and reduce barriers to improve vaccination rates in these high-risk populations.

The Clinical Problem

Description and Significance of the Problem

Asthma is one of the most common chronic diseases of childhood, in the United States. Over 10 million children, under the age of 18 years, have been diagnosed with asthma and with at least 6.8 million children with ongoing asthma symptoms (Center for Disease Control, 2012, p.4). The severity of disease symptoms range from mild intermittent to severe persistent, and medical management differs from person to person. The prevalence of asthma continues to rise while asthma control remains inadequate with 39.9% of children diagnosed with asthma rating their health as poor to fair (CDC, 2012). Predictors of asthma control and asthma exacerbations include: age, gender, race, socioeconomic status, environmental exposures and/or allergens. Improving asthma control requires prevention of exacerbations through avoidance of triggers like allergens and vaccinating against preventable viruses affecting the respiratory system like influenza.

A Korean cross-sectional survey of 309 children hospitalized for lower respiratory tract infections found that infections with rhinovirus and influenza might represent a risk factor for acute exacerbation of asthma, particularly in children who are sensitized to allergens (Kwon et al, 2014). Kwon et al. (2014) found that influenza vaccination in those who are sensitized to allergens may reduce asthma exacerbations. Further evidence is needed to determine a causal relationship between allergic sensitization and viral infections causing asthma exacerbation. This

is critical to asthma management as the increasing incidence of asthma has been associated with increased atopic sensitization paralleled by rises in other allergic conditions such as eczema and rhinitis (Masoli et al., 2004).

The current recommendation is for all children 6 months to 18 years, with or without a diagnosis of asthma, to be vaccinated during the influenza season, typically October thru March (CDC, 2013). The impact of influenza vaccination depends partially upon the extent that influenza causes illness or exacerbation in persons with asthma and understanding the variability in severity of illness between pandemic and non-pandemic seasons (Cates & Rowe 2013). To improve vaccination rates, it is critical to understand the impact of influenza among both high-risk children and the general population. A United States national surveillance report assessed the number of deaths in children, and found that a total of 830 deaths associated with influenza occurred between 2004 and 2012 (Wong et al., 2013). Both children with high-risk conditions and generally healthy children died each year with 16% of the total deaths being children with asthma (Wong et al., 2013).

Asthma is considered a high-risk condition associated with higher morbidity with influenza including exacerbation of asthma, pneumonia, hospitalization and death (CDC, 2013). Although there is evidence that having asthma increases the risk for exacerbation, hospitalization and in some cases death, vaccination rates remain below the target goal. The most recent vaccination statistics from the CDC National Health Interview Survey (NHIS) 2012 found 52.8% of children, aged 6 months through 17 years with a current diagnosis of asthma were vaccinated for influenza. This is an improvement from 29.3%, in 2005-2006 influenza season but remains below the Healthy People 2020 goal of 70% of children ages 6 months to 17 years with asthma receiving annual influenza vaccination. Influenza vaccination rates in the general population and

high-risk persons are still below the target goal and as non-medical exemptions from routine childhood vaccinations are on the rise it is important to understand the factors that impact vaccination coverage from season to season.

Purpose of the Project

The purpose of the quality improvement project was to identify facilitators and barriers to influenza vaccination in children ages 2 to 18 years of age with a diagnosis of asthma. The questions were: 1) what are the rates of influenza vaccination in children ages 2-18 years with a diagnosis of asthma compared to children ages 2-18 years without a diagnosis of asthma over two influenza seasons (September 2013- January 2014 and September 2014- January 2015) and; 2) what are health care providers' perceived barriers and facilitators of influenza vaccination at a rural pediatric practice setting?

The following aims of this project were: 1) to determine influenza vaccination rates in children ages 2 to 18 years with a diagnosis of asthma 2) to determine influenza vaccination rates in children ages 2 to 18 years without a diagnosis of asthma 3) to compare influenza vaccination rates in these two groups of children over two influenza seasons, 4) to assess for change in coverage of live attenuated influenza vaccine (LAIV) preparations with new immunization recommendations and 5) to assess health care providers perception of barriers and facilitators of vaccination in the targeted practice. The intended impact of this project is to understand barriers and facilitators of influenza vaccination in children with asthma to improve existing practices and develop interventions to decrease missed clinical opportunities and increase vaccine coverage.

Literature Review

Search Methodology

A review of the literature was performed to explore current literature on pediatric asthma and influenza vaccination prevalence rates and barriers to vaccination. Electronic searches were conducted, between June 2014 and April 2015, utilizing Ovid MEDLINE without Revisions 1996 to current, PubMed and Cumulative Index to Nursing and Allied Health Literature (CINAHL) databases. The MESH terms included the words: ‘asthma’, ‘pediatric, ‘influenza vaccine". Filters used included: age birth to 18 years, human subjects, English language and using the most recent and relevant data from 1998 to 2014. Using PubMed the initial search yielded 45 results of which 41 articles were original data based studies including meta-analyses and systematic reviews. The same search terms were used in Ovid Medline yielding 14 articles, 12 of which were original data based studies. A similar search was utilized with the CINAHL database using "asthma" and "influenza vaccine" with filters for "all children" and English language. This search yielded 36 results. A second search on PubMed using the MeSH terms: "asthma" and "pediatric" or "child" and "influenza vaccine" and "health knowledge, attitudes, practice" OR "Patient Acceptance of Health Care" yielded 10 articles of which 9 were original data-based articles, one article was unavailable for review. Searches from government websites including the Centers for Disease Control and HHS Healthy People 2020 were used for asthma and influenza statistics and prevalence data.

A total of twenty original articles, two systematic reviews, and six documents from government websites were reviewed for the purposes of this paper. A summary of these articles excluding the government documents is provided in Table 1 in the Appendix. The majority of the original studies are cohort or cross-sectional designs, conducted to analyze influenza vaccination prevalence, missed clinical opportunities for vaccination, demographic information,

asthma status/severity and assessment of practices to promote increased influenza vaccination. While providing key descriptive data and vaccination trends, the major limitation of these studies is a lack of ability to predict causation or directionality. Randomized controlled trials would be required to truly know the impact and effectiveness of influenza vaccination on children with asthma. The purpose of this review is to assess prevalence rates of influenza vaccination in children with asthma, predictors of vaccination, potential barriers to vaccination and review of current interventions and recommendations.

Definitions

The majority of studies defined asthma from patient and/or parent report or based on ICD-9 code (493.0 to 493.9) use at an outpatient or emergency department visit or hospitalization. The exception was a prospective cohort study by Soyer et al. (2011), which defined asthma based on international guidelines from Global Initiative for Asthma Program "history of intermittent wheezing and demonstration of reversible airway obstruction as defined by at least a 12% improvement in forced expiratory volume in 1 sec following bronchodilator administration." Studies that assessed influenza prevalence in children with "chronic high risk conditions" that defined asthma as "high risk" were included. Inclusion or exclusion of children varied from study to study, ages ranged from 6 months to 18 years. Two studies, a systematic review by Cates & Rowe (2013) included all persons with asthma and a retrospective cohort study by Cohen et al. (2012) included urban Hispanic children and adults.

Predictors of Vaccination

Influenza vaccination of children is largely dependent on parent preference and knowledge of asthma, influenza, and the vaccine. A retrospective cohort study of 500 parents of

children with asthma, found the most common reasons for vaccination were: the belief that it would help their child's asthma (53%) or to prevent the flu (40%) (Gnanasekaran et al., 2006). Influenza vaccination rates were higher among parents' who perceived a potential benefit in vaccinating their child and was dependent on their knowledge of the severity of asthma and influenza.

Severity of asthma or perceived severity from asthma complications, are strong predictors for vaccination. Asthma severity can be measured by the frequency of beta-agonist prescriptions and hospitalizations or emergency department visits predicted vaccination status, compared to only having a diagnosis of persistent asthma (Kramarz et al., 2000). A cross-sectional study by Chung et al. (1998) assessed vaccination rates in 117 children 6-48 months of age with asthma, found children with moderate to severe asthma (25%) and children who had been hospitalized in the last year were more likely to receive influenza vaccination. Previous hospitalization or perceived severity of asthma as predictors of vaccination indicates that parents who perceived a higher threat from influenza are more likely to vaccinate to prevent future hospitalizations. These findings reflect the need to target interventions to increase parental knowledge of risks associated with influenza and the importance of vaccination.

A retrospective study of 1058 children, enrolled in a Medicaid program, found that children with persistent asthma were less likely to miss vaccination however only 16% of children were vaccinated, of which 21% were children with persistent asthma (Gnanasekaran et al., 2006). This reflects the findings that persistent asthma and/or recent hospitalization increased likelihood of vaccination but demonstrates that even strong predictors of vaccination can result in low vaccine rates. A retrospective cohort study of 509 Hispanic households, in urban New York, assessed predictors of vaccination in adults and children, in Hispanic children the greatest

predictors of vaccination were knowledge of influenza, chronic respiratory disease and younger age with children, under 5 years of age having 47.3% vaccination compared to children ages 5-17 years at 39.3% (Cohen et al., 2012). Younger age has been associated with higher influenza vaccination rates in children however, some studies there is variability in the age groups compared in most of the studies. Gnanasekaran et al. (2006) found older age between 9-16 to be predictive of lower vaccination rates. While Kramarz et al. (2000) reported coverage was lower in children with asthma 1-3 years of age compared to 4-18 years, in both influenza seasons children ages 1 to 3 had the lowest vaccination rates at 5.4% and 7% respectively. From these studies it is difficult to assess where the overlap between age groups occurs to result in higher vaccination rates and which age groups have a lower rate.

Perception of access and availability of health services are major influences on health. Increased vaccination coverage has been associated with the increased utilization of health-care visits in a year, with lower vaccination rates among those who had no health-care visits in the past year (CDC, 2013). A descriptive analysis of 12,895 children found children with high-risk conditions to high utilizers of health care at a higher rate compared to children without a high-risk condition (56% versus 36%), having four or more outpatient health care visits a year (Ehart et al., 2004). The increased utilization of health care should logically correlate with higher vaccination rates in high-risk children however this is not always the case as sometimes increased use of health care is a predictor of poor control and compliance of preventative medicines. Other important influences on vaccination among children include parental knowledge of influenza, vaccine availability, effectiveness, and adverse effects (Gnanasekaran et al., 2006).

Increasing parental awareness and adherence to routine influenza vaccination of children with asthma and other high-risk conditions is a major responsibility of the provider. The most important factor parents cited for influenza vaccination, for their children with asthma, was recommendation from a physician (Soyer et al., 2011). This is a frequent finding through out the literature and lack of recommendation has also been cited as a potential barrier to vaccination. A cross-sectional survey of 320 family physicians and pediatricians by Dombkowski et al. (2008) reported that 96% of respondents routinely recommended influenza vaccine to children with persistent asthma however only 82% of physicians reported recommending vaccination for children with mild intermittent asthma. Further studies of provider recommendations based on the severity of asthma are necessary to assess any correlation between influences of provider recommendation on severity of asthma being a predictor of vaccination. Few studies have focused on the influence of other health care professionals role in vaccination. Soyer et al. (2011) cited that parents reported that nurses and pharmacists to also have influence on the decision for vaccination at 6.4% and 7.7% respectively. Limiting the scope of influence to only physicians, does not give a full picture of the impact of other health care professionals or information on how to enhance their roles in improving vaccination rates.

The literature had limited evidence evaluating the impact of media during the various influenza seasons covered. Only two studies assessed media influence Gnanasekaran et al. (2006) and Soyer et al. (2011). Their respective studies focused on influenza seasons during 2002-2004 and 2007-2008. During the study period of 2003-2004 there was a vaccination shortage and increased media attention regarding the severity of influenza and the shortage. Gnanasekaran et al. (2006) found a significant increase in vaccination rates from 27% to 43% in 2002-2003 to 2003-2004, which they partially attributed to media influences per parental report

and comparison of weekly rates. The study period of 2007-2008 was not associated with an increased amount of media attention however media influence was still measured by parental report. Soyer et al. (2011) reported only a minor (5.1%) effect of the media influencing parental decision to vaccinate their children.

Barriers to Vaccination

Vaccination coverage and barriers to vaccination are assessed largely on the basis of demographic characteristics of children and families and from the perspective of parents and/or caregivers and health care providers. A retrospective cohort study of 500 parents of children ages 2-12 years, found that the most commonly reported reason for not vaccinating children was a low perceived risk of influenza (46%) (Flood et al., 2010). This finding has been echoed in other studies, including a prospective cohort study of missed opportunities for vaccination in 926 children that found unimmunized children's parents were more likely to have low perceived susceptibility to influenza and lack of knowledge of children's high risk conditions (Daley et al., 2005). General perception of influenza as a low risk condition has also been reported among health care professionals. An Italian retrospective cohort study by Esposito et al. (2006) assessed pediatrician and parental knowledge of influenza and vaccination. They found that the majority of pediatricians lacked critical knowledge of the recommendations for vaccination of children with high-risk conditions and did not consider influenza a severe disease even in the presence of an underlying chronic disease (Esposito et al., 2006). Increasing vaccine coverage and the impact of providers, requires an understanding of the literature and recommendations behind vaccination to improve vaccination rates.

Two studies, a prospective cohort study by Daley et al. (2005) and a retrospective cohort study by Dombkowski et al. (2006) analyzed missed opportunities for vaccination during influenza seasons. Missed opportunities were defined as medical visits to primary providers or specialists during the influenza season, when discussion or administration of influenza vaccination did not occur. Dombkowski et al. (2006) analyzed missed opportunities over two influenza seasons and found that 39.6% of children with asthma had two missed opportunities in successive seasons. They assessed the potential for eliminating missed opportunities between seasons could have resulted in almost 70% more children being vaccinated the following year (Dombkowski et al., 2006). Daley et al. (2005) found that missed opportunities were more likely to occur later in the influenza season, during December and January, and were more likely to occur at non- well child visits. Increasing provider awareness of the commonly missed opportunities may increase discussion of vaccination at these critical times to improve vaccination rates.

Providers tasked with educating parents and children about the need for vaccination should work to address parental (and or caregiver) concerns and misconceptions about influenza vaccination. Common concerns regarding influenza vaccinations are the belief that the vaccine causes the flu (44.0%), potential for side effects, like runny nose or sore arm, (36.6%) and concerns about vaccines containing thimerosal (mercury-containing preservative) (32.9%) (Flood et al., 2010). Assessment of parental concerns allows providers and recommending bodies like the CDC to target education towards these concerns. Gnanasekaran et al. (2006) found similar parental reasons for not vaccinating including; a perceived lack of need (26%), concern about adverse effects (16%) and approximately 10% were concerned that the vaccine would trigger an asthma attack. Increasing awareness of influenza vaccination requires open dialogue

between providers and families beyond a simple recommendation. Another barrier to vaccination was illness at the time of vaccination (20%) (Soyer et al., 2011). Degree or type of illness was not specified however this further illustrates the need to educate parents about the indications and contraindications to vaccination.

Demographic considerations were explored in the majority of studies. One of the most common findings was parental education as a potential barrier to vaccination, parents with less than a high school education were least likely to vaccinate at 10% compared to 24% with at least a college degree (Gnanasekaran et al., 2006). Much of the literature was inconclusive regarding significant differences in vaccination rates between racial and ethnic groups. A cross-sectional study of 1663 persons in managed Medicaid programs explored characteristics associated with asthma status and use of preventative medical services (Lieu et al., 2002). This study did not look specifically at vaccination rate but explored other preventative practices, and found that black and Latino children had worse asthma status and less use of preventive asthma medications than white children within the same managed Medicaid populations with an equal rate of preventative visits and specialists (Lieu et al., 2002). Further efforts to improve health outcomes in these populations should focus on influenza vaccination as having decreased access to preventative medication and poor asthma control potentially increasing the may increase risk for complications from influenza.

Current Interventions and Recommendations

A systematic review of eleven articles by Jones & Walton-Moss (2013) analyzed the use of reminder or recall systems since 1992-2009. Their findings suggest that improvements in vaccination rates have been well demonstrated in the literature using reminder systems.

Reminder systems included electronic health record reminders for providers and written or mailed reminders for children and families. A registry-based randomized control trial of 3618 children, ages 24-60 months, who were Medicaid enrollees by Dombkowski et al. (2012), received a mailed reminder for vaccination during influenza season 2008-2009 compared to the control group who did not receive a reminder. Their findings were consistent with the literature and found 30.8% of children who received notification had at least one vaccination compared to 24.35% who did not receive a reminder (Dombkowski et al., 2012). This study was included in the literature because it was not included in the systematic review, as it had not been published at that time. A quasi-experimental study comparing one group pre-post test used an asthma education tool (AET) in addition to a reminder system to compare baseline influenza rates from 2003-2005 to 2005-2007 (Martin, 2008). The use of AET was easily applied in a primary practice setting, taking less than 5 minutes at each visit and in conjunction with a reminder system was associated with an increase in vaccination rates from 13.1% to 59.4%. The studies findings were included in the review because the intervention included an educational tool as well as a reminder system.

DNP Implications

Most of the literature assessing prevalence of vaccination, predictors and barriers to vaccination focus on the perspective of parents or physicians. Few studies assessed vaccination rates among all levels of providers; nurse practitioners, physician assistants or registered nurse led immunization clinics. Further research is indicated to assess the perspectives and experiences of all providers with influenza vaccination and knowledge of the current recommendations. Moreover, few studies have assessed children perceptions of influenza and vaccination. One prospective cohort study by Flood et al. (2011), interviewed 28 children ages 6-12 years

regarding their knowledge and experience with influenza. Their analysis found that children as young as eight years understood the concept of "risk" in association with influenza (Flood et al., 2011). This study was limited by a sample size of only 28 children, yet yielded critical novel findings. Additionally children were found to be able to consider multiple points when determining preference for route and type of vaccination with the majority of children preferring the nasal preparation to an injection (Flood et al., 2011). Their findings suggest that children are an important audience to capture in the literature not only to assess their beliefs around health maintenance practices but also the factors that motivate them to take on these practices. Further studies should aim for larger sample sizes and assess overall patterns of vaccination for influenza not only lifetime use.

The live attenuated influenza vaccine (LAIV) formulation or Flumist vaccine first became available for use in September 2003. Flumist or the LAIV preparation was previously contraindicated in children with a diagnosis of asthma due to potential adverse pulmonary effects and limited data to support the safety of use in persons with high-risk chronic respiratory conditions (CDC, 2013). The newest recommendation from the CDC (2014) is for cautious use of LAIV for children with a diagnosis of asthma over the age of 5 years and use of LAIV remains a contraindication for children ages 2-4 years who have had asthma symptoms or wheeze within the last 12 months.

The previous designation of the LAIV formulation as being contraindicated in high-risk children may be a potential barrier to optimal vaccination rates and overall effectiveness of the vaccine. An open-label, control study of 2229 children 6-17 years of age with a diagnosis of asthma, by Fleming et al. (2006), compared an investigational refrigerator-stable formulation of LAIV known as CAIV-T to the injectable trivalent inactivated influenza vaccine (TIV). CAIV-T

in children with asthma was found to have a significantly greater relative efficacy of 35% compared to TIV with no significant associated increase in adverse pulmonary outcomes compared with TIV (Fleming et al., 2006). Although this study demonstrates safety and effectiveness in children with asthma, additional research is required to generalize these findings to the greater population. Further research is required to demonstrate safety and increased efficacy in high-risk children who may have a higher acceptance of vaccination when using a nasal preparation. In healthy children over the age of 2 years, studies that have demonstrated safety of the vaccine as well as increased effectiveness in comparison to the inactivated injectable preparation (CDC, 2013). Further investigation is needed to assess if the rate of influenza vaccination has been impacted since implementation of these new guidelines.

Approach to the Conduct of the Project

Project setting

The project setting was at Woodburn Pediatric Clinic (WPC), and the timeline was during the fall of 2014 thru the early spring of 2015. WPC was recently designated a rural health clinic and is the only pediatric practice in Woodburn, Oregon. The practice serves a diverse population of Hispanic/Latino and non-Hispanic white patients. The majority of the clinical staff is bilingual, interpreter services are always available and all patient education materials are provided in English and Spanish. WPC has eight providers six general family or pediatric providers and two mental health specialists: three physicians, three nurse practitioners and two physician assistants. There are two nurses in the clinic who oversee and manage routine childhood vaccination programs and seasonal influenza clinics and a school based influenza vaccination program. There are ten medical assistants administer influenza vaccination and participate in the seasonal influenza clinics.

Organizational/systems or individual or population readiness to change

WPC participates in the federally funded vaccines for children program, which provides vaccines at no cost to children who do not have the ability to pay or lack insurance coverage. Currently, nursing staff oversee and coordinate the vaccine for children (VFC) program and offer monthly influenza clinics in October and November and a school based influenza clinic. The school based influenza clinic utilizes the live attenuated influenza vaccine (LAIV), the nasal flutist, which until this season had been contraindicated in children with a history of or current diagnosis of asthma.

Anticipated Barriers, Facilitators, Challenges

This project was proposed and approved by the quality improvement (QI) committee at WPC at which time members were encouraged to ask questions about the project and give feedback. Initial barriers were identified and addressed including: difficulty with creation of a data report using the electronic health record, the focus of the project towards data collection rather than a real-time intervention to be utilized during the current influenza season. The committee identified that only three persons have access to run and/or create a data report. The clinic manager agreed to assist in development of the report to allow for student access after data is de-identified. Through discussion with the quality improvement committee and WPC mentor understanding of the project as an ongoing improvement process with the goal of collecting meaningful data to be utilized by the QI committee or other students to develop interventions to increase vaccination in the future.

Participants/population

Inclusion and Exclusion Criteria

There was no requested participation from children or families in this project. Data collection included all patients of WPC children ages 2 to 18 years of age with and without a diagnosis of asthma who received influenza vaccination over two consecutive influenza seasons 2013-2014 and 2014-2015. The influenza seasons included will be from September 1st-January 1st to capture peak vaccination times. Demographic data will include: (a) age 2 to 18 years, (b) race/ethnicity, (c) zip code, (d) type of insurance and (e) gender. Type of insurance was included despite WPC's participation in the vaccines for children program (VFC), as vaccination supply and administration is based on type insurance or VFC qualification.

The focus group was targeted to include all providers (physicians, nurse practitioners and physicians assistants), nurses and medical assistants involved in ordering and administration of influenza vaccination at the clinic.

Size and rationale

The retrospective chart review had a total of 6,730 children seen over two consecutive influenza seasons with a total of 5,831 children who received influenza vaccination. The focus group data was collected with a convenience sample of three focus-group participants: one registered nurse, one nurse practitioner and one medical assistant.

Protection of participants

All patient data was de-identified prior to data collection by this researcher. Health care provider participation in the focus group was voluntary and responses were de-identified.

Implementation and Outcomes

Data Sources

The key data sources will include the electronic health record (EHR) and health care providers' focus group responses.

Data Collection Processes and Procedures

Data for this project was garnered through a retrospective data abstraction. An EHR developer generated the report after approval was obtained from the clinic manager and then from the chief medical information officer for the WVP health authority. The report was imported into an excel spreadsheet to exclude identifying patient data. The data report included all patients of WPC children ages 2 to 18 years of age with and without a diagnosis of asthma who received influenza vaccination over two consecutive influenza seasons 2013-2014 and 2014-2015. The influenza seasons included were from September 1st-January 1st to capture peak vaccination times. Demographic data included: a) age: 2 to 18 years, (b) race/ethnicity, (c) zip code, (d) type of insurance and (e) gender.

The first report included ICD 9 codes for all codes for asthma used in the EHR database: 493.90, 493.92, 493.12, 493.00 and CPT codes for all influenza vaccine preparations: 90655, 90657, 60658, 90656, 90660, 90686, 90685 and 90672. The second report included the above criteria with the exclusion of any ICD 9 diagnosis of asthma: 493.90, 493.92, 493.12, and 493.00 to capture children without asthma. No identifying data was collected. Data was analyzed using descriptive statistics.

Data for the second quality improvement question was garnered during a focus group aimed to assess health care providers' perceived barriers and facilitators to influenza vaccination in this setting. The study participant population was targeted to include all providers (physicians, nurse practitioners and physicians assistants), nurses and medical assistants involved in the process of ordering and administration of influenza vaccination at the clinic. The focus group contained four central questions: (1) What is your impression regarding the immunization rates for children with asthma collected that have been presented, (2) What processes do you believe

are in place in this clinic that maximize influenza vaccine in children with influenza, (3) What barriers do you think exist, (4) Moving forward what processes do you suggest to maximize influenza vaccine in children with asthma? Focus groups were audio-recorded and transcribed verbatim. The transcription was analyzed to summarize and characterize the data by an iterative data analysis process and participant responses analyzed as a straight descriptive summary.

Outcome Evaluation

Data Analysis

A Retrospective chart review of 6,730 of children was conducted to compare the September 1st 2013-January 1st 2014 influenza season to the September 1st 2014-January 1st 2015 influenza season. Data collected from the EHR reports were compiled into excel and analyzed using descriptive statistics. The qualitative focus group responses were compiled and reviewed for important themes that emerged from the session.

Outcome Results

Demographics

Ethnicity

This rural pediatric practice is comprised of a predominantly Hispanic/Latino population (73%) with 19% of patients identifying as non-Hispanic white and 8% of patients as other or declining to specify. (See Figure 1)

Insurance

In 2013 the majority of patients had Medicaid insurance (55.9%), 12% had commercial insurance and 31% had no insurance or other. There was limited variation between the two years in 2014 61% of patients had Medicaid insurance, 11.9% had commercial insurance and 25.9% of patients had no insurance or other listed. The slight increase of patients with Medicaid coverage

may be reflective of expansion of Medicaid insurance coverage under the Affordable Care Act. (See Figure 2)

Gender:

The majority of patients seen in two consecutive influenza seasons were male 52% with 48% of patients seen identifying as female. Influenza vaccination rates were higher for males in both influenza seasons, which may reflect the overall make up of the clinic with a slightly higher proportion of patients seen being males. (See Figures 3 and 4)

Age

Ages were compiled into by groups: children 2-5 years of age, 6-9 years of age, 10-13 years of age and 14-18 years of age. Children with asthma ages 6-9 years had the highest rate of influenza vaccination in consecutive influenza seasons 2013-2014 and 2014-2014 at 34% (n=173) and 35% (n=159) respectively. In 2013-2014 children with asthma ages 2-5 years had the lowest rate of vaccination at 19% (n=96) followed by children 14-18 years of age at 22% (n=109) and children 10-13 years of age at 25% (n=126). In 2014-2015 children with asthma ages 14-18 years had the lowest rate of vaccination at 20% (n=88) followed by children ages 2-5 years at 22% (n=97) and children ages 10-13 years at 23% (n=104).

See Figures 5 and 6 for the total vaccination rate by age group for children with and without a diagnosis of asthma.

See Figure 7 for the total of patients seen per age group with comparison to patients vaccinated per age group over two consecutive influenza seasons.

Vaccination Rates

Data revealed in the 2013-2014 influenza season a total of 82.8% of children (2998 out 3620 children seen) received influenza vaccination. A total of 675 children were seen with a

diagnosis of asthma and 504 children received an influenza vaccine (74.6%). Of these children 17.6% (n=87) of children with asthma received the Flumist or trivalent intranasal preparation and 40.9% (n=1228) without a diagnosis of asthma received Flumist and the trivalent nasal prep. Following implementation of the new guidelines in the 2014-2015 influenza season total vaccination for all children seen was 91.9% (2833 out of 3110 children seen) with 32.7% (n=145) of children with a diagnosis of asthma received the Flumist and 52.6% (n=1492) of all patients seen received Flumist vaccination.

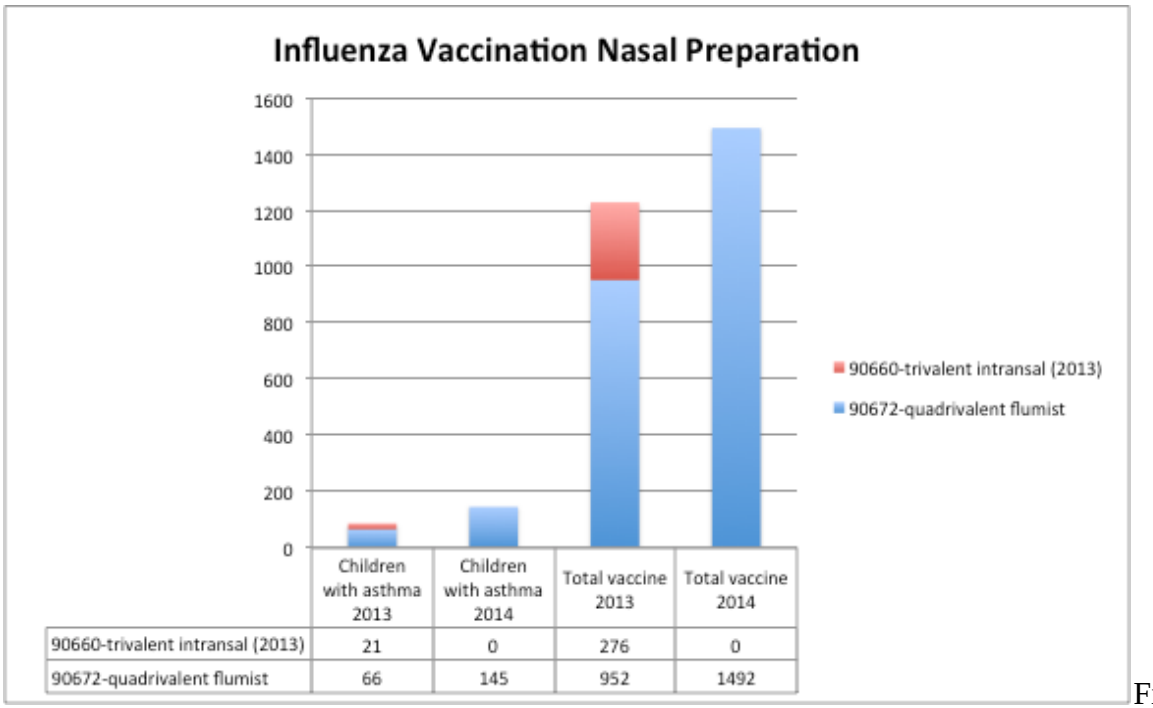

Figure 8

In 2013-2014 42% of all children who received influenza vaccination received the injectable trivalent (inactive) vaccine, without added preservatives, for children over 3 years, 16% of children received the injectable preparation for children, under 3 years, 32% of all children received the Flumist (quadrivalent live attenuated intranasal vaccine (LAIV)) and 9% received the trivalent intranasal preparation. In 2014-2015 influenza season 53% of children who received the influenza vaccine received the Flumist (quadrivalent LAIV), 35% of children

received the injectable quadrivalent (inactive) vaccine for children over 3 years and 12% received the preparation for children (less than 3 years to 6 months). In both influenza seasons the other inactive preparations that contain preservative had less than 1% of total children vaccinated. (See Figures 9 and 10).

In 2013-2014 69% of children with asthma who received influenza vaccination received the injectable trivalent (inactive) vaccine for children over 3 years, 13% of children received the injectable preparation for children under 3 years to 6 months of age, 13% of all children received the Flumist (quadrivalent live attenuated intranasal vaccine (LAIV)), and 4% received the trivalent intranasal preparation. In 2014-2015 influenza season the majority of children with asthma (58%) received the injectable quadrivalent (inactive) vaccine for children over 3 years and 9% received the preparation for children, less than 3 years to 6 months. The rate of Flumist (LAIV quadrivalent) vaccination had the greatest increase between influenza seasons with 33% of children with asthma vaccinated. As noted above in both influenza seasons the other inactive preparations that were not preservative free and had less than 1% of total children vaccinated (See Figures 11 and 12). Comparison of vaccination preparation and total rate for children with asthma and children without asthma represented in Figures 13 and 14.

Focus Group

There were a total of three participants in the focus group including a pediatric nurse practitioner, registered nurse and medical assistant. Common themes and examples/explanations are provided below.

Facilitators of vaccination

Focus group data revealed that health care providers found that the practice of vaccination outreach thru seasonal (early October-late November) influenza clinics, school based influenza clinics to be facilitators to vaccination. The VFC (vaccine for children) designation program a federally funded vaccine program improved vaccination rates by reducing barriers to access and enabling all children to receive vaccination at the clinic regardless of ability to pay or insurance coverage. The use of vaccine tracking through the use of the electronic health record and the state wide alert system was also predictive of influenza vaccination. In previous influenza seasons the clinic utilized a call/alert process after generating a report of patients who were not vaccinated. The alert system was previously staffed by nurses or providers when available staff is in place and there is not a standardized written or call system in place. The use of the Flumist vaccine and the media were identified as both facilitators and barriers to vaccination. Flumist was a facilitator of vaccination related to ease of administration, no negative association with pain and the current use of Flumist in school based influenza clinics. Providers found the media to be predictive of vaccination in times of heightened attention during vaccination shortages and/or seasons with higher associated morbidity and mortality.

Barriers of vaccination

The use of Flumist was found to be a barrier to influenza vaccination related to parental/patient belief that an injection is more effective vaccine related to previous experience with other childhood vaccines. Media was found to be a barrier to vaccination related to the rise of social media and increased access to inaccurate information regarding vaccination and media attention during the most recent influenza season (2014-2015) regarding reduced efficacy of the vaccines in preventing influenza. Additional limiting factors identified by the providers

included: access to vaccination, time and changing vaccination policies and practices. Changing vaccination policies and practices.

Clinical Implications

Health care providers identified the need for a standardized vaccine alert system for patients, increased provider access to the electronic health record and increased outreach and education to parents and children in high-risk populations and children under the age of 5 years.

Discussion and Limitations

This retrospective chart review was a descriptive not predictive analysis with inclusion of children who received influenza vaccination. Children who had not received vaccination were not included. The initial reports were generated by receipt of vaccination to avoid identifying patients and creation of report to include children without vaccination would have been difficulty without the use of identifying data to prevent overlapping or inaccurate data. A major limiting factor was time: there was an approximately six-week turn around from the report request to the creation of the reports. The report requests were created in December after Internal Review Board approval was obtained. There was a then a required approval process from the clinic manager and a second (unanticipated) approval process from the EHR chief medical information officer. The clinic staff was unable to create a report with the requested criteria and an off-site EHR specialist was identified and contacted to perform the report generation. Communication with the EHR specialist was exclusively via email and did no allow for the researcher to be hands on to extract or revise data reports. Multiple requests for additional data or revisions were performed via email over the course of four months (January thru April). The researcher had limited background in data analysis requiring consultation with a statistician and independent research and education regarding use of excel for descriptive analysis.

Limited participation in the focus groups impacted the generalizability and depth of insight into the processes in place that are impacting vaccination. The initial proposal planned for two hour-long focus groups to allow for increased participation. The focus groups were limited in time and participation due to cancellations and delays of scheduled meetings related to staff and clinic obligations. Focus group data was collected after the data was analyzed and presented to the clinic. A formalized pre and post session may have provided additional information on current and desired processes to improve vaccination. Use of a written tool/survey may have been useful in reducing the barriers associated with limited administrative support at the clinic related to cancellations and unexpected delays.

The limited time and scope of the researchers project did not allow for inclusion of parents/caregivers or patients in focus group discussions. Understanding predictors and barriers of vaccination requires investigation of parental/caregiver and patient beliefs regarding influenza, vaccination and preferences regarding vaccination preparation.

Clinical Implications/Recommendations

This retrospective chart review was performed at a rural health practice that serves a predominantly Hispanic/Latino population with a majority of Medicaid or uninsured patients. Given the specific population the findings may have reduced generalizability to private insurance patients or non-Hispanic whites or other racial/ethnic groups. Responses from clinicians highlighted the need to increase outreach through use of standardized recall/alert systems for all children especially high-risk patients (children with asthma and the youngest patients under 5 years of age). Current practices at this rural health practice which were found to improve overall influenza vaccination rates and should be implemented at other pediatric and rural health practices include the use of influenza clinics both school and clinic based. The lack of clinician

ability to collect data from the electronic health record limits the ability of the clinic to continue to track vaccination rates. Increasing education of clinicians on the use of the EHR system and increasing staff access may allow for reduced barriers to obtaining data in the future.

Conclusions

Overall this rural health practice had higher rates compared to national and state averages with total children seen in consecutive influenza seasons at 82.8% and 91.9% for all children compared to all persons in Oregon at 42.2% for the 2013-2014 influenza season (CDC, 2014). Children with asthma also had higher rates of vaccination compared to national averages at 74.6% and 76.7% in 2013-2014 and 2014-2015 compared to 52.8% at the national level (CDC, 2012). Following implementation of the new guidelines for use of Flumist in children with asthma there was there was a 15% increase in children with asthma vaccinated using the Flumist preparation. There was an overall increase in vaccination rates between influenza seasons, vaccination rates increased by approximately 9% for all children seen during September 1st thru January 1st.

Children in age groups 2-5 years and 14-18 years had the lowest rates of vaccination in two consecutive influenza seasons. Children with a diagnosis of asthma had lower overall rates of influenza vaccination compared to children without a diagnosis of asthma. Children under 5 years of age and children with asthma are at higher risk for morbidity and mortality associated with influenza. More research is needed to understand the gaps in practice and patient/family preference that contribute to lower levels of vaccination and reduce barriers to improve vaccination rates in these high-risk populations.

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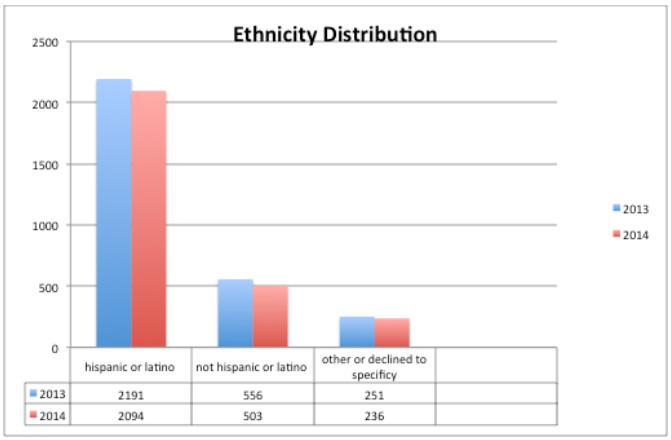
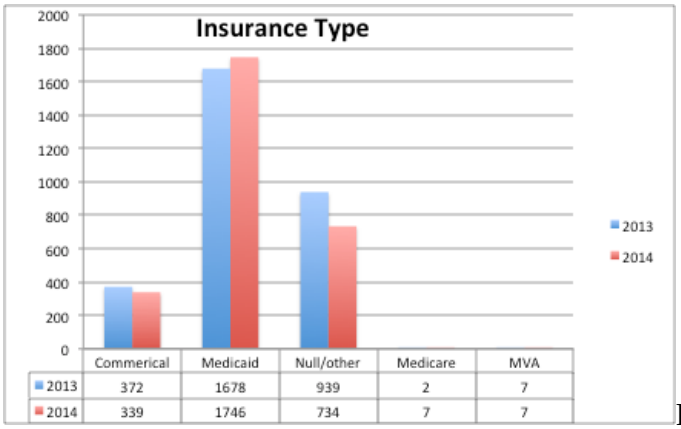


Figure 1



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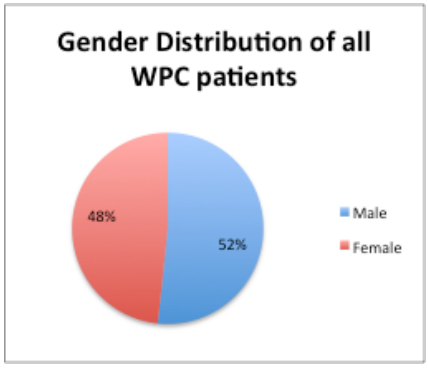

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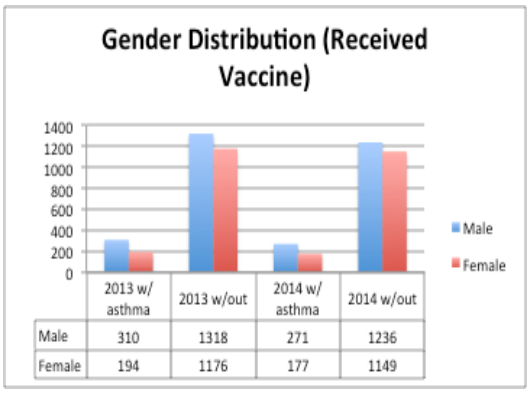

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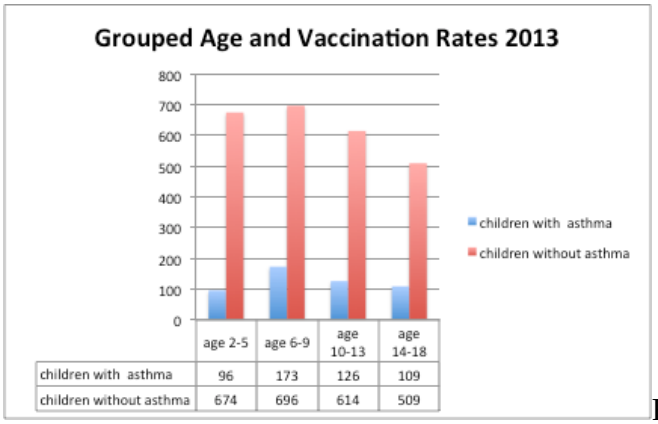

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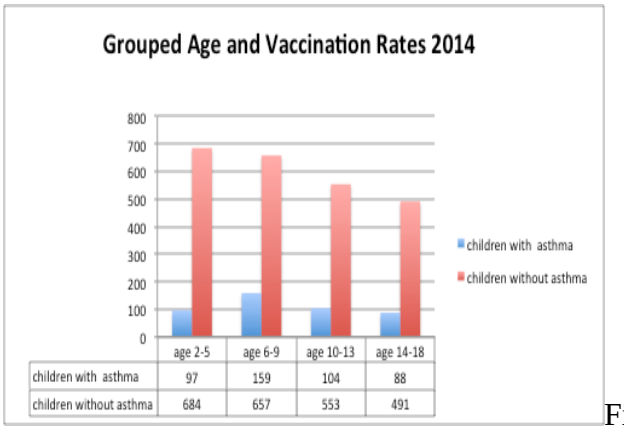

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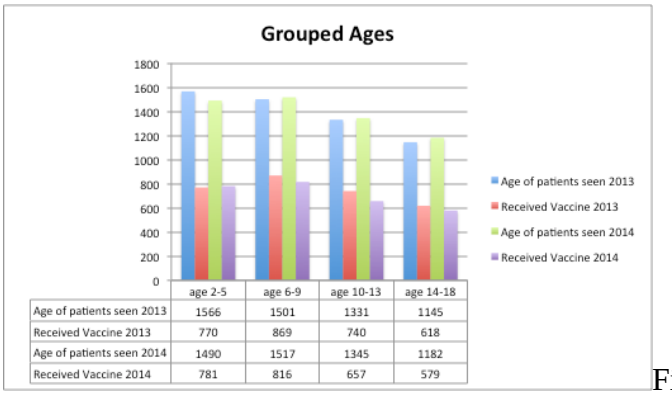

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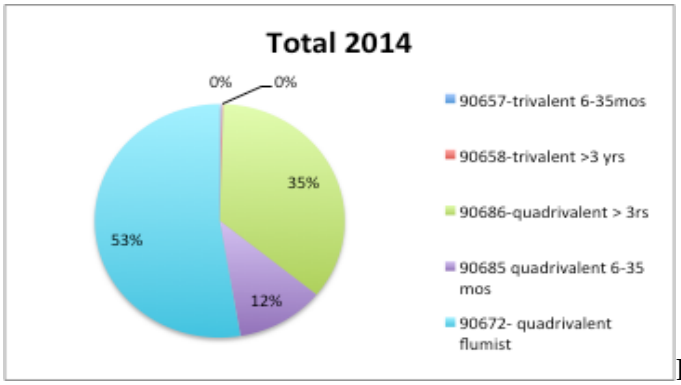
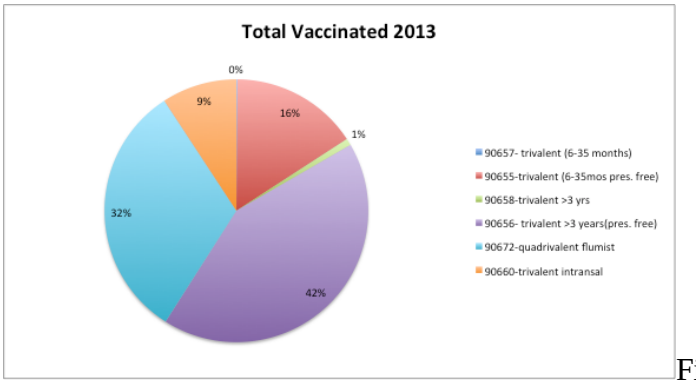


Figure 9



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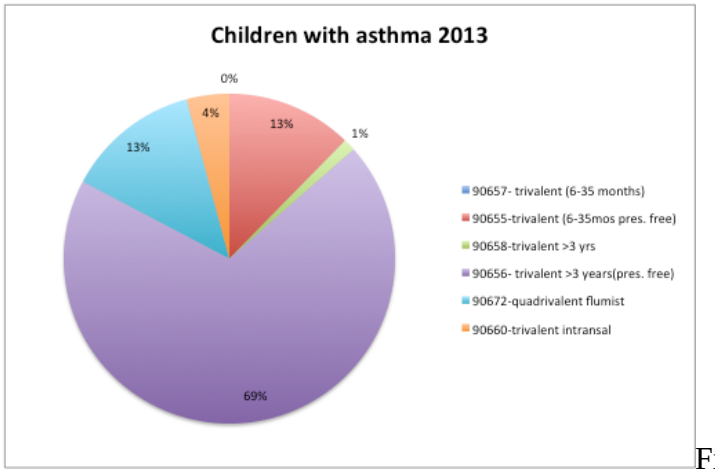

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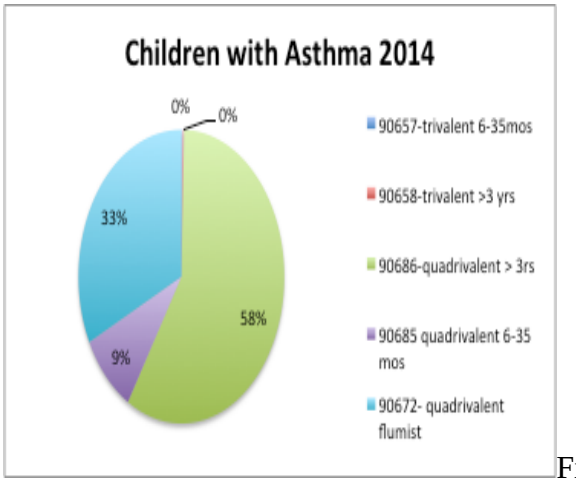

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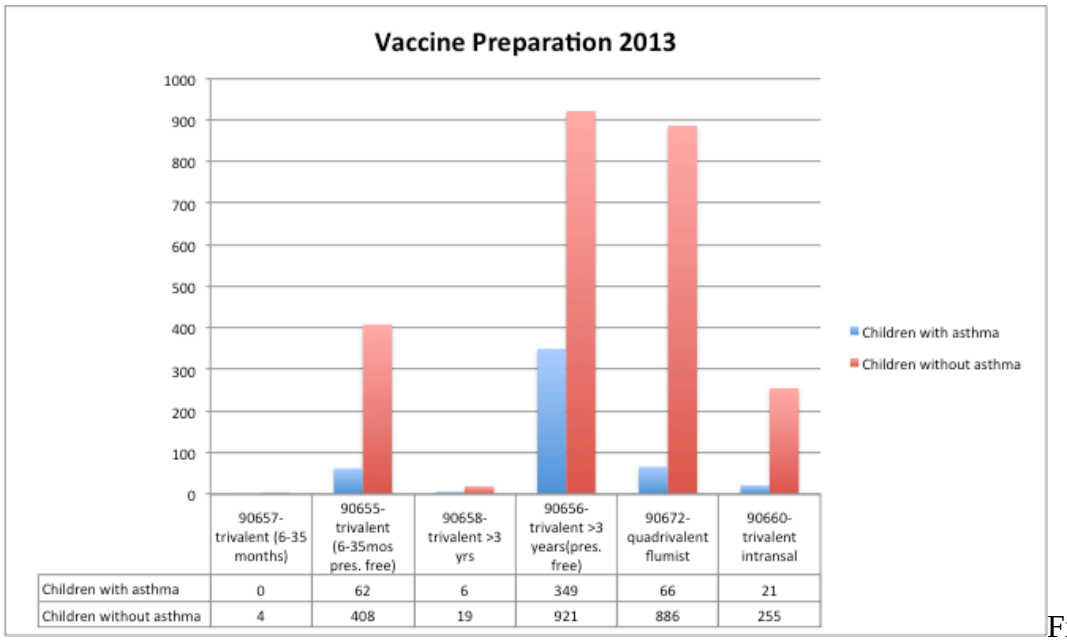
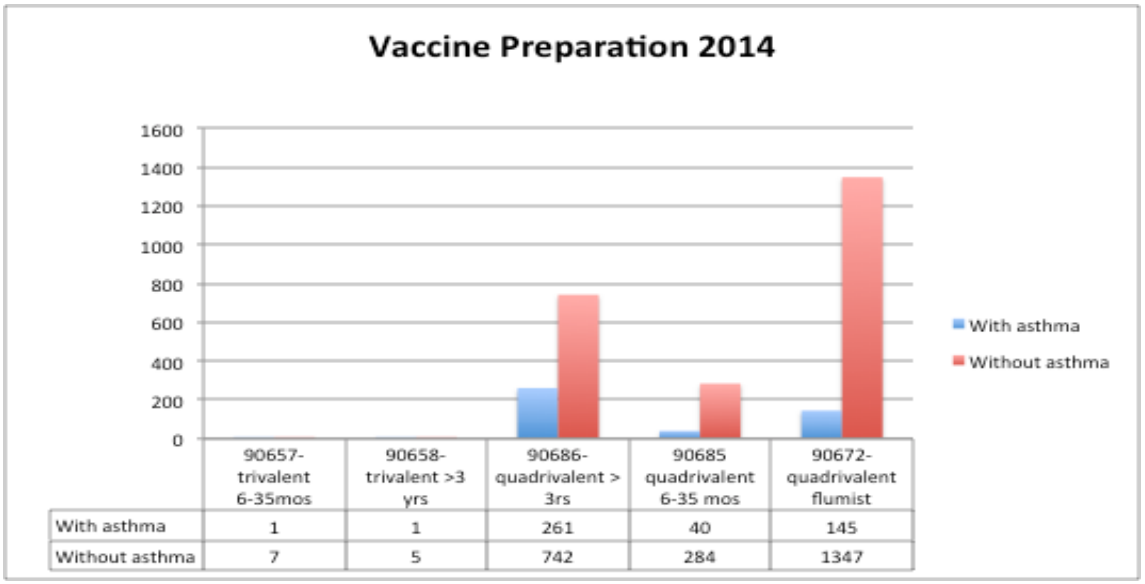


	90657-trivalent (6-35 months)	90655-trivalent (6-35mos pres. free)	90658-trivalent >3 yrs	90656-trivalent >3 years(pres. free)	90672-quadrivalent flumist	90660-trivalent intransal
Children with asthma	0	62	6	349	66	21
Children without asthma	4	408	19	921	886	255

Figure 13



	90657-trivalent 6-35mos	90658-trivalent >3 yrs	90686-quadrivalent > 3rs	90685 quadrivalent 6-35 mos	90672-quadrivalent flumist
With asthma	1	1	261	40	145
Without asthma	7	5	742	284	1347

Figure 14