Influenza Vaccine and Children: Evaluation of Vaccine Compliance and Subsequent
Influenza-Like Illness at a Pediatric Primary Care Clinic

Dua K. Siam, MSN, RN, APRN, FNP-c

Alice L. March, PhD, RN, FNP, CNE

University of Alabama

Capstone College of Nursing
Abstract

Influenza can spread quickly among children. Vaccination is the most effective way in preventing the disease and stemming the spread of influenza. This study investigated: 1) the relationship between influenza vaccination adherence and the rate of subsequent influenza-like illness among children; 2) the rate of practitioner offered influenza vaccine; and 3) This retrospective chart review evaluated pediatric primary care clinic in rural southeast Kansas. The charts were selected from visits between September 1, 2013 and February 28, 2014. The charts were reviewed with the following variables recorded: age, visit date, reason for visit, caregiver presence, type of provider, vaccine offered, vaccine accepted, return sick visit, diagnosis for return visit. A power analysis for a chi square goodness of fit test with parameters set at 0.05 alpha and 0.80 power yielded sample size of 143 charts to be reviewed. The grouping variable is patients who have received the vaccine versus those who have not. Within the grouping variable three groups exist: vaccinated, offered and declined, not offered. The dependent variable is illness versus no illness. This allows us to examine the relationships between those who received the vaccine and did or did not become ill, versus those who received the vaccine and did or did not become ill. The data will be analyzed using SPSS. Expected analytical tests include frequencies to explicate the demographic composition of the sample and other data. The chi square goodness of fit test will determine the statistical significance of the relationships.

Keywords: Influenza vaccine, children, vaccine compliance, influenza-like illness
Introduction

In 2008, about 40% of the United States (US) population eligible for influenza vaccine was vaccinated, which was below Healthy People 2020 goal of increasing immunization rates and reducing preventable infectious disease (McAuliffe et al., 2013). The Centers for Disease Control and Prevention (CDC) has issued recommendations that all children age 6 months to 18 years of age be vaccinated for influenza (CDC, 2014). Influenza rates have increased dramatically in recent years and have now reached epidemic proportions (Groshkopf et al., 2013). Intervention by healthcare providers has become imperative. In spite of the best efforts by the CDC and healthcare providers in issuing advisories, the rate of immunization to prevent influenza does not seem to be affected. Studies attribute the refusal of patients and caregivers to be vaccinated to concerns about the effects of vaccines and issues related to the safety of the vaccine (Robbins et al., 2011). These attitudes seem to be independent of whatever demographic group the patients fall in. Healthcare providers are facing an uphill battle in attempting to get patients immunized. To tackle the issue, healthcare providers mounted a campaign to address the most common misconceptions about the need for, efficacy of, and safety of the vaccine in order to increase the rate of patients’ immunizations (Perio, 2012).

The burden of influenza in the US is substantial with approximately 24,000 deaths and 226,000 hospitalizations per year. Infection rates are highest in children, and children play a crucial role in initiating and maintaining influenza epidemics in the community. Influenza is still one of the major threats to public health (O’Leary, et al., 2012). The World Health Organization (WHO) attributes up to five million severe illnesses and up to one half million deaths each year to influenza (Palache, 2011). Influenza among children is associated with increased medical
costs directly through the care of sick children, and indirectly through increased work
absenteeism among adults caring for infected children (Kempe et al., 2005).

The Advisory Committee on Immunization Practices (ACIP) has expanded
recommendations for yearly influenza vaccination for all children 6 months through 18 years
(Kemp et al, 2012). Influenza vaccination can prevent individual illness and reduce disease
burden within communities (Hofstetter, et al., 2013). Healthcare providers need to be more
aggressive in tackling the issue of parents’ refusal to immunize their children by being more
forceful in mounting an education campaign to assuage parents’ fears and trepidations (Gilkey, et
al, 2013).

In light of all this evidence and in order to understand the relationship between influenza
vaccination adherence and the rate of subsequent influenza-like illness among children, it was
decided to undertake this study at a rural pediatric clinic in southeast Kansas. The reason for the
choice of a pediatric clinic is the fact that it includes a large portion of highly susceptible
population ranging in age, including the ages 6 months to 36 months, an age group that is
deemed by the CDC as vulnerable population.

Theoretical Framework

The theoretical framework for the study employs a mid-range nursing theory and is
guided by Pender’s health promotion model (HPM). This model focuses on the following
concepts: importance of health, perceived benefits of health promoting behaviors and perceived
barriers to health-promoting behaviors (Pender, 1996). The HPM stresses the importance of
individual characteristics and experiences affecting behavior specific cognitions and outcomes.
The driving force for a health promoting behavior relies on knowledge and education. The model
also stresses the importance of intervention by the healthcare providers through stressing benefits of healthcare behaviors (Pender, 1996).

The HPM posits many assumptions, at the crux of which lies the realization by patients and their caregivers that a health promoting behavior leads to health benefits (Pender, 1996). On that theoretical basis, the healthcare providers can utilize these driving motivations by emphasizing and reinforcing health-promoting behaviors, always reminding the patients and caregivers of the probable benefits of such behaviors. Such a process produces a synergistic effect that can only result in higher levels of awareness and recognition of the fact that by engaging in health promoting behaviors, patients reap benefits.

In this study, the health promoting behavior is influenza vaccination for children. Healthcare providers can enhance the outcomes of such behaviors by educating patients and caregivers about the perceived benefits of influenza vaccination, i.e. vaccinated patients have a lower likelihood of contracting an influenza-like illness than non-vaccinated. It is also important for healthcare providers to stress that influenza is a transmitted disease and that health promotion activities of patients do not rely solely on themselves, but on others they come into contact with, such as school or day care. This argument becomes more convincing and appealing to patients and caregivers because they realize that others’ actions may lead to undesired effects associated with contracting influenza virus and related illnesses.

Literature Review

Studies demonstrate that children with high-risk medical conditions may have severe episodes of illness when after contracting influenza (Tran, 2011). The CDC recommends a seasonal influenza vaccine annually and taking preventative actions, such as washing hands, (CDC, 2009). Such actions are consistent with Penders’ HPM, stressing the importance of health
and health promotion behaviors. It is reported that the rate of actual vaccination of children is about 25% (Singleton et al, 2010). According to Tran (2011) in one study, 43% of mothers reported that they would not vaccinate their children and about 61% were unsure if they would vaccinate their children (Tran, 2011). This alarming high number of parents expressing a disinterest in vaccinating their children necessitates the study of the factors leading to these decisions.

Factors affecting the decision to vaccinate children include but are not limited to perceptions and beliefs, perceived risk, worry of contracting influenza, and low susceptibility to contracting disease (Tran, 2011). Other barriers include lack of awareness about influenza vaccination, recommendations from the CDC and lack of routine preventative care among adolescents (Gowda et al, 2012). For children and adolescents, the person responsible for making the decision is typically a parent or legal guardian. Parents may be inadequately informed of the seriousness of influenza and or may have not experienced the seriousness of the disease in other children (Chen et al., 2011).

Barriers to immunizing children relate to beliefs and perceptions of the parents or the legal guardian such as parental concern and misconceptions about the benefit of vaccination (Lutchy, 2010). Other barriers stem from exposure to media outlets that spread rumors about adverse effects of immunizations, or the ineffectiveness of those vaccines (Robbins, 2011). Despite positive recommendation to vaccinate, negative news has stronger effect on caregivers (Chen et al., 2011). Studies also demonstrate misconceptions about the efficacy of the vaccine coupled with the belief that the vaccine is not safe (Perio, 2012). Such perceived barriers to health promoting behaviors are consistent with Penders’ HPM and according to the HPM, individual characteristics and experiences do effect behaviors specific cognitions and outcomes.
Thus it is necessary for the health promoting behavior to rely on knowledge and education and the intervention by health care providers stressing the benefits of healthcare behaviors.

The CDC advisory committee on immunizations practices (ACIP) has issued recommendations for influenza vaccination to include annual influenza vaccination for all persons aged 6 months and older (Groshkopf et al., 2013). It is the contention of the ACIP that an annual influenza vaccination would be an effective means of preventing influenza and the complications arising from influenza. The adherence to the aforementioned recommendations by healthcare providers varies greatly depending on specialty. Pediatricians are more likely to adhere to the recommendations when compared to family medicine physicians (O’Leary, 2012). The barriers to compliance by the providers range from vaccine supply to cost and lack of time (Flocke, 2007). Providers also report lack of health insurance coverage as a barrier to vaccination (Gannon et al, 2012).

Faced with all of these impediments to immunization, providers at all levels of practice must mount a strong campaign to educate parents and patients about the importance of following the recommendations of the ACIP. Health care providers are highly regarded by patients and parents. Provider opinions matter and carry weight related to the decision making process of the parents. Hence, healthcare providers can achieve the goal stated by ACIP by ensuring visible (and education level appropriate) educational material throughout the clinic, distributing pamphlets to parents, sending reminders and scheduling vaccine only visit (Humiston, 2013).

Methodology

Setting

The study is a retrospective chart review in a small rural southeast Kansas pediatric primary care clinic, to investigate: 1) the relationship between influenza vaccination adherence
and the rate of subsequent influenza-like illness among children, 2) the rate of practitioner offered influenza vaccine, and 3) the rate of patient/family acceptance of vaccination recommendation.

Sample

This is a retrospective chart review of patients ages 6 months to 18 years who visited the clinic during the period starting September 1, 2013 and ending February 28, 2014. Inclusion criteria included charts of patients who were ages 6 months to 18 years at the index visit between the specified dates. All patients less than 6 months of age were excluded from the study. A power analysis for a chi square goodness of fit test with parameters set at 0.05 alpha and 0.80 power yielded a sample size of 143 charts to be reviewed.

Procedure

After human subjects approval was obtained, a query of the system created a list of charts meeting inclusion criteria. Once the list was developed, a random number approach will be used to replace the patient name on the identified charts with a study ID number. Variables assessed are listed in the data collection tool included: age, visit date, reason for visit, caregiver presence, type of provider, vaccine offered, vaccine accepted, return sick visit, diagnosis for return visit.

The charts were selected using the random number approach according to the de-identified study ID numbers. A total of a 143 charts were selected and the investigator pulled the charts to record the assessed variables on the data collection too. Some charts which were duplicates were replaced by more charts being selected using the same random method of selection to bring the total number of charts to 143 unique charts. The charts were reviewed for an index visit, defined as the first visit the vaccine was or should have been offered on or after September 1, 2013. Once an index visit was established, the chart will be reviewed for the listed
variables and for subsequent visits with a diagnosis of influenza, influenza-like illness, or influenza complications.

**Analysis**

The grouping variable is patients who have received the vaccine versus those who have not. Within the grouping variable three groups exist: vaccinated, offered and declined, not offered. The dependent variable is illness versus no illness. This allowed an examination of the relationships between those who received the vaccine and did or did not become ill, versus those who received the vaccine and did or did not become ill.

**Collection Tool**

A collection tool has been developed and used in the transcription of findings during the chart review. Table 1 shows the collection tool that was used in the study. The collection tool breaks down the population at the clinic to three subgroups: 6 months to 35 months, 36 months to 8 years 11 months, and 9 years to 18 years, thus meeting the inclusion criteria and excluding those aged less than 6 months. The charts were searched for an index visit defined as first visit on which the influenza vaccine was given or the vaccine should have been offered. Subsequent sick visits for influenza like illness were also recorded. Another parameter investigated was whether the vaccine was offered or not and if offered whether it was accepted or refused.

**Results**

The data was collected and tabulated. The sample size was 143, which were broken down into three age categories, for 6 months to 35 months age categories total of 44 charts reviewed, for 36 months to 8 years 11 months a total of 52 charts, and for 9 years to 18 years total of 47 charts.

Age group 6 months-35 months: Table 2 shows that in this age group, 28 were vaccinated and 16 not vaccinated. Of those vaccinated, two became subsequently ill with influenza-like illness
whereas 26 did not become ill. Of the 16 not vaccinated, four became subsequently ill whereas 12 did not. On a percentage basis, table 3 shows that 7% who were vaccinated contracted influenza-like illness as opposed to 25% who were not vaccinated.

Age group 36 months-8 years 11 months: table 2 shows that in this age group, 20 were vaccinated and 32 not vaccinated. Of those vaccinated, none became subsequently ill with influenza-like illness. Of the 32 not vaccinated, 6 became subsequently ill whereas 26 did not. On a percentage basis, table 3 shows that 0% who were vaccinated contracted influenza-like illness as opposed to 19% who were not vaccinated.

Age group 9 years-18 years: Table 2 shows that in this age group, 11 were vaccinated and 36 not vaccinated. Of those vaccinated, one became subsequently ill with influenza-like illness. Of the 36 not vaccinated, 3 became subsequently ill whereas 33 did not. On a percentage basis, table 3 shows that 9% who were vaccinated contracted influenza-like illness as opposed to 8% who were not vaccinated. For a graphical representation, the data in table 2 and table 3 are plotted on a bar graph represented in figures 1 and 2, respectively.

Another part of the study concerned itself with the question whether the vaccine was being offered by the providers or not and when the vaccine was offered was it accepted or refused by the patients’ care givers. In a comparison of the different age groups, the following results were obtained.

Age group 6 months-35 months: Table 4 shows that the vaccine was offered 31 times to patients in this age group and 28 accepted as opposed to 3 who refused the vaccine. The vaccine was not offered in 13 patient encounters. Table 5 is a percentage representation of table 4, showing that the vaccine was offered 70% of the times and was accepted at a 90% rate when offered with a 10% rate of refusal.

Age group 36 months-8 years 11 months: Table 4 shows that the vaccine was offered 23 times to patients in this age group and 20 accepted as opposed to 3 who refused the vaccine. The
vaccine was not offered in 29 patient encounters. Table 5 is a percentage representation of table 4, showing that the vaccine was offered 44% of the times and was accepted at a 87% rate when offered with a 13% rate of refusal.

Age group 9 years to 18 years: Table 4 shows that the vaccine was offered 14 times to patients in this age group and 11 accepted as opposed to 3 who refused the vaccine. The vaccine was not offered in 33 patient encounters. Table 5 is a percentage representation of table 4, showing that the vaccine was offered 30% of the times and was accepted at a 79% rate when offered with a 21% rate of refusal.

Discussion

It is clear from looking at the data in tables 2 through 5 that there seems to be a high rate of vaccination in the age group 6 months to 35 months and there is a dramatic drop off in the rate of vaccination amongst the other two age groups. The rate of incidences of influenza-like illness amongst those who are vaccinated is much lower in the first two age groups as opposed to those who have not been vaccinated. In contrast the rate of incidences of subsequent influenza-like illness amongst the 9 year to 18 year age groups seems to be unaffected by the fact that vaccination took place or not.

There seems to be much more conscious effort at offering the vaccine to children 6 months to 35 months old as opposed to the two other age groups. It is worthwhile to point out that whenever the vaccine is offered, the rate of acceptance of the vaccine exceeds 79%. It is unclear from the study why the high vaccination rates and coupled with the high rate of offering the vaccine co-inside with the age group of 6 months to 35 months and drop off with the other age groups. Once explanation might be that for this vulnerable age group of 6 months to 35 months, both the caregiver and the provider and consciously and actively seeking to protect this population. It might be that when the children are older, then the parents or the caregivers may
not be as worried about them getting the influenza as they would if they were in that vulnerable age group. Such speculation is not founded in any of the research methodology followed in this study, therefore, to further understand the reasons for such health promoting behaviors and barriers, a more detailed study would have to be undertaken.

It is recommended that the healthcare provider make a more conscious effort at offering the vaccine to the patient since the data show that when the vaccine is offered, the rate of acceptance exceeds 79%.
References


Mei-Fang Chen, Ruey-Hsia Wang, Joanne, Kraenzle Schneider, Chung-Ting Tsai, Donald Dah-Shyong Jiang, Min-Nan Hung, & Li-Jen Lin. (2011). Using the health belief model to


Table 1: data collection tool

<table>
<thead>
<tr>
<th>Study ID # ________________</th>
</tr>
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<tbody>
<tr>
<td>Age (Circle one): 6 months to 35 months</td>
</tr>
<tr>
<td>36 months to 8 years 11 months</td>
</tr>
<tr>
<td>9 years to 18 years</td>
</tr>
<tr>
<td>Date of index visit: __________</td>
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<tr>
<td>Reason for index visit (Circle one): Well child</td>
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<tr>
<td>Sick visit</td>
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<td>Caregiver present (Circle one): Yes</td>
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</tr>
<tr>
<td>Provider (Circle one): MD</td>
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<tr>
<td>NP</td>
</tr>
<tr>
<td>Influenza vaccine offered (Circle one): Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td>Influenza vaccine accepted (Circle one): Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td>If no-state reason ________________</td>
</tr>
<tr>
<td>Return sick visit for influenza-like illness: Date ________________</td>
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<td>None</td>
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<td>Diagnosis: ________________</td>
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Table 2: number of vaccinated vs. not vaccinated and incidences of subsequent influenza-like-illness among different age groups (sample size N=143)

<table>
<thead>
<tr>
<th>Age group</th>
<th>Number</th>
<th>Vaccinated</th>
<th>Not vaccinated</th>
<th>Sick</th>
<th>Not sick</th>
<th>Sick</th>
<th>Not sick</th>
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</thead>
<tbody>
<tr>
<td>6-35 mo</td>
<td>44</td>
<td>28</td>
<td>16</td>
<td>2</td>
<td>26</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>36 mo-8 yr 11 mo</td>
<td>52</td>
<td>20</td>
<td>32</td>
<td>0</td>
<td>20</td>
<td>6</td>
<td>26</td>
</tr>
<tr>
<td>9 yr- 18 yr</td>
<td>47</td>
<td>11</td>
<td>36</td>
<td>1</td>
<td>10</td>
<td>3</td>
<td>33</td>
</tr>
</tbody>
</table>
Table 3: percentage of vaccinated vs. not vaccinated and incidences of subsequent influenza-illness among different age groups (N=143)

<table>
<thead>
<tr>
<th>Age group</th>
<th>Number</th>
<th>Vaccinated</th>
<th>Not vaccinated</th>
<th>Sick</th>
<th>Not sick</th>
<th>Sick</th>
<th>Not sick</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-35 mo</td>
<td>44</td>
<td>64</td>
<td>36</td>
<td>7</td>
<td>93</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>36 mo-8 yr 11 mo</td>
<td>52</td>
<td>38</td>
<td>62</td>
<td>0</td>
<td>100</td>
<td>19</td>
<td>81</td>
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<tr>
<td>9 yr- 18 yr</td>
<td>47</td>
<td>23</td>
<td>77</td>
<td>9</td>
<td>91</td>
<td>8</td>
<td>92</td>
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Table 4: comparison of vaccine offering and rate of acceptance/refusal (N=143)

<table>
<thead>
<tr>
<th>Age group</th>
<th>Number</th>
<th>Offered</th>
<th>Not offered</th>
<th>Accepted</th>
<th>Refused</th>
</tr>
</thead>
<tbody>
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<td>6-35 mo</td>
<td>44</td>
<td>31</td>
<td>13</td>
<td>28</td>
<td>3</td>
</tr>
<tr>
<td>36 mo-8 yr</td>
<td>11 mo</td>
<td>52</td>
<td>23</td>
<td>29</td>
<td>20</td>
</tr>
<tr>
<td>9 yr-18 yr</td>
<td>47</td>
<td>14</td>
<td>33</td>
<td>11</td>
<td>3</td>
</tr>
</tbody>
</table>
Table 5: percentage of vaccine offering and rate of acceptance/refusal (N=143)

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Age</th>
<th>Number</th>
<th>Offered</th>
<th>Not offered</th>
<th>Accepted</th>
<th>Refused</th>
</tr>
</thead>
<tbody>
<tr>
<td>N-35 mo</td>
<td>6-35 mo</td>
<td>44</td>
<td>70</td>
<td>30</td>
<td>90</td>
<td>10</td>
</tr>
<tr>
<td>36 mo-8 yr</td>
<td>36 mo-8 yr</td>
<td>52</td>
<td>44</td>
<td>56</td>
<td>87</td>
<td>13</td>
</tr>
<tr>
<td>11 mo</td>
<td>11 mo</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>9 yr-18 yr</td>
<td>9 yr-18 yr</td>
<td>47</td>
<td>30</td>
<td>70</td>
<td>79</td>
<td>21</td>
</tr>
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Figure 1: representation of the values in table 2
Figure 2: presentation of the percentage values of percentages in table 3