


Knowledge Base and Perceptions of Inpatient Providers and Parents About Influenza Vaccination in Hospitalized Children

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The American Academy of Pediatrics recommends influenza vaccination for all children 6 months and older.¹ The influenza vaccine is estimated to have prevented 19 414 hospitalizations and 178 deaths in children under 18 years of age in the United States (U.S.) during the 2017-18 influenza season.² However, only 59% of children 6 months and older received the influenza vaccine in the U.S. during the 2013-17 influenza seasons.³

The inpatient setting has been vastly underutilized as a venue to provide the influenza vaccine for children. Only 4% of children received an influenza vaccine in the hospital setting in the U.S. in 2016-17.⁴ Providing influenza vaccination to hospitalized children can increase the overall influenza vaccine coverage for children.

We implemented a quality improvement initiative to increase influenza vaccination rates in our children's hospital during the 2017-18 influenza season.⁵ A critical element in increasing vaccination rates is provider knowledge about the influenza vaccine, which can greatly impact their ability to counsel and vaccinate their patients. Increased obstetrician knowledge about the influenza vaccine was associated with increased rates of vaccination in their patients.⁶ Understanding both the attitudes of providers about influenza vaccination and barriers to vaccination in the hospital setting is critical for any effort to increase vaccination rates in hospitalized children.

We sought to determine the knowledge base and attitudes of our inpatient medical providers regarding influenza vaccination and to identify barriers to offering vaccination. Identifying knowledge gaps of providers and barriers to vaccination would help us tailor educational interventions to address these gaps and barriers. In addition, we also surveyed parents of hospitalized children about their acceptance of the influenza vaccine in the inpatient setting. Understanding reasons for refusal can help us better develop strategies to increase vaccine acceptance.

Method

This study was conducted in the inpatient units of a 350-bed, tertiary care freestanding children's hospital in an urban center in the Midwestern U.S. with approximately 16 000 annual admissions. A survey was designed to query inpatient medical providers about their knowledge of influenza vaccination and barriers to administering the vaccine in the inpatient setting. Survey questions with answers presented in a multiple choice format were designed by MS (senior author and attending physician in the hospitalist service) and was administered to all pediatric residents (n=94) and hospitalists (n=55) between 10/01/2017 and 10/15/2017 via e-mail with a web link to SurveyMonkey (SurveyMonkey Inc. Palo Alto, CA). In addition, MS walked around the inpatient units and handed out paper copies of the surveys to residents with a request to complete them and place them in an envelope. Survey responses were anonymous and not linked to specific e-mail addresses. Answers to the questions were provided at the end of the web-based survey/quiz.

Surveys (lacking patient identifiers) to query the parents of hospitalized children about their attitudes regarding influenza vaccination were distributed to a convenience sample of parents/families of children admitted to the inpatient units (excluding the intensive care units) between 11/3/2017 and 4/28/2018. The completed surveys were subsequently collected by a nurse or a member of our team. Due to the limited team member availability, only families available at the time a team member was present were approached.

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Table 1. Knowledge of American Academy of Pediatrics Recommendations About Influenza Vaccination.

| | All providers ^a N=116 (%) | Hospitalists N=45 (%) | Residents N=71 (%) | <i>p</i> ^b |
|--|---|--------------------------|-----------------------|-----------------------|
| What type of vaccine is recommended for the 2017-18 influenza season by the American Academy of Pediatrics for children? | | | | .04 |
| Inactivated influenza vaccine ^c | 102 (88) | 36 (80) | 66 (93) | |
| Live attenuated influenza vaccine (intranasal) for children greater than 2 years of age | 0 (0) | 0 (0) | 0 (0) | |
| Either inactivated influenza or live attenuated (intranasal) vaccine based on the child's age and co-morbidities | 14 (12) | 9 (20) | 5 (7) | |
| The American Academy of Pediatrics recommends influenza vaccine to | | | | |
| All children >6 months of age ^c | 114 (98) | 45 (100) | 69 (97) | >.99 |
| Two doses of influenza vaccine are required for children in the following age range during their first season of vaccination: | | | | .0007 |
| 6-23 months | 73 (63) | 19 (42) | 54 (76) | |
| 6 months to 8 years of age ^c | 28 (24) | 19 (42) | 9 (13) | |
| 6 months to 5 years of age | 11 (10) | 5 (11) | 6 (8) | |
| Do not know | 4 (3) | 2 (4) | 2 (3) | |
| The minimum interval between the 2 doses is | | | | .5 |
| 4 weeks ^c | 73 (63) | 34 (76) | 47 (66) | |
| 8 weeks | 28 (24) | 1 (2) | 5 (7) | |
| 6 weeks | 11 (10) | 6 (13) | 8 (11) | |
| Do not know | 4 (3) | 4 (9) | 11 (15) | |
| Contraindications for inactivated influenza vaccine are^d: | | | | |
| History of severe allergic reaction to influenza vaccine ^c | 114 (98) | 45 (100) | 69 (97) | .5 |
| Age less than 6 months ^c | 106 (91) | 40 (89) | 66 (93) | .5 |
| Being on stress dose steroids | 29 (25) | 7 (16) | 22 (31) | .08 |
| Fever | 26 (22) | 8 (18) | 18 (25) | .4 |
| Egg allergy | 20 (17) | 5 (11) | 15 (21) | .2 |
| Daily steroid use | 7 (6) | 5 (11) | 2 (3) | .1 |

^aAll providers: Includes hospitalists and residents.

^b*P* values calculated to determine if there are any significant differences in responses of hospitalists versus residents.

^cIndicates the correct response.

^dRespondents can select more than one answer.

Chi-square or Fisher's exact tests were used to compare the responses of hospitalists and residents as well as to compare the characteristics of children whose families who had either vaccinated their child or were planning to vaccinate them during the hospitalization versus parents who did not want to vaccinate their child during this admission. A *P*-value <.05 was considered significant. Washington University Institutional Review Board approval was obtained for administering the parent feedback survey. The provider survey was done as part of a quality improvement initiative in the hospital, and Washington University Institutional Review Board determined that this initiative was exempt from human subjects review.

Result

Seventy-one residents (75%) and 45 hospitalists (82%) responded to the survey.

Most physicians (88%) were aware that the AAP recommended the inactivated influenza vaccine for the 2017-18 influenza season and that vaccination was indicated for children 6 months and older (98%) (Table 1). Most physicians (76%) did not know or did not correctly identify the age range (6 months-8 years) during which two doses of the vaccine are required for the child's first influenza season (Table 1). About a third (37%) of the physicians failed to correctly identify that four weeks is the minimum interval between two doses of the vaccine (Table 1).

Steroid use (31%), fever (22%), and egg allergy (17%) were all incorrectly considered as contraindications by some medical providers (hospitalists and residents) indicating knowledge gaps regarding contraindications to the influenza vaccine (Table 1).

The primary reasons that providers chose for not offering the influenza vaccine to children were that they were

Table 2. Provider Attitudes and Barriers to Influenza Vaccination.

| | All providers ^a N = 116 (%) | Hospitalists n = 45 (%) | Residents n = 71 (%) | <i>p</i> ^b |
|--|---|----------------------------|-------------------------|-----------------------|
| What are the reasons you did not offer influenza vaccine to hospitalized children under your care in the past year?^c | | | | |
| Was more worried about their acute illness and did not think about vaccination | 57 (49) | 18 (40) | 39 (55) | .1 |
| Just did not think about it | 54 (47) | 22 (49) | 32 (45) | .7 |
| Felt that vaccination should be given at PMD office | 18 (16) | 6 (13) | 12 (17) | .8 |
| Concerned about administering vaccine to a sick child | 17 (15) | 4 (9) | 13 (18) | .2 |
| Other ^d | 20 (17) | 6 (13) | 14 (20) | .4 |
| What do you think are barriers to administering influenza vaccine in the inpatient setting?^c | | | | |
| It is not ordered often during admission, subsequently it is forgotten as we discuss other acute issues | 92 (79) | 29 (64) | 63 (89) | .002 |
| Parental refusal | 63 (54) | 27 (60) | 36 (51) | .3 |
| Delays discharge since we do not often order it during admission | 24 (21) | 9 (20) | 15 (21) | >.99 |
| Parents are often not available to obtain consent | 20 (17) | 6 (13) | 14 (20) | .4 |
| Other | 1 (1) | 0 (0) | 1 (1) | >.99 |

^aAll providers: Includes hospitalists and residents.

^b*P* values calculated to determine if there are any significant differences in responses of hospitalists versus residents.

^cRespondents can select more than one answer.

^dOther response: Almost all provider "other" responses stated they were medical students the previous year (residents) or were not in inpatient rotations during the influenza season (residents/hospitalists) and thus did not have an opportunity to offer the influenza vaccine.

more worried about the acute illness for which the child was hospitalized and did not think about vaccination (49%) or just did not think about it (47%) (Table 2). The primary barrier identified by 79% of providers to administering the influenza vaccine was not ordering the vaccine at admission and forgetting about it subsequently during the child's hospitalization (Table 2). Another major barrier identified by 54% of the providers was parental refusal of the vaccine (Table 2).

Comparison of the knowledge base, attitudes, and barriers to vaccination between hospitalists and residents showed only a few significant differences in the responses between the two groups (Tables 1 and 2). A significantly ($P=.04$) higher proportion of residents (93%) compared to hospitalists (80%) were aware that the AAP recommended inactivated influenza vaccine for children during the 2017-18 influenza season. However, a significantly higher proportion of hospitalists (42%) compared to residents (13%) were aware that two doses of the influenza vaccine was recommended for children 6 months to 8 years of age. There was no significant difference in resident and hospitalist knowledge base of contraindications to influenza vaccine or the minimum interval needed between two doses of the influenza vaccine.

Parent feedback was obtained from 253 families; 76% (192/253) of families reported that either their child had already received the influenza vaccine this season prior to admission or were planning to vaccinate their child during the hospital stay, and 24% (61/253) of families did not plan to vaccinate their child during the hospitalization.

Most children (70%) whose families were surveyed were less than 9 years of age (Table 3). About a quarter of the children (24%) had been admitted to the pediatric intensive care unit (PICU) during their hospital stay, and 53% of children had one or more chronic medical conditions. There was no significant difference in the proportion of children admitted to the PICU or had a chronic medical condition between families who had either vaccinated their child or were planning to vaccinate them during the hospitalization versus parents who did not want to vaccinate their child during this admission (Table 3).

The four main reasons listed by families for vaccine refusal were concern about the side effects of the vaccine (30%), lack of belief that the vaccine works (26%), did not think their child needed the vaccine (20%), and did not want to give the vaccine when their child was sick (20%) (Table 4). Most families (61%) responded that it was convenient to get the vaccine in the hospital, and only 11% did not want their child to receive the vaccine in the hospital (Table 4).

Discussion

Our study identified knowledge gaps about influenza vaccination among both residents and attending physicians. Studies have shown that in children less than 9 years old, two doses of the influenza vaccine are more protective compared to one dose (partially vaccinated) during the first influenza season for the child.^{7,8} Our survey results show a lack of knowledge about the age

Table 3. Baseline Characteristics of Children Whose Families were Surveyed.

| | All families N = 253 (%) | Vaccinated or will vaccinate during this admission n = 192 (%) | Not vaccinated and do not want to vaccinate during this admission n = 61 (%) | P ^a |
|--|-----------------------------|--|--|----------------|
| Age range of child | | | | .5 |
| 6 months-2 years | 114 (45) | 90 (47) | 24 (39) | |
| 3 years-8 years | 63 (25) | 45 (23) | 18 (30) | |
| >9 years | 75 (30) | 57 (30) | 18 (30) | |
| Was your child admitted to the PICU during this admission? | | | | .2 |
| Yes | 61 (24) | 50 (26) | 11 (18) | |
| No | 189 (75) | 139 (72) | 50 (82) | |
| No answer provided | 3 (1) | 3 (2) | 0 (0) | |
| Does your child have any chronic medical condition?^b | | | | .9 |
| One or more chronic health issues | 135 (53) | 103 (54) | 34 (56) | |
| No chronic health condition | 89 (35) | 68 (35) | 21 (34) | |
| No answer provided | 29 (11) | 21 (11) | 6 (10) | |

^aP values are calculated to determine if there was a significant difference in the responses of parents who had either already vaccinated their children or were planning to vaccinate them during hospitalization versus parents whose children were not vaccinated and were not planning to vaccinate their children during this admission.

^bList of chronic medical conditions included asthma, heart disease, diabetes, kidney disease, cystic fibrosis, Crohn's disease or ulcerative colitis, genetic syndrome, prematurity (born at less than 35 week gestation), epilepsy or seizure disorder, cancer, or other chronic medical condition for which the child is seen by at least 1 specialist.

Table 4. Parent Feedback.

| | N = 61 ^a (%) |
|--|-------------------------|
| Reason for not getting flu vaccine this admission^b | |
| I am worried about side effects of the flu vaccine | 18 (30) |
| Do not think it really works | 16 (26) |
| Do not think my child needs the flu vaccine | 12 (20) |
| Do not want to give the vaccine when my child is sick | 12 (20) |
| Would prefer to get the vaccine at the pediatricians office | 3 (5) |
| My child has never had the flu so I do not think my child needs the vaccine | 3 (5) |
| We do not vaccinate our child with any vaccines | 3 (5) |
| Cannot remember if he/she already got the flu vaccine this season | 1 (2) |
| Contraindication | 3 (5) |
| Other reason that I would rather not discuss | 6 (10) |
| Do you like having the opportunity to give the flu vaccine to your child in the hospital?^c | |
| Yes, it is really convenient to get it in the hospital | 155 (61) |
| Does not matter to me | 62 (25) |
| No, I would rather not deal with getting the flu vaccine when my child is sick | 29 (11) |
| Other | 7 (3) |

^aThese are families whose children were not already vaccinated and did not want flu vaccine this admission.

^bRespondents can select more than 1 answer.

^cPercentages are calculated for all families surveyed (N = 253).

range for this requirement among both residents and hospitalists.

Parents rely on physicians to provide information about influenza vaccination. Egg allergy of any severity is not a contraindication to influenza vaccination.¹ Patients

admitted with asthma exacerbation are often on steroid therapy, which is also not a contraindication for influenza vaccination. Some providers (both hospitalists and residents) incorrectly believed egg allergy and ongoing steroid use are contraindications for influenza vaccination.

These misperceptions can lead to a lack of immunization of children with asthma who are at increased risk for influenza-related morbidity and mortality.

The primary reason cited by medical providers for not offering the vaccine was that they did not think about it or were worried about the acute illness for which the child was hospitalized. Understanding these reasons helped us tailor our education sessions to address the safety of influenza vaccination during hospitalization for an acute illness.⁵ The primary barriers reported by the medical providers to administering influenza vaccination were parental refusal and forgetting to order the influenza vaccine at the time of admission. We also incorporated trigger questions into our electronic medical record and modified the history and physical exam template to help remind providers to order the vaccine at the time of admission.⁵

Survey results showed a dichotomy in provider and parental perceptions about influenza vaccination. A large proportion of providers cited parental refusal as a barrier to administering influenza vaccination in the inpatient setting. However, most parents surveyed answered that it was convenient to receive the vaccine in the hospital. Rao and colleagues noted a similar dichotomy between provider and parental attitudes about vaccination in the inpatient setting.⁹ Their study showed that parents were more open to inpatient influenza vaccination than what was perceived by the providers. We shared our results about parental attitudes regarding vaccination in the inpatient setting with our medical providers to change their perception and encourage them to offer influenza vaccine to all hospitalized children.

Reasons for parental refusal in our survey are similar to those cited by parents in other studies.¹⁰ Studies have shown that parental acceptance of influenza vaccine was higher when clinicians discussed vaccination using a presumptive format (presume acceptance) rather than a participatory format (parents asked questions about vaccination rather than presume that they will accept the vaccine).^{11,12} Teaching providers a presumptive format to initiate a vaccine discussion will be an important step to improve vaccination during future influenza seasons. It is interesting that admission of the child to the PICU or the presence of chronic medical conditions did not have a significant impact on parental decision to vaccinate their child. Targeted education efforts to families of children with chronic medical conditions is necessary to ensure that these children with increased risk from influenza are vaccinated.

There are limitations to this study. The study was conducted in one institution and may not be applicable in other settings. In addition, due to limited team member availability, we were not able to survey parents of all hospitalized children. We also did not have data on parents

who did not complete the survey, and therefore cannot calculate a response rate for the parental survey. Thus, the responses obtained may not accurately reflect the general attitudes of all parents. Since the parental surveys were anonymous, we could not confirm parental response about the vaccination status of their children or confirm whether children whose parents stated that they would vaccinate their child in the hospital did receive the vaccine.

The strength of this study is that it provided us with specific gaps in the knowledge base and attitudes/perceptions of providers that were addressed by our educational interventions.⁵ Provider education as well as other efforts during our quality improvement initiative to increase influenza vaccination at our hospital resulted in a 4.7-fold increase (10% baseline vs 46% during QI initiative) in the percentage of hospitalized children discharged with at least one dose of the influenza vaccine.⁵ We also believe that our survey can be utilized by providers at other institutions as an educational tool to assess the knowledge base of providers as well as educate them about the annual influenza vaccine recommendations.

Conclusion

We identified specific knowledge gaps as well as gained an understanding of the attitudes and barriers of providers and parents to administering influenza vaccine to hospitalized children. This helped us design interventions to educate providers and to overcome barriers, leading to an increase in influenza vaccination of hospitalized children at our institution.

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Author Contributions

Mythili Srinivasan contributed to the conception and design, acquisition, analysis and interpretation of data, drafted and critically reviewed the manuscript, and approved the final manuscript. **Shakila Mathew** contributed to acquisition, analysis and interpretation of data, critically reviewed the manuscript, and approved the final manuscript.

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