Evaluation of a Computer-based Patient Education and Motivation Tool on Knowledge, Attitudes and Practice towards Influenza Vaccination

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Abstract

The objective of this pilot study was to assess and describe changes in knowledge, attitudes and practice regarding influenza vaccination in an inner city setting using an interactive computer-based educational program.
A convenience sample of ninety participants whose children were in the age group of 6 months to 5 years was enrolled in this study during October 2007- November 2007. A pre-post non –randomized study was conducted at a pediatric emergency department (ED) and a pediatric clinic (PC) in an inner city setting. Two computer-based kiosks were used to present the interactive Patient Education and Motivation Tool (PEMT) with influenza vaccine specific content. An eighteen percent improvement in influenza vaccine knowledge was seen using this pre-post educational program ($p<0.0001$). Eighty four percent of the participants perceived that their child would get the flu this year. Ninety five percent of the participants thought that the flu shot was safe to give to their child; however thirty two percent of the participants thought flu shot to be painful and sixty three of the participants thought that their child will have a bad reaction after getting the flu shot. Forty two percent of the participants thought that their child could get the flu once he/she gets the flu shot. There was a change in the attitudes related to the influenza vaccine concerning its safety and side effects after the use of this educational program. Ninety three percent of the participants would recommend the use of this program to others while seventy seven percent of the participants would be interested in using this computer based educational program in the near future. PEMT is an effective method for assessing and describing changes in the influenza vaccine knowledge and attitudes in a pediatric emergency department as well as pediatric ambulatory inner city clinic.

Keywords: *Influenza, Children, Computers, Education, Knowledge, Barriers*

Introduction

Influenza-related illnesses cause an average of 36,000 deaths[1] and 134,000 hospitalizations[2] every year in the United States.[3] Children less than 2 years of age have a high rate of influenza-related hospitalizations[4-6] and influenza infections can cause deaths among otherwise healthy children.[7] Among children aged less than 5 years, hospitalization rates have ranged from approximately 500/100,000 children for those with high-risk medical conditions to 100/100,000 children for those without high-risk medical conditions.[8] During 2003-2004, fifty-two deaths among children were attributed to influenza and its known complications (particularly secondary bacterial infections) [9] with more than 40% having severe outcomes (death or neurological sequel).[10, 11]

The Advisory Committee on Immunization Practices (ACIP) recommends influenza vaccination of children aged 24-59 months, as well as their household contacts and out-of-home caregivers.[10] ACIP also emphasizes that all children aged 6 months to 9 years who have not been previously vaccinated at any time with either live, attenuated influenza vaccine (LAIV) or trivalent inactivated influenza vaccine (TIIV) should receive 2 doses of vaccine.[10, 11] The National Immunization Survey (NIS) data on Baltimore City showed that 39.8% of children aged 6 months-2 years had received only one vaccination while 25% had received the complete two doses.[12] Further improvements in vaccination coverage levels are needed, especially among children aged 6-59 months and children with known risk factors for influenza complications.[13]

The ACIP influenza recommendations also highlight the importance of educating parents about the "impact of influenza and the potential benefits and risks of vaccinating young children".[14, 15] Significant barriers to vaccination include both parental and patient misconceptions about the safety and efficacy of the vaccine[3]. By understanding the barriers (e.g. knowledge, attitudes) to delivering influenza vaccine to a target population we can develop appropriate messages to improve vaccination rates for children aged 6 months to 5 years.

Purpose of Study

The objective of this research was to assess and describe changes in knowledge, attitudes and practice regarding influenza vaccination among parents of Baltimore children aged 6 months to 5 years in a pediatric emergency department and the University of Maryland inner city clinical practice using a self-guided, interactive computer-based influenza vaccine educational program.

Methods

Study design

A pre-post study was conducted in a pediatric emergency department (ED) and a pediatric clinic (PC) setting at the University of Maryland, Baltimore during October 2007- November 2007. The aim of this pre-post study was to examine differences in influenza vaccine knowledge, attitudes and practice of the participants through use of an interactive computer based program. Parents or guardians of children between 6 months and 5 years presenting to the ED or clinic were provided information on the program and enrolled if they agreed to participate. No identifying information was collected, and the study was approved by the University of Maryland IRB. The inclusion criteria included all guardians of children aged 6 months-59 months of age presenting to the ED or PC for any medical complaint or in the case of the PC, routine well child care. The exclusion criteria included guardians of children less than 6 months or more than 59 months or children with presenting medical condition in the ED precluding computer education. Patients with existing prior contraindication to influenza vaccination such as severe egg allergy, aspirin therapy, previous severe reaction to influenza vaccination, history of Guillian Barre syndrome were also excluded from the study.

Study Variables

The study variables included socio-demographic characteristics, participants' knowledge, attitudes and practice related to influenza vaccination and the program evaluation. All information was completed by the parents or the caregivers and the entire content of this computer based educational program was in English. Each of the study variables has been described below.

Socio-demographics

Information included study participants' location (Baltimore City/Baltimore County/Other), gender (male/female), race (Caucasian/African American/Asian/Hispanic/Other), primary care provider (yes/no/not sure), insurance (medical assistance or government insurance/self/other/no insurance), age category of the child (0-5 months/ 6

months-4 years and 5-18 years) and if there child had received a flu shot or mist last year (yes/no/not sure).

Knowledge, Attitudes and Practice (KAP) Questionnaire

Questions on knowledge, attitudes and practice (KAP) were based on the framework of the health belief model[17] which suggests that an individual's intention to undertake any given health action is influenced by three main factors which include a set of beliefs, a cluster of motivational factors and various normative pressures.[17, 18] The computer based program was aimed to examine the knowledge, attitudes and practice towards the influenza vaccine and deliver the educational material related to basic facts, mode of spread and methods of prevention of the flu in a more structured, organized, interactive manner, enhanced using multimedia in the form of animations, audio, text, and images.
The influenza vaccine knowledge questionnaire comprised of 6 questions and each correct response was assigned a score of 1 as compared to an incorrect response that was assigned a score of 0 (Table II). The total score ranged from 0 to 6 with higher scores reflecting increased number of correct responses. The perception of the study participants' about the attitudes towards the influenza vaccine was gathered using a series of nine questions. These questions were primarily focused to gather study participants' perception towards the influenza vaccine's usefulness, benefits, safety, associated pain and side effects if administered to their child. Practice of influenza vaccination was assessed based on the study participants' response to one question "if they were planning to get the vaccine for their child this year". The participants provide KAP information both during the pre and post learning sessions.

Program evaluation

The program evaluation comprised of a 10-item questionnaire with every response on a 4-point Likert scale ranging from 1 (very easy) to 5 (very difficult). The questionnaire gathered feedback about the level of difficulty of the educational material and the functionalities of the computer-based educational program including its ease of use, navigation, font, colors and animations. Feedback was also collected from the participants about the future use of this computer-based educational program again, and whether they would recommend it to others or not. The complete program lasted about 20 minutes and was embedded within the regular clinic visit.

Study Implementation

Two touch-screen computer-based kiosks provided an interactive Patient Education and Motivation Tool[16] (PEMT) containing the influenza vaccine education program. A quiet space was provided for kiosk viewing for parents/ guardians in the PC and the ED groups.

Patient Education and Motivation Tool (PEMT)

Conceptual framework: PEMT is an interactive computer-based educational program designed to teach children and parents about the importance of flu vaccine, its prevention and management. This computer based educational program is comprised of a touch screen computer based on three learning theories[19]: behavioral: technology based instructional applications should be divided into small portions of the material; cognitive: structured education to individuals along with positive reinforcement and humanistic: individual willingness to learn and their ability to get evaluated. The framework of PEMT has been described in our previous study.[16]

The PEMT involves 3 key components including: (1) Screening, (2) Learning and (3) Post-education evaluation. The screening component (Fig1a &1b) collects socio-demographic and the KAP information as described.

The learning component (Fig1c) was aimed to deliver information about the influenza vaccine in a structured format using a series of continuous educational messages enhanced using audio and images.

The influenza vaccine educational material was derived from information from the CDC and included basic facts about influenza, mode of spread and methods of prevention but did not have content related to the management of influenza (Appendix1). The learning component was self-paced and allowed the users to go back and review the information any time during this component.

An evaluation component (Fig1d) followed the learning module. The evaluation component included the same KAP questions that were asked at the baseline and a 10-item attitudinal survey to assess the acceptance of the program. Feedback was provided to the users based on their responses to the influenza vaccine knowledge questions. Participants providing correct responses were given encouragement in the form of motivational messages including "correct" or "well done" while feedback in the form of

educational messages was provided during an incorrect response. The participants were also provided feedback in the form of related messages when examined about their attitudes towards the influenza vaccination. A self-report response regarding plans to get the influenza vaccine for the child in the future was also assessed at the conclusion of the program.

Navigation (Fig2): The touch screen computer program automatically generated a unique identifier for each individual. The program had a "How to proceed?" section on each screen that helped the user to move through the different sections of the program with ease. The "back" and "next" button on an individual screen provided users more flexibility and self control on the navigation of the program. The animated character guided through the entire educational program and the user could turn on/off this character anytime. There was a "replay" button on each screen that allowed the user to review the information on the screen again. A "progress bar" at the bottom of screen indicated the degree of completion of the program. The "exit" button would allow the user to quit the educational program at anytime during its use.

Technical Design

The PEMT program for influenza vaccine was implemented on a 17-inch touch screen equipped laptop computer as a three-tier application. The user interface, processing logic and data storage were designed and maintained as three independent modules using Macromedia Flash™ and Microsoft Agent™ technology in the presentation tier for user interface, .NET framework application tier for data processing logic and MS Access™ database in the data tier for data storage and retrieval. The three-tier architecture allows for greater scalability and the interactive educational program is platform independent due to its modular nature. The user interface was designed to deliver educational messages and multiple choice questions for screening and evaluation using a touch screen, mouse or keyboard for user input. The use of Macromedia Flash™ enabled a combination of animations and audio content with traditional text and images to create an interactive learning environment that allowed individual user interaction to trigger multimedia reactions from the animated interface character. The Visual Basic .Net™ middle tier coordinates interactions between the Macromedia Flash™ interface and the MS Agent™ plug-in and facilitates data storage and retrieval from the MS Access™ database application.

Analyses

A descriptive analysis was performed using univariate statistics for the continuous variables and frequency distribution for the categorical variables. Results for the continuous variables have been reported as means and standard deviations while percent distributions have been reported for the categorical variables. Statistical significance was determined using t-statistics for the continuous variables and chi square test for the categorical variables. Results have been reported as p-values. All analyses were performed using SAS version 9.1 (INC, NC).

Results

Patient characteristics

Ninety participants whose children were in the age group of 6 months to 5 years had completed the program in this study. Of the total ninety participants enrolled, 58 participated at the pediatric ED and 32 participated at the PC. Fifty five percent (n=50) of the participants were males and eighty five percent (n=77) of the participants were African Americans. Ninety four percent (n=85) of the participants had a primary care provider and eighty seven percent (n=79) of the participants were on medical assistance or government insurance. Fifty one percent (n=46) of all the participants had received some form of influenza vaccination the prior season. Five participants were not able to complete the program and were excluded from the analysis.

There were no significant differences between the two groups regarding county of residence, gender, and race, having a primary care provider, insurance status, child's age, and whether or not the child received influenza vaccination the prior season (Table I).

Knowledge, Attitudes, Practice (KAP)

Knowledge

Overall improvement in knowledge was 18% after using this computer-based influenza vaccine educational program. There was a change in the average influenza vaccine knowledge score during the post learning (mean=4.9; SD=1.29) period as compared to their average pre learning score (mean= 3.9; SD=1.19); ($p<0.0001$). A change in the pre-post knowledge scores was also seen among participants

whose children had received prior influenza vaccination (pre mean=4.13; SD=1.02 and post mean=4.91; SD=1.26) as compared to those who did not receive it (pre mean=3.65; SD=1.31 vs. mean=4.89; SD=1.33). Participants in both the groups showed improvement in their knowledge scores after using the computer based educational program ($p<0.0001$); however there was no difference in their baseline scores. The frequency distribution of the participants with correct responses to influenza vaccine knowledge questionnaire during pre and post learning has been outlined in Table 2.

Attitudes

We examined attitudes related to influenza vaccine both during pre learning and after using the computer based educational program. There was a change in the frequency of participants who perceived flu shot to be painful for their child (32% vs. 21%) and those participants who perceived that their child could get the flu once he/she gets the flu shot (42% vs. 30%). Nine percent of the participants thought that their child needed a flu shot at the baseline as compared to 67% after post learning. There was also a change in the frequency of the participants who believed that there child could get a bad reaction after getting a flu shot this winter (63% vs. 14%). (Table3)

Practice

Practice of influenza vaccination was assessed based on the participants' response to the question "planning to get the vaccine for their child this year". There was a high frequency of participants who planned on getting the vaccine for their child this year both during the pre and post learning periods (89%; n=80 vs. 91%; n=82).

Sub-analysis

Knowledge related to influenza vaccine*:* We assessed and described changes in the influenza vaccine knowledge scores based on the source of setting (ED vs. PC) and those children who had received flu shot or mist during the last year. A change in influenza vaccine knowledge scores was seen among the participants in both the groups ($p<0.0001$) (Figure3.)

Attitudes related to influenza vaccine*:* Prior to receiving influenza vaccine educational program, the attitude of the participants whose children had received flu shot and those who did not was compared. Forty nine percent (n=44) of the participants had children who had received the flu shot in the prior season. Ninety percent of the participants (n=40) perceived influenza vaccine to be safe as compared to hundred percent (n=46) of the parents whose children did not receive the flu shot previously ($p=0.04$). No difference was seen in the attitude of the participants whose children had earlier received a flu shot and those who had not. It was found that the participants were more likely to vaccinate their child (74% vs. 48%) ($p=0.01$) if they thought that their child's doctor felt the need for it. Moreover, the perceptions of friends and family did not play a significant role in the decision making for the vaccination (85% vs. 77%) ($p=0.36$).

Practice related to influenza vaccine*:* Eighty nine percent (n=80) of the participants planned to get a flu shot for their child this year. Of these, seventy nine of them agreed that the vaccine was safe to give to their child. However, there was a difference when compared to those who were not planning to receive the flu vaccine (n=10) as only thirty percent (n=3) of these individuals perceived the vaccine as a risk ($p<0.0001$).

Program Evaluation

A ten-item survey assessed the acceptance of the computer-based PEMT. Ninety five percent (n=86) of the participants found the program easy to use, ninety one percent (n=82) of the participants found the program easy to navigate through different screens of the educational program. Ninety four percent (n=85) of the participants found it easy to read the text on the computer screen and ninety three percent (n=84) of the participants liked the colors used on the computer screen. Ninety seven percent (n=88) of the participants found the educational sections easy to understand and ninety seven percent (n=88) of the participants got significant information about the influenza vaccine. Seventy eight percent (n=70) of the participants would use this educational program in near future and ninety three percent (n=84) of the participants would definitely recommend this program to others in near future.

Discussion

This research assessed and described changes in knowledge, attitudes and practice regarding influenza vaccination among parents of Baltimore children aged 6 months to 5 years in an inner city setting. It also considered the use of an interactive structured computer based program for providing education to families in an inner city setting.

We implemented an influenza vaccine education program using the previously piloted Patient Education and Motivation Tool[16]. This interactive tool is designed based on learning theories and presents material in a series of structured educational messages enhanced using audio, textual and images. The computer based program is self paced and its short-term effectiveness is measured using a pre-post study design. The educational program provides encouragement and reinforcement based on the participants' responses. There was a change in the influenza vaccine knowledge after using this computer-based educational program in a pediatric emergency department and pediatric ambulatory clinic in an inner city setting. Our study sample showed that fifty percent of the participants had children with prior influenza vaccination. This could be due to the diverse population residing in Baltimore City, Baltimore County and other areas.

More research is needed to examine the impact of tailored influenza vaccine education program in improving vaccination rates in other age groups (adolescents) and children in other settings. The educational content should be tailored based on individual characteristics including age, gender, prior knowledge, and attitudes related to influenza vaccine. The study showed that there are misperceptions regarding influenza vaccination. Targeting strategies to dispel misinformation and providing acceptable methods of delivering accurate information are important public health goals. Our study showed that the physicians had a major role in influencing influenza vaccination rates among urban children.

One of the most concerning misperceptions was that influenza vaccination caused the disease itself. In light of the CDC[20] and ACIP[10] recommendations for universal influenza vaccination for all school aged children, providers will have an important role in educating their patients' families regarding the importance of vaccination for the upcoming winter. With limited clinician time available, an educational computer program would seem to be a useful adjunct in delivering education. Overall, there was a high acceptance of the program with ninety three percent of the participants agreeing that they would recommend this educational program to the other participants.

Some limitations of the study have been described here. The sample size of the study was small and a multivariate regression analysis was not performed. The results cannot be generalized as the study was primarily limited to one geographical area. We do not know if this immediate improvement in influenza vaccine knowledge would be retained over a period of time and whether this improvement in knowledge will result in improving influenza vaccination rates. Because emergency departments as well as ambulatory clinics can offer vaccine at routine and sick visits, this important outcome can be measured in the future. We are planning a prospective study to explore how rates of vaccination can be directly affected by our program.

Conclusion

The program can be effectively used to provide opportunities for parents and children to effectively learn about influenza vaccine in clinical settings. In most patient care settings there is "downtime" where a targeted program can be delivered without interfering other care and moreover providing an opportunity to cover other areas that the practitioner may be to busy to deal with. Our program assessed individual knowledge and attitude about the influenza vaccine and provided them with educational material to better guide future decisions regarding influenza vaccination. This can be cost effective as it may reduce the amount of time spent by the clinical staff on providing education and by their delivery of consistent but adjustable content tailored to the needs of each child[16]. Interactive educational software may play a useful adjunctive role in improving outcomes for children with chronic conditions[6]. Parents found the program very easy to navigate and enjoyable to use. Such programs have important implications for the future computer-assisted education programs for other medical topics.

The pilot study has demonstrated that an interactive computer assisted, structured influenza vaccine education program enhanced by multimedia using audio and video animations can effectively assess knowledge attitudes and practice toward influenza vaccine knowledge in children in the pediatric ED and pediatric clinic in an inner city setting.

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Table 1. Socio-demographic characteristics of the study population stratified based on pediatric emergency and pediatric ambulatory inner city clinic

Patient characteristics	**Pediatric**		**p-value**
	ED **N=58**	**PC** **N=32**	
Location			
Baltimore City	47 (81.03%)	24 (75%)	0.77
Baltimore County	10 (17.24%)	7 (21.88%)	
Other	1 (1.72%)	1 (3.13%)	
Gender			
Male	33 (56.9%)	17 (53.13%)	0.73
Female	25 (43.1%)	15 (46.88%)	
Race			
White	3 (5.17%)	4 (12.5%)	0.19
Black	50 (86.21%)	27 (84.38%)	
Hispanic	2 (3.45%)	-----	
Asian	2 (3.45%)	1 (3.13%)	
Other	1 (1.72%)		
PCP			
Yes	54 (93.1%)	31 (96.88%)	0.92
No	4 (6.9%)	----	
Not sure	-----	1 (3.13%)	
Insurance			
Medical Assistance	50 (86.21%)	29 (90.63%)	0.23
Self	1 (1.72%)	2 (6.25%)	
Other	4 (6.9%)	1 (3.13%)	
No insurance	3 (5.17%)	-----	

Received influenza shot or mist last year			
Yes	30 (51.72%)	16 (50%)	0.88
No	28 (48.28%)	16 (50%)	

Table 2. Pre and Post influenza vaccine knowledge questionnaire

Knowledge questions regarding Influenza Vaccination	**Frequency distribution of the changed responses**	
	Pre learning	**Post learning**
Each year flu can cause many hospitalizations and deaths among children	96.67%	95.56%
Choose the ways you think flu can be spread from person to person	34.44%	67.78%
Who do you think should get the flu shot	34.44%	62.22%
There are different places I can get a flu shot	96.67%	97.78%
My child will be less likely to get the flu if he/she gets a flu shot	70%	85.56%
Giving my child the flu shot will reduce the time I lose from work	65.56%	81.11%

Table 3. Change in the attitudes before and after use of the computer based educational program

Attitude questions regarding Influenza Vaccination	**Frequency distribution of changed responses**	
	Before	**After**
Its possible my child will get the flu this year	84.44%	92.22%
Its more likely that my child will get the flu than other kids	26.67%	23.33%
My child does need the flu shot	8.89%	67.78%
The flu shot is safe to give to my child	95.54%	97.78%
Its quite painful for my child to get the flu shot	32.22%	21.11%
I'm worried that my child could get the flu once he/she gets the flu shot	42.22%	30%
My child could have a bad reaction after getting the flu shot	63.33%	14.44%
My child's doctor thinks my child should get a flu shot this winter	61.11%	74.44%
My friends and family think it is important for my child should get a flu shot	81.11%	86.67%

Figure 1a. Screening (Patient characteristics)

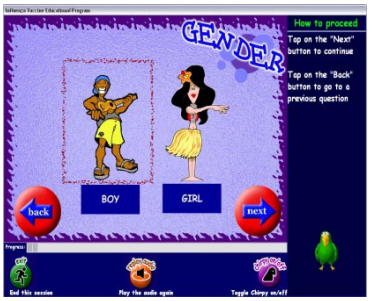


Figure 1b. Screening (Baseline vaccine Knowledge)

Figure 1c. Learning (Series of structured educational messages)

Figure1d. Evaluation of computer based educational program.

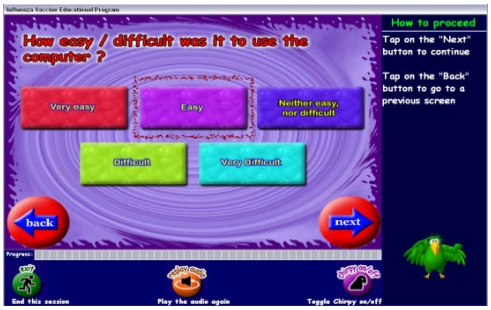


Figure 2. Navigation section

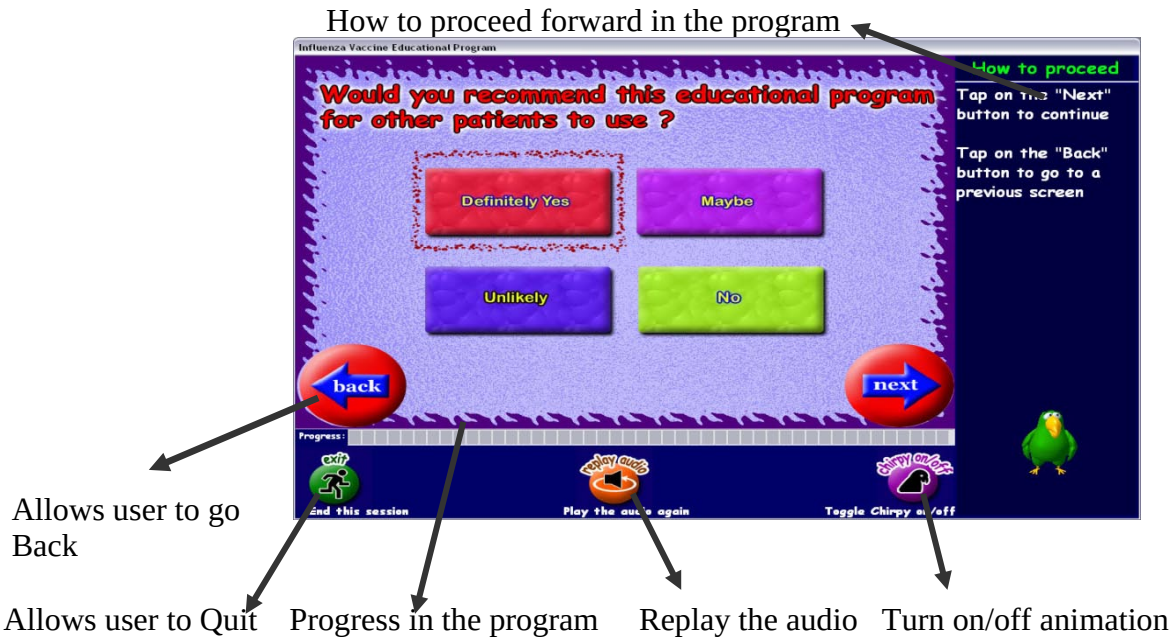
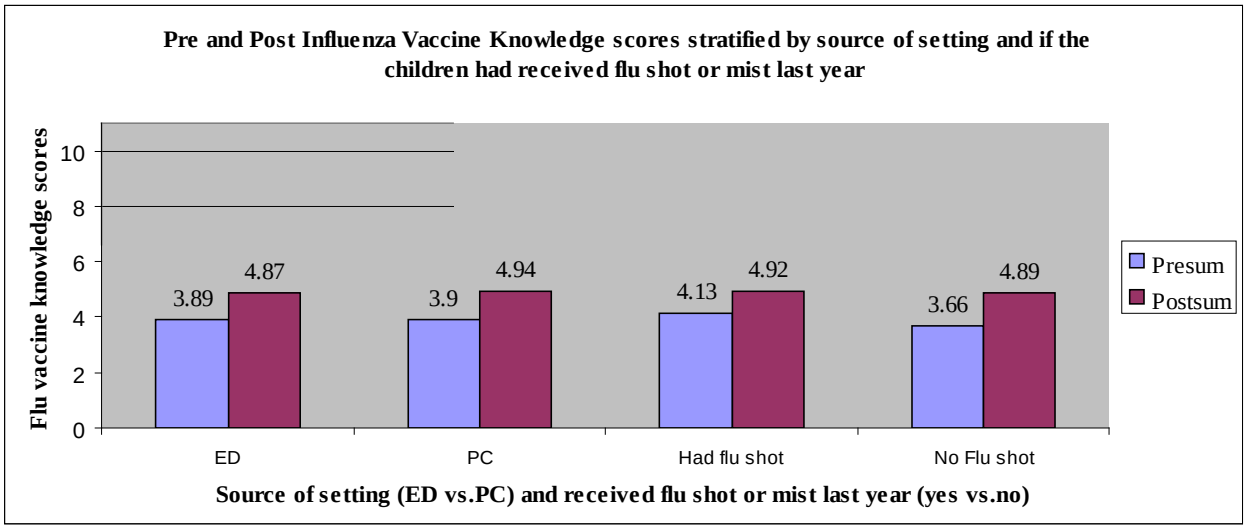


Figure 3. Pre and post influenza vaccine knowledge scores stratified based on source of setting and if the child had a flu shot or mist last year



Appendix1. Sections of Influenza Vaccine Educational Program

Topics of Influenza Vaccine Education	**Content**
What is Influenza?	Defines influenza, and its statistics
Symptoms of Flu	Outlines the different types of flu symptoms including fever, dry cough, headache, and their occurrences
Complications of Flu	Outlines flu complications including bacterial pneumonia, ear infections, sinus infections, and past pandemic information
Spread and Prevention of Flu	Provides information about the different methods of spread of flu including person to person, coughing, and sneezing.
Who should get Flu Vaccine?	Defines people characteristics that are at high risk of getting flu and should get the flu vaccine. Also lists the contraindications for the flu vaccine