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The Rate of Seasonal Influenza Vaccination in Diabetic Children, the Effect of Recommendation and the Factors Influencing the Acceptance of Recommendation: An Interventional Study

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ABSTRACT

Objective: To investigate the vaccination rate of influenza in diabetic children and the effect of recommendation and other factors on vaccination rate.

Material and Methods: On July 2011, 144 diabetic children and their families were informed about and were recommended to receive the influenza vaccine every year, in September. On December 2011, parents were questioned about the vaccination.

Results: Influenza vaccination rate of the previous season (28.3%) increased to 50.0% ($p<0.05$). Receiving the vaccine in 2010 was the only contributing factor to the recommendation success. The reasons given by the non-receivers were; forgetting (50.0%), fear of adverse-effects (26.4%), not believing in usefulness (15.2%), rejection by the child (4.2%) and effects of media (4.2%). 88.9% of those who forgot declared that they would receive if they were reminded at the beginning of the season.

Conclusion: The rate of influenza vaccination was low. The majority of those who didn't recieve the vaccination declared that they would if they were reminded at the beginning of the season and the fact that "receiving the vaccine in 2010" was the only factor influencing the recommendation success indicate that recommending isn't enough but that reminding and giving detailed information about the vaccine will increase vaccination rates independent of other factors.

Key Words: Influenza, influenza vaccine, diabetes, vaccination

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Introduction

Bacterial and viral infections are major morbidity and mortality factors in diabetic patients. The main reasons are specific defects in host defense mechanisms such as antibody response, cell-mediated immune response, leukocyte function and colonization (1). The mortality rate related with influenza is increased 2-4 fold in diabetic patients compared with healthy subjects (2). Despite problems in the immune system, diabetic patients have appropriate responses to vaccinations and vaccination is a cost-effective public health issue in diabetics (1, 3). Therefore, influenza vaccination is recommended to be received by all diabetic patients who are over six months of age annually every September (1, 4-7). It is among the targets of "Healthy People 2010" that influenza vaccine will be performed in at least 60% of all diabetic patients (8). Although global vaccination strategies direct the higher risk groups to be vaccinated more efficiently, the vaccination rates of children with chronic illnesses usually remain lower than desired.

There are a limited number of studies focusing on the vaccination rates of children with chronic illnesses against vaccine-preventable diseases and they show that the rates are low especially when influenza is considered (9-14). The aim of this study is; to investigate the influenza vaccination rate, the effect of recommendation on the vaccination rate and to investigate the factors influencing the success of the recommendation in children with diabetes.

Material and Methods

One hundred sixty-three children with type 1 or type 2 diabetes who were being followed up in the pediatric endocrinology clinic were included in the study. On July 2011, all the diabetic children and their families were invited to participate in the meeting held to give them information about the influenza vaccine. One hundred forty-four children (88.3%) with their families attended the meeting and filled a questionnaire covering their demographic data, the previous vaccination recommendations of the clinicians that were in charge of their follow-up, previous vaccinations of seasonal influenza and/or 2009 pandemic H1N1, and any self-afforded vaccines. During the meeting, the necessity, benefits, adverse-effects and other information about the influenza

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vaccine were given by a social pediatrician and they were recommended by their pediatric endocrinologist to receive the vaccine every year in September, starting with 2011. A vaccine-card was given to every patient having the warning "Influenza vaccine should be performed in September 2011" on it. All the families were called by phone between 20-25th of December 2011 and asked whether they were reminded about the vaccination at the follow-up visits after the meeting and whether they had received the vaccination and the reasons if they had not. The answers of the families, together with their diabetic data gathered from their files, were noted. Diabetic control level was defined according to their annual average hemoglobin A1c (HbA1c) value; good control: <7.5%, moderate control: 7.5-9.0%, poor control: >9.0% (15).

The local ethics committee had approved the study, and informed consent was obtained from the children and/or their families.

The statistical analyses were made using the "Statistical Package for Social Sciences version 11.5" (SPSS/PC) program. The continuous variables were expressed as mean±standard deviation, minimum and maximum values, categoric variables were expressed as percent. Comparison between continuous variables were made using the Student-t test. Categoric variables in related groups were compared using the Mc Nemar test while the Chi-square test was used in unrelated groups. Those variables with p value of <0.1 in bivariate analysis were entered into logistic regression analysis (Backward stepwise) to evaluate the effect of variables on receiving vaccination. The results were evaluated in a 95% confidence interval, significance being considered when p value was <0.05.

Results

The sociodemographic properties of the study group were similar compared with those who did not participate in the study because they were not able to attend the meeting held on July 2011 (p>0.05). Table 1 represents the sociodemographic properties and the vaccination status of the study group. Their mean age was 12.0±3.8 years and male-female distribution was even. Recommendation rate of any vaccine by their follow-up physicians before the meeting was 14.6% and influenza was the most recommended among these (71.4%). The recommendation status was similar among children with different diabetic control levels (ie; good, moderate, p=0.43). 42.7% of the families had received at least one vaccine that was afforded by themselves and again, influenza was the most common among these (61.7%). The rates of any previous seasonal influenza vaccination and 2009 pandemic H1N1 influenza vaccination and vaccination against influenza in 2010 were 43.1%, 23.6% and 28.5% respectively. No additional recommendation of any vaccine was made by their follow-up physicians during their routine visits after the meeting. The 2010 influenza vaccination rate of 28.5% increased up to 50.0% (p=0.0001) after the intervention (the meeting).

Table 1. The properties of diabetic children and their families in July 2011

Female / Male[1]	74 (51.4)/70 (48.6)
Age (years)[2]	12.0±3.8 (2.0-20.5)
Age at diagnosis (years)[2]	8.5±4.0 (0.1-18.0)
Follow-up period (years)[2]	3.0±2.8 (0.08-11.0)
HbA1c (%)[2]	8.1±1.8 (5.8 -14.6)
Mother's age (years)[2]	38.8±7.0 (25-54)
Father's age (years)[2]	43.0±7.2 (28-60)
Mother's/Father's education level[1]	
Primary school	89 (61.8)/54 (37.5)
High school	33 (22.9)/44 (30.6)
University	22 (15.3)/46 (31.9)
Monthly income ($) [1]: ≤800/>800	78 (54.2)/66 (45.8)
Previous recommendation of any vaccine by the physicians[1]	21 (14.6)
Previously recommended vaccines[1]	
Influenza / Others; Hib*, Pneumococcal, H1N1, Hepatitis A-B	15 (71.4)/6 (28.6)
Any previous self-afforded vaccination[1]	61 (42.7)
Previously received self-afforded vaccines[1]	
Influenza / Others; Hib*, Pneumococcal, Hepatitis A-B	37 (61.7)/23 (38.3)
Any previous seasonal influenza vaccination[1]	62 (43.1)
2009 pandemic influenza H1N1 vaccination[1]	34 (23.6)
Seasonal influenza vaccination in 20101	41 (28.5)

[1]: The data is represented as n (%)
[2]: The data is represented as mean±standard deviation (minimum-maximum)
*: Hib: Hemofilus Influenzae type B

The reasons of the parents who missed the influenza vaccination in 2011 (the non-receiver group) are given in Table 2. "Forgetting" the recommendation was the reason in half (n=36) of the patients and 88.9% of these (n=32) declared that they would receive it if they were reminded at the beginning of the season, ie; in September 2011. The reasons of the other half were; fear of adverse-effects, not believing in its necessity or benefit, negative effects of the common media and refusal by the child.

Table 3 represents the factors that affect the rate of receiving the influenza vaccine after the meeting, ie; the factors influencing the intervention success. The mean age, follow-up period and HbA1c levels were similar among groups of receivers and non-receivers (p>0.05). "Any previous self-afforded vaccination", "any previous seasonal influenza vaccination", "previous recommendation of any vaccine by the follow-up physicians", "receiving the influenza vaccine in the previous (2010) season" were the factors affecting the influenza vaccination rate in 2011 in bivariate analyses. The regression analyses revealed that the only independent contributing factor to the influenza vaccination rate in 2011 was "receiving the influenza vaccine in the previous (2010) season" and it had a coefficient of 2.4 affecting the intervention success (β=2.4, Confidence interval 95%=1.2-5.3, p=0.03).

Table 2. The reasons for the families not receiving the vaccine

The Reason for the Families not Receiving the Vaccine	Number of Cases (%)
Forgetting to receive	36 (50.0)
Opponent behaviour	
Fear of adverse- effects	19 (26.4)
No belief in usefullness	11 (15.2)
Negative effects of common media	3 (4.2)
Child's refusal	3 (4.2)
Total	72 (100)

Discussion

It is globally accepted and become a consensus that the influenza vaccine is a necessity in diabetic children (1, 4-7). The common target is having at least 60% of subjects with diabetes who are younger than 65 years vaccinated against influenza (8). There are very few studies concerning the vaccination rates among children with chronic illnesses and they reveal that the rates are lower than desired, this being the case especially in influenza (9-14). The rate of influenza vaccination is 21-61% in Italy and 41% in Spain (9, 16, 17). The rates are higher in Great Britain, still being at about 75% (18). The rate of influenza vaccination after the intervention in our study increased from 28.3% to 50%, rising to the level of most European countries but still leaving half of the diabetic children vulnerable to influenza infection. Having no disagreement about the benefits but having much lower rates is an indicationof the necessity to search and focus on the status of the vaccination rates and the reasons for missing the opportunity of receiving the influenza vaccine in diabetic children. There

Table 3. Probable reasons for not receiving the influenza vaccine in diabetic children (n=144)

Factors Investigated	Receivers n (%)	Non-Receivers n (%)	p
Sex			0.89
Female/Male	36 (48.6)/36 (51.4)	38 (51.4)/34 (48.6)	
Frequent influenza infection in medical history			0.85
Yes/No	51 (49.0)/21 (52.5)	53 (51.0)/19 (47.5)	
Previous recommendation of any vaccine by the physicians			0.017
Yes/No	16 (76.2)/56 (45.5)	5 (13.8)/67 (54.5)	
Any previous self-afforded vaccination			0.011
Yes/No	38 (62.3)/33 (40.2)	23 (37.7)/49 (59.8)	
Any previous seasonal influenza vaccination			0.011
Yes/No	39 (62.9)/33 (40.2)	23 (37.1)/49 (59.8)	
2009 pandemic influenza H1N1 vaccination			0.17
Yes/No	21 (61.8)/51 (46.4)	13 (38.2)/59 (53.6)	
Seasonal influenza vaccination in 2010			0.009
Yes/No	28 (68.3)/44 (42.7)	13 (31.7)/59 (57.3)	
Mother's / Father's education level			0.71/0.31
Primary school	44 (49.4)/30 (55.6)	45 (50.6)/24 (44.4)	
High school	18 (54.5)/18 (40.9)	15 (45.5)/26 (59.1)	
University	10 (45.5)/24 (52.2)	12 (54.5)/22 (47.8)	
Monthly income ($)			0.87
≤800/>800	38 (48.7)/34 (51.5)	40 (51.3)/32 (48.5)	

are very few interventional studies focusing on these topics and the results of a study as an interventional one focusing on these topics may open a pathway for physicians to increase the current rates.

The intervention in our study was successful from one point of view; the rate increased from 28.5% to 50.0%, but it was not enough and was below the desired rate of 60% (8). The reason in half of the non-receivers was "forgetting to receive the vaccine" in our study. Among them, 88.9% declared that they would have received it if they were reminded at the beginning of the season, ie; in September. There was a lag of two or three months from the intervention to the beginning of the season and this result suggests that even if it is recommended, patients should be reminded at every visit, especially those at the beginning of the vaccine season. Lin et al. (19), in their study that covered two consecutive seasons, demonstrated that influenza vaccination rates could only be increased by recommendation followed by several reminders. Other studies also show that reminding is as important as recommendation (10). Although this reminding duty is delegated to the physicians who are in charge of taking care of the patients, their performance is not sufficient in most of the centers. In the USA, Daley et al. (13) showed that the reason for missing the influenza vaccine was "not to be recommended" in 1/3 of the cases. In Italy, it was demonstrated that the recommendation rate among the high-risk groups was as high as 89% in patients with chronic pulmonary illnesses but was as low as 22% in those with metabolic illnesses like diabetes (16). Besides, it is revealed that, in a reference clinic for diabetes, the pediatricians recommend the influenza vaccine only to those with poor metabolic control because they feel that it is not indicated in those with better metabolic control (9). The HbA1c level did not contribute to the vaccination recommendation rates in our study. Studies also demonstrate that the recommendation rates of pediatricians working at the primary care units are higher than those at the reference units and this is attributed to the fact that pediatricians in the reference units are focused on the chronic problem itself and overlook the whole picture (9). This was also the situation in our study; the recommendation rate of 14.6% before the intervention was very low and, although all the physicians had attended the intervention meeting, none of the patients were reminded at the follow-up visits afterwards. These findings of our study suggest that the physicians on duty should also be reminded at certain intervals that vaccination is as important as their chronic illnesses for children with diabetes. This might help them to avoid overlooking the recommendation and reminding of influenza vaccination and giving the desired time to this topic while being busy focusing on diabetes, diabetic control and other possible complications. Other studies also demonstrate that the most important factors increasing the vaccination rate is the physicians' recommendation and reminding (2, 19-23). At this point, another issue arises which is that other reminding instruments other than the follow-up physicians should be taken into consideration. Although they were not investigated in our study, Gaglani et al. (24) demonstrated that, in patients with chronic asthma, the vaccination rate of influenza is increased from 5.4% to 32.1% by using automatic phone and e-mail messages. Other reminding instruments may be personal like web sites or public education programs in schools or common media. Theoretically, the vaccination rate of our diabetic population would increase up to 72.2% (additional 32 patients if their family did not forget) if the families were reminded on time. This rate would be high enough to be considered "successful" in this era (18).

It is as important as recommending and reminding to determine the main topics which should be focused on during recommendation and/or reminding. It is well known that, in communications between physicians and patients, in order to optimize the limited time and maintain attention, giving short and focused information is very important. In our study, in addition to "forgetting", the most important reason for not receiving the vaccine was "being afraid of the adverse-effects" (26.4%). Other studies also give similar reasons for vaccine refusal (25-28). Families declare that "too much vaccination" is performed on their children, that these cause the immune system to attenuate and influenza vaccine even "causes" the disease itself (25). In adult diabetics, fear of adverse-effects is among the least common reasons but it increases to be more common in children (29-31). The rates of fear of adverse-effects are between 8.9-18.8% in different studies (11, 21). This rate being higher in our study suggests that emphasizing that the undesired effects of the influenza vaccine has no importance when compared with the benefits is crucial in the communication between families and the physicians.

The other reason for vaccine refusal was "not believing in its necessity or benefit". This reason is most common in adult diabetics and vaccine refusal rate because this reason rises to 55% (2, 13, 27, 29, 30). Daley et al. (13) showed that, among the non-receivers, about 33% of the families of children with chronic illnesses did not receive the influenza vaccine because they did not believe in its usefulness. Although this rate was as low as 15.2% in our study, it is high enough to deserve attention. This emphasizes that physicians should be aware of the importance of informing the families and patients in detail and in a persuasive manner about the benefits of the influenza vaccine during recommendation and reminding. This will also be a solution for those who did not receive the vaccine because "the child did not accept the injection". It is expected that the families would convince a child who is taking at least two, and usually four injections of insulin per day if they believed that their children "should" receive the vaccine.

The reason given by the remaining families who did not receive the vaccine was "the negative effects of the media". Although the rate was low (4.2%), this result is worthy of interest because it reveals that a perfect and effective instrument which could be used in favor of vaccine acceptance has worked as a contrary factor. A good example of how the common media can have deleterious effects on a wide range of population by giving delusive and negative information is what happened during the epidemic of H1N1 in 2009. Akis et al. (32) demonstrated that the news about the side effects of the pandemic H1N1 and seasonal influenza vaccines during 2009 in the common media had increased the vaccine refusal rate five-fold. This reveals that efficient effort should also be spent to inform the workers in the common media about the influenza vaccine.

In our study, "receiving the vaccine in the previous season (2010)" was the independent contributing factor to the success of intervention. This might have helped the vaccine to be remembered as well as convincing the family about the benefits and minimizing the adverse-effects of it in their minds. Rodriguez-Rieiro et al. (17) also demonstrated the same contribution. The other factors investigated in our study (ie; family income and education, age of diagnosis, follow-up time, metabolic control level, …) being excluded and "receiving the vaccine in the previous season" being the only independent factor for the success of the recommendation strengthen the value of giving detailed and persuasive information about the benefits and adverse-effects to diabetic children and families increases the rate of vaccination not only currently but also in a prospective manner.

Conclusion

This study demonstrates that the most important factor in increasing the rate of influenza vaccination among diabetic children is "recommendation by the physician" who is in charge of taking care of them and that the recommendation should be reinforced by consecutive reminders . The vaccination rates will theoretically increase over 70% if appropriate attention is focused on these factors. It is also emphasized that the rates can reach even higher levels and will be permanent if the physicians spare the time to give information about the benefits and adverse-effects of the vaccine. The rate being increased from 28.3% to 50.0% with a single intervention and "receiving the vaccine in the previous season" being the only independent factor contributing to recommendation success emphasize that the community is ready to accept the vaccine independent of their economic status, education and the variables of diabetes itself.

Conflict of Interest

No conflict of interest was declared by the authors.

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