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Short Report
Seasonal and pandemic influenza vaccine: recommendations to families of at-risk children during the 2009–10 season

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We performed a study in three Italian regions to evaluate the association between provided recommendations and immunization uptake of the two influenza vaccines in children with chronic diseases. We interviewed families of 119 at-risk children, collecting information regarding recommendations and immunizations against seasonal and pandemic influenza. In total 60.5% of children had received seasonal influenza vaccine, 38.7% had received pandemic influenza vaccine and 33.6% had not been vaccinated. The majority of immunized children had received specific recommendations by a physician. Physicians involved in the management of children with chronic diseases should actively recommend influenza immunization.

Introduction
Children affected with chronic diseases pay a significant toll due to influenza in terms of morbidity and mortality. These patients are a target group for seasonal influenza vaccine and were considered among the groups with the highest priority for pandemic influenza vaccination during the 2009 pandemic in Europe.1,4 Although the clinical presentation of pandemic influenza was mild during the 2009–10 season, patients with chronic diseases had a significant burden in terms of complications and hospitalizations.

The Italian Ministry of Health identified children with underlying diseases as a priority category to be vaccinated against 2009–10 A/H1N1v pandemic and seasonal influenza viruses.10 In Italy, an adjuvated (MF59) monovalent vaccine from one single vaccine manufacturer was used during the pandemic course. The vaccination campaign started in mid-October 2009. However, controversies, inappropriate media communication to the public and late vaccine availability limited the immunization uptake in all targeted groups, including patients with underlying diseases.11–13

Immunization coverage in targeted groups resulted poor. Only 12.7% of individuals aged 6 months to 65 years with at least one chronic disease were immunized with A/H1N1v vaccine at the national level.13 Immunization coverage for seasonal influenza is poor. The vaccine is offered to targeted groups each year. According to a national survey conducted in 2006–07, seasonal influenza immunization coverage in children aged 12–24 months affected with a chronic condition was 2.4%.14 Since strategies for delivering seasonal and pandemic influenza vaccines and communication initiatives differed, we investigated the association between recommendations provided by physicians and immunization uptake for pandemic and seasonal influenza vaccines in children with chronic diseases in three Italian regions.

Methods
In a previous study conducted in 2009 we measured immunization coverage and timeliness of routine and recommended vaccinations in a sample of 275 children aged 6 months to 18 years affected with type 1
diabetes, cystic fibrosis, Down’s syndrome, human immunodeficiency virus (HIV) infection or a neurological disease (including epilepsy or conditions impairing the respiratory function), who subsequently presented to specialist clinics in three Italian regions for routine follow-up visits. These conditions were chosen as they represent a wide spectrum of chronic diseases, in terms of morbidity, mortality and frequency of contact with health care centres. The population of children with chronic diseases in the charge of the three reference centres was of approximately 5000. One interviewer visited the reference centres once a week during visiting hours, and performed a face-to-face interview with parents of vaccinated children. Families were requested to bring proof of the child’s vaccinations in order to review and record the child’s vaccination history. In addition, the study explored causes of delayed immunization and determinants of vaccine administration of children with chronic diseases.

In the same year, children with chronic diseases were recommended by the Italian Ministry of Health to receive pandemic influenza vaccination. The influenza immunization campaign started in November 2009. In April 2010, we contacted by telephone the previously enrolled families of children with chronic diseases, in order to collect additional information on recommendations received for seasonal and pandemic influenza immunization, on pandemic and seasonal influenza immunization uptake and on parents’ self-perception of being informed about the pandemic vaccine and reasons for not being vaccinated. Information on parents’ influenza vaccination status was also collected. Participants signed an informed consent before entering the study. We used a standardized questionnaire for telephone interviews. A family was deemed lost to follow-up after three unsuccessful monthly telephone call attempts. The study was approved by the ethical committee of the Bambino Gesù Hospital in Rome, Italy.

Statistical analysis
We analysed the questionnaire data according to type of vaccine received (H1N1 vaccine, seasonal influenza or both). The association between recommendation received and vaccine uptake was measured through risk ratio (RR) and 95% confidence interval (CI). Proportions were compared through chi-square or Fisher’s exact test when appropriate. Differences were considered statistically significant at the P < 0.05 level. Stata 10 statistical software was used for data analysis.

Results
We interviewed the families of 119 children with chronic diseases. Of the original cohort, a contact telephone number was available for 259 families (94.2%), who were therefore contacted by telephone. We were not able to reach 115 families by telephone (44.4%). Of the 144 families (55.6%) who were reached, 25 families (9.7%) declined the interview, and in every case the reported reason was lack of time. A total of 119 families (50.9%) accepted the interview. No substantial differences were observed regarding children’s age distribution, sex and type of diseases between responding and non-responding families (data not shown).

Table 1: Study sample description

<table>
<thead>
<tr>
<th></th>
<th>Cystic Fibrosis</th>
<th>Diabetes type 1</th>
<th>HIV infection</th>
<th>Down Syndrome</th>
<th>Neurological Diseases</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients (%)</td>
<td>28/119 (23.5)</td>
<td>16/119 (13.5)</td>
<td>11/119 (9.2)</td>
<td>45/119 (37.8)</td>
<td>19/119 (16.0)</td>
<td>119</td>
</tr>
<tr>
<td>Age (years), mean (SD)</td>
<td>10.5 (4.9)</td>
<td>10.3 (3.4)</td>
<td>13.2 (3.3)</td>
<td>6.8 (4.1)</td>
<td>9.1 (4.5)</td>
<td>9.1</td>
</tr>
<tr>
<td>Females, n (%)</td>
<td>16/28 (57.1)</td>
<td>9/16 (56.3)</td>
<td>5/11 (45.5)</td>
<td>2/11 (18.2)</td>
<td>0/19 (0)</td>
<td>1/19</td>
</tr>
<tr>
<td>Foreign patients, n (%)</td>
<td>0/28 (0)</td>
<td>0/16 (0)</td>
<td>0/11 (0)</td>
<td>0/2/11 (18.2)</td>
<td>0/19 (0)</td>
<td>0/19</td>
</tr>
<tr>
<td>Mother’s age, mean (SD)</td>
<td>39.9 (7.3)</td>
<td>40.9 (3.7)</td>
<td>53.4 (24.6)</td>
<td>41.2 (8.5)</td>
<td>39.1 (5.9)</td>
<td>41.6</td>
</tr>
<tr>
<td>Father’s age, mean (SD)</td>
<td>43.0 (5.7)</td>
<td>42.4 (4.8)</td>
<td>62.8 (23.8)</td>
<td>42.5 (6.0)</td>
<td>41.8 (5.9)</td>
<td>41.6</td>
</tr>
<tr>
<td>Mothers with high school diploma, n (%)</td>
<td>18/24 (75.0)</td>
<td>11/16 (68.8)</td>
<td>0/0 (0)</td>
<td>3/31/41 (75.6)</td>
<td>15/19 (78.9)</td>
<td>15/19</td>
</tr>
<tr>
<td>Fathers with high school diploma, n (%)</td>
<td>19/28 (67.9)</td>
<td>9/16 (56.3)</td>
<td>0/0 (0)</td>
<td>3/32/44 (72.7)</td>
<td>16/19 (84.2)</td>
<td>16/19</td>
</tr>
<tr>
<td>Unemployed mothers, n (%)</td>
<td>11/25 (44.0)</td>
<td>3/16 (18.8)</td>
<td>5/8 (62.5)</td>
<td>20/43 (66.5)</td>
<td>8/19 (42.1)</td>
<td>8/19</td>
</tr>
<tr>
<td>Unemployed fathers, n (%)</td>
<td>1/28 (3.6)</td>
<td>0/16 (0)</td>
<td>2/5 (40.0)</td>
<td>3/45 (6.7)</td>
<td>1/19 (5.3)</td>
<td>1/19</td>
</tr>
</tbody>
</table>

Characteristics of patients and families included in the study are shown in table 1. Fifty-nine (49.6%) children were males. The average age was 9 years (SD 4.6, 6 months to 18 years). Forty-five children (38.7%) were affected by Down’s syndrome, 28 (25.5%) by cystic fibrosis, 19 (16.0%) by neurological diseases, 16 (13.4%) by diabetes type 1 and 11 (9.2%) by HIV infection. Among the 119 families enrolled in the study, 12 (11%) had more than one child with a chronic disease.

Regarding influenza vaccine uptake in this cohort of 119 children, 72 (60.5%) had received seasonal influenza vaccine and 46 (38.7%) had received pandemic influenza vaccine. In particular, 39 (32.8%) had received both vaccines, while 40 (33.6%) had not been vaccinated with either vaccine.

Forty-four out of 46 (95.7%) children immunized against pandemic influenza and 70 out of 72 (97.2%) children immunized against seasonal influenza had received a specific recommendation by a physician (table 2). On the other hand, 16 out of 47 children (34%) who did not receive seasonal influenza vaccine and 16 of 73 (21.9%) of those who did not receive the pandemic vaccine, had received a specific recommendation by a physician.

Children who had received a specific recommendation for seasonal influenza vaccine were 13.4 times more likely to be immunized than those who had not received recommendations (RR = 13.4, 95% CI 3.5–51.7) (P < 0.001). Children who had received a specific recommendation for pandemic influenza vaccine were 21.6 times more likely to be immunized than those who had not (95% CI 5.5–85.2) (P < 0.001).

Of the 70 individuals vaccinated against seasonal influenza, 40 (57.1%) had been recommended to do so by their family paediatrician and 28 (40%) by their specialist paediatrician. On the other hand, of the 44 patients vaccinated against seasonal influenza, 15 (34.1%) had been provided recommended to by their family paediatrician and 25 (56.8%) by their specialist paediatrician (table 2).

Of the 16 children who did not receive either seasonal or pandemic vaccine only 2 (12.5%) had received a specific recommendation by a specialist paediatrician (table 3).

Figure 1 shows the reasons for not receiving seasonal and pandemic influenza vaccines.

Table 2: Information about the recommendation of immunized children by type of vaccine of 119 children with chronic diseases

<table>
<thead>
<tr>
<th>Recommendation received in vaccinated children by type of vaccine and provider</th>
<th>Vaccinated for seasonal influenza, n (%)</th>
<th>Vaccinated for pandemic influenza, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immunized children</td>
<td>72/119 (60.5)</td>
<td>46/119 (38.7)</td>
</tr>
<tr>
<td>Recommendation received</td>
<td>70/72 (97.2)*</td>
<td>44/46 (95.7)*</td>
</tr>
<tr>
<td>Vaccination recommended by Family paediatrician</td>
<td>40/70 (57.1)</td>
<td>15/44 (34.1)</td>
</tr>
<tr>
<td>Specialty paediatrician</td>
<td>28/70 (40.0)</td>
<td>25/44 (56.8)</td>
</tr>
<tr>
<td>Other physician</td>
<td>2/70 (2.9)</td>
<td>4/44 (9.1)</td>
</tr>
</tbody>
</table>

a: P < 0.001 vs. unvaccinated for seasonal influenza vaccine
b: P < 0.001 vs. unvaccinated for pandemic vaccine
Forty-one out of 47 families of children who did not receive seasonal influenza immunization reported reasons for not vaccinating their child. Seventeen (41.5%) families reported that they did not know that the vaccine was recommended for their child; 5 (12.2%) stated ‘I was advised against it by the doctor’. Sixty-eight out of 73 families of children who did not receive pandemic influenza immunization reported reasons for not vaccinating their child; 25 (36.8%) declared that a physician advised against vaccination.

Among all responding families, 40 out of 118 (33.9%) declared that they would consider immunization for their children in case of a new influenza pandemic.

The proportion of immunized parents also varied with immunization of their children. Considering parents of children immunized against seasonal influenza, a total of 54.2% (39 of 72) received the same vaccine, while among children who did not receive seasonal vaccine 17% of parents (8 of 47) were immunized (P<0.001). Among children immunized against pandemic influenza, 17.4% (8 of 46) of parents received the same vaccine, while among those not vaccinated for pandemic influenza 1.4% (1 of 73) of parents were immunized (P<0.01).

**Discussion**

Our study investigated the association between recommendations provided by physicians and uptake of seasonal and pandemic vaccines in children with chronic diseases. Our results indicate that receiving recommendations towards seasonal or pandemic influenza vaccine is a powerful determinant of immunization. Our results also suggest that recommendation provided by specialty paediatricians is essential to increase immunization coverage. A high immunization coverage in children with chronic diseases was also associated with a higher increase immunization coverage.

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Several strategies based on selective vaccination of at-risk groups have largely proved to be poorly effective, often resulting in a suboptimal vaccination rate. This could be due to the complexity of the process for identifying at-risk categories, and to the involvement of different professional figures in the management of patients with underlying conditions. The complexity of this system could lead to inconsistent communication strategies and suboptimal influenza immunization coverage.

European countries have adopted a selective influenza vaccination strategy for at-risk groups. Other authors suggest that routine vaccination of specific age groups may significantly reduce influenza mortality rate in all age groups. A stochastic simulation model shows that immunizing at least 50% of children aged 5–18 years could reduce mortality in all age groups by >75%, therefore indirectly protecting patients with chronic diseases.

The observation that influenza vaccine recommendation by a health care provider is a powerful predictor of immunization is not new. However, a study conducted in Italy already showed that health care workers’ knowledge about recommendations for influenza vaccine is limited.

Lack of recommendation by the physician is often reported by unvaccinated patients as a reason for not receiving the immunization. The finding that a significant number of practitioners do not strongly recommend influenza vaccination for high-risk patients is concerning.

Special efforts should be made to improve the way recommendations on influenza vaccines that are provided to at-risk patients. Their chronic disease specialists should be primarily involved in this process, as they have frequent contacts with these patients for routine visits.

Immunizations should be considered as a part of the global care of children with chronic medical conditions. Considering that misinformation and lack of recommendation led to missed vaccinations, all the health care providers involved in the management of these children should be prompted to actively provide recommendations for influenza immunization in order to increase immunization uptake.

**Limitations of the study**

Study sample size was limited and participants were selected in three Italian regions only. Although sample size may have conditioned precision of estimates, we selected three regions in the northern, central and southern part of the country to account for geographical trends.

We were able to interview only half of the original cohort. Nevertheless, no substantial differences concerning age, sex and type of underlying disease were found between included and not included patients. However, participation in the influenza study may have selected families with a higher level of attention to this vaccination. We also interviewed families of participants several months after the influenza vaccination.

**Table 3 Information about recommendation of non-immunized children by type of vaccine of 119 children with chronic diseases**

<table>
<thead>
<tr>
<th>Type of vaccine</th>
<th>Seasonal influenza</th>
<th>Pandemic influenza</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total 40/119 (33.6)</td>
<td>12/40 (30.0)a</td>
<td>4/40 (10.0)b</td>
</tr>
</tbody>
</table>

a: P<0.001 vs. vaccinated for seasonal influenza vaccine  
b: P<0.001 vs. vaccinated for pandemic influenza vaccine

**Figure 1 Reasons for not receiving seasonal and pandemic influenza vaccines. The percentages refer to 41 of 47 children not immunized for seasonal influenza and to 68 of 73 children not immunized for pandemic influenza**
immunization campaign; this may have led to a recall bias towards an
underestimation of immunization rate.
Although we did not apply any criteria for patient selection, we
conducted the study in a short period of time and therefore we may
have selected families with a higher attitude to refer to the health centre.

Funding
Italian Ministry of Health (grant number Cap 4393/2007).

Conflicts of interest: None declared.

Key points
- Paediatricians' recommendation is strongly associated with
seasonal and pandemic influenza vaccination in children with
chronic diseases.
- Influenza immunization of children with chronic diseases is
associated with a greater number of family members who
receive the same vaccination.
- In order to increase vaccination coverage in children with
underlying conditions, it is essential to improve paediatricians'
training, emphasizing the need for an active and accurate recom-
mendation for vaccination in at-risk patients.

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