Perceived risks of adverse effects and influenza vaccination: a survey of hospital employees

Boris P. Ehrenstein, Frank Hanses, Stefan Blaas, Falitsa Mandraka, Franz Audebert, Bernd Salzberger

Background: Many hospital employees shun influenza immunization because they want to avoid adverse reactions. We surveyed hospital employees to elucidate whether the conception of the adverse effects of vaccination stems from correct or misperceived incidence rates of vaccine adverse effects. Methods: We used an anonymous self-administered paper questionnaire at a tertiary-care university hospital in Germany, in 2006. Multiple-choice questions probed respondents’ knowledge about influenza, influenza vaccine and about rates of 12 possible vaccine adverse effects. We correlated overestimation of each adverse effect with failure to obtain vaccination in 2005–06, stratified by professional group. Results: The overall response rate was 34% (652/1898). Of the 304 respondents unvaccinated in 2005–06, 127 (42%) attributed their vaccination status mainly to concerns about adverse effects. Among physicians, failure to obtain influenza vaccination was associated with the overestimation of both non-severe and severe adverse effects. Non-vaccinated nurses were significantly more likely than the vaccinated nurses to overestimate the rates of five of six non-severe adverse effects, but differed significantly in rates of overestimation of merely one of the six severe adverse effects. Overestimation of vaccine-caused absenteeism from work was negatively associated with vaccination rates among all professionals. Conclusions: Overestimation of the actual low rates of influenza vaccine adverse effects was associated with non-receipt of the vaccine among hospital employees. Due to our finding of different misconceptions about adverse effects, educational and promotional programmes should be targeted differentially for nurses and physicians.

Keywords: influenza, influenza vaccines, adverse effects, hospital employees, immunizations

Introduction

The annual non-pandemic burden of influenza remains high despite the availability of potent preventive strategies. In Germany, each year approximately additional 20,000 hospitalizations and 10,000 deaths are attributed to non-pandemic influenza.1 The preventive strategies include the yearly vaccination of persons at high risk for contracting influenza or for complications, early therapy with antiviral agents and the prevention of nosocomial spread by vaccinating hospital employees, as recommended by national vaccination guidelines.2 Despite the availability and proven effectiveness of these strategies, their implementation has not been very successful. Particularly, vaccination rates among hospital employees fall short of expectations. A multiplicity of surveys, over the last two decades delineated reasons for the reluctance of hospital employees to get vaccinated against influenza, e.g.3–14 summarized by Hofmann et al.15 While some studies attributed low rates of vaccination to the lack of promotion programmes and unavailability of free-of-charge vaccination at the workplace, other studies conducted in conjunction with pro-active vaccination programmes suggested that, among other concerns, fear of vaccine adverse effects contributed significantly to the unwillingness of hospital employees to be vaccinated. We conducted our survey to elucidate the role of feared vaccine adverse effects on vaccination uptake at our institution and to evaluate whether this fear is based on correct or misperceived incidence rates for influenza vaccine adverse effects.

Methods

This survey was conducted in February 2006, at a tertiary-care university hospital in the south of Germany. We invited all at our institution to complete an anonymous self-administered paper questionnaire—637 physicians and final-year medical students (hereafter ‘physicians’), 994 nurses and 267 hospital administrators The study was conducted in conjunction with a survey regarding ethical issues arising during the management of an influenza pandemic.16 Participation in the study was voluntary. No financial or other incentive was provided for returning completed surveys. Since the study was conducted strictly anonymous, formal institutional review board approval was not required, but approval by the main board of the medical centre representing all professional groups was obtained before conducting the survey. Influenza vaccination is promoted by posters and lectures in the beginning of each vaccination season at our institution. It is provided free of charge to all employees at a walk-in occupational health clinic.

Questions probed the respondents’ knowledge about the annual incidence of influenza [five multiple-choice categories: >50% of persons; 1 in 10 (correct); 1 in 100; 1 in 1000; 1 in 10 000] and influenza fatality rate (same categories, the option 1 in 1000 is correct). The correct rate figures were derived from a report by the American Advisory Committee on Immunization Practices (ACIP) and other publications.17–19 To estimate the general knowledge on influenza vaccine, respondents were asked to endorse (true/false) eight statements: the vaccine is live-attenuated (false), yearly revaccination is necessary (true), subcutaneous administration is possible (true), infection with human immunodeficiency virus (HIV) is a contraindication (false), risk of adverse effects is higher for immunosuppressed vaccinees (false), vaccination reduces incidence of other viral respiratory diseases (false), vaccination should be administered from May to August (false), current vaccine confers protection

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in case of a new influenza pandemic (false) and were asked if the official German vaccination guidelines recommend influenza vaccination for hospital personnel (true). Further, the respondents were requested to estimate the rates of six non-severe and six severe possible adverse effects of influenza vaccination, using six multiple-choice categories: one in two or more often (a), 1 in 10 (b), 1 in 100 (c), 1 in 1000 (d), 1 in 10000 (e), 1 in 100000 or less common (f). The non-severe adverse effects listed were headache [correct answer (b)], muscle aches (b), fever (b), chills (c), local pain (b) and absence from work for > 2 days (d); the severe adverse effects were skin necrosis at vaccination site (f), severe hepatitis [e.g. aspartate amino transferase (AST) or alanine amino transferase (ALT) 5× greater the upper limit of normal] (f), acute kidney failure (f), encephalitis (f), Guillain–Barré syndrome (f) and permanent neurological disability (f). The rate figures of these adverse effects were taken from the licensing information of the inactivated split-virion vaccine that had been used at our institution in 2005–06 and from studies of similar vaccines conducted among healthy volunteers or medical personnel. Respondents were also asked to estimate the proportion of vaccine recipients who experience no adverse effects (five categories: >9 in 10, 7 in 10 (correct), 5 in 10, 3 in 10, <1 in 10). Further, respondents were asked to indicate if they received influenza vaccination in the current season (2005–06) and to select from two lists of options (one for receipt and one for failure to receive vaccination) the most important reason for their decision. Finally, respondents were asked to report their sex, age (<35 years, ≥35 years), professional group (physicians, nurses or administrators) and the number of previous influenza vaccinations (none, one, two to five or more than five).

Questionnaires were included in the analysis if respondents indicated their sex, age, professional group, vaccination status in the current season, and provided an estimate for at least nine of the 12 adverse-effect incidence rates.

Respondents vaccinated and unvaccinated in 2005–06 were compared according to the following dichotomous variables: overestimated the incidence for each of the 12 vaccine adverse effects, underestimated the proportion of adverse-effect-free vaccinees, underestimated the incidence of influenza, underestimated the influenza fatality rate, poor knowledge about influenza vaccine [number of correctly answered items below the median for all respondents (<4)], ignorance of official recommendation for vaccination recommendation of all hospital employees, sex and age (χ²-test, statistical significance defined as P<0.05). The analyses were stratified by professional group. We used logistic regression to model, for each professional group, the outcome of no influenza vaccination in 2005–06 as a function of the above-listed dichotomous variables. Potential predictors were retained in the model as the result of the forward selection procedure (predictors were included if P-value remained 0.05 or smaller, and were retained if P-value remained 0.10 or smaller); this analysis was restricted to respondents with no missing data. Data were analyzed with SPSS software (version 12.0G, SPSS Inc.).

Results

We received 652 (34%) completed surveys (Table 1), with the highest return rate among administrators (53%), followed by physicians (37%) and nurses (27%). Of the respondents, 398 (61%) were female and 317 (49%) reported an age ≥35 years with differences among professional groups [female sex: physicians (41%), nurses (77%), administrators (62%); age ≥35 years: physicians (43%), nurses (42%) and administrators (72%)]. According to the statistics provided by the hospital’s occupational health department, in 2005–06, 710 of the 1631 (44%) physicians and nurses were vaccinated; data regarding vaccine receipt among administrators were not available (Table 1). Of the 511 physicians and nurses completing our survey, 299 (59%) reported having been vaccinated in the current season, with a substantial difference in vaccination rates between these two professional groups (Table 1).

Of the 304 respondents unvaccinated in 2005–06, 127 (42%) attributed their lack of getting vaccinated to concerns about adverse effects, with no substantial differences among the three professional groups (physicians 36%, nurses 43% and administrators 43%). While 35% of non-vaccinated physicians stated that they ‘just forgot or had no time’ to be vaccinated, this reason was given less frequently by nurses (17%) and administrators (13%). Of the 348 respondents vaccinated in 2005–06, 198 (57%) stated that protecting patients or patients and oneself was most important in their decision to get vaccinated (physicians 69%, nurses 57% and administrators 14%). A minority of respondents (192/652, 29%) reported no history of ever receiving influenza vaccination (17% of the physicians, 34% of the nurses and 43% of the administrators). Only 74 (11%) of the 652 respondents reported having been vaccinated more than five times previously (13% of the physicians, 8% of the nurses and 16% of the administrators).

Figure 1 displays the appraisal of the surveyed adverse-effect rates. All of the six non-severe adverse-effect rates, with the exception of ‘pain at the injection site’, were underestimated by a majority of respondents. Due to the very low true incidences of severe adverse effects, by the design, these rates could only be correctly estimated or overestimated. The rates for ‘skin necrosis at the injection site’ and ‘severe hepatitis’ were overestimated by a majority of respondents. In comparison, <25% of respondents overestimated the rates for the remaining four severe adverse effects.

Table 2 summarizes the univariate association of overestimated adverse-effect rates and other dichotomous variables with the current-season vaccination status, stratified by professional group. Among the physicians, failure to receive influenza vaccination was significantly associated with the

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Professional group and influenza vaccination status for 2005–06 of hospital personnel receiving the survey or returning completed questionnaires</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Physicians n (%)</td>
</tr>
<tr>
<td>Survey received</td>
<td>637 (100)</td>
</tr>
<tr>
<td>Vaccinated in 2005–06*</td>
<td>395 (62)</td>
</tr>
<tr>
<td>Completed survey returned</td>
<td>234 (37)</td>
</tr>
<tr>
<td>Stating receipt of vaccine in 2005-06</td>
<td>168 (72°)</td>
</tr>
</tbody>
</table>

a: Data provided anonymously by the occupational health department.
b: Not available.
c: Percentage of respondents stating receipt of vaccine in 2005–06 among respondents returning completed surveys.
overestimation of several non-severe ('fever', 'chills' and 'absenteeism >2 days') and severe adverse effects ('acute renal failure', 'encephalitis' and 'permanent neurological disability'), and with three other characteristics, namely, underestimation of the rate of adverse-effect-free vaccinees; correct or overestimation of influenza incidence; and poor knowledge about the influenza vaccine. By comparison, the non-vaccinated nurses were significantly more likely than the vaccinated nurses to overestimate the rates of five of six non-severe adverse effects (all except 'local pain'), but differed significantly in estimation of merely one of the six severe adverse effects ('skin necrosis at the injection site'). Among administrators, the overestimation of the rates for 'absenteeism >2 days', 'encephalitis', 'Guillain–Barre´ syndrome' as well as female sex was significantly associated with non-receipt of influenza vaccine in 2005–06. The differences among professional groups are also reflected in the three logistic models, which are summarized in Table 3. Overestimation of the rate of a severe adverse effect was independently associated with lack of influenza vaccination in 2005–06 among physicians and administrators. Among nurses, only overestimation of two non-severe adverse-effect rates was retained in the model.

Discussion
In this survey of hospital employees, approximately two-fifths of the unvaccinated respondents attributed their lack of being

**Figure 1** Appraisal of potential influenza-vaccine adverse-effect rates by hospital employees

**Table 2** Failure to receive a current-season (2005–06) influenza vaccination with respect to rates of overestimation of adverse effects and other characteristics, stratified by professional group

<table>
<thead>
<tr>
<th>Rate of adverse effect ‘overestimated’</th>
<th>234 physicians (168 vaccinated)</th>
<th>277 nurses (131 vaccinated)</th>
<th>141 administrators (49 vaccinated)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( n )</td>
<td>( V^- % )</td>
<td>( V^+ % )</td>
</tr>
<tr>
<td>Headache</td>
<td>234 3</td>
<td>3</td>
<td>0.676</td>
</tr>
<tr>
<td>Muscle aches</td>
<td>233 8</td>
<td>4</td>
<td>0.301</td>
</tr>
<tr>
<td>Fever</td>
<td>234 6</td>
<td>1</td>
<td>0.023</td>
</tr>
<tr>
<td>Chills</td>
<td>232 14</td>
<td>5</td>
<td>0.035</td>
</tr>
<tr>
<td>Local pain</td>
<td>234 21</td>
<td>23</td>
<td>0.742</td>
</tr>
<tr>
<td>Absenteeism &gt;2 days</td>
<td>234 24</td>
<td>5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Skin necrosis at injection site</td>
<td>233 69</td>
<td>69</td>
<td>0.978</td>
</tr>
<tr>
<td>Severe hepatitis</td>
<td>233 75</td>
<td>70</td>
<td>0.434</td>
</tr>
<tr>
<td>Acute renal failure</td>
<td>234 35</td>
<td>20</td>
<td>0.019</td>
</tr>
<tr>
<td>Encephalitis</td>
<td>234 27</td>
<td>15</td>
<td>0.028</td>
</tr>
<tr>
<td>Guillain–Barre´ syndrome</td>
<td>234 21</td>
<td>13</td>
<td>0.093</td>
</tr>
<tr>
<td>Permanent neurological disability</td>
<td>234 17</td>
<td>5</td>
<td>0.005</td>
</tr>
<tr>
<td>Adverse-effect-free vaccines ‘underestimated’</td>
<td>233 32</td>
<td>19</td>
<td>0.038</td>
</tr>
<tr>
<td>Influenza incidence ‘underestimated’</td>
<td>232 74</td>
<td>86</td>
<td>0.042</td>
</tr>
<tr>
<td>Influenza fatality rate ‘underestimated’</td>
<td>233 32</td>
<td>22</td>
<td>0.103</td>
</tr>
<tr>
<td>Poor knowledge about vaccine</td>
<td>234 24</td>
<td>9</td>
<td>0.002</td>
</tr>
<tr>
<td>Ignorance of vaccination-recommendation for hospital employees</td>
<td>233 6</td>
<td>2</td>
<td>0.102</td>
</tr>
<tr>
<td>Female sex</td>
<td>234 46</td>
<td>40</td>
<td>0.436</td>
</tr>
<tr>
<td>Age &gt;35 years</td>
<td>234 42</td>
<td>43</td>
<td>0.952</td>
</tr>
</tbody>
</table>

\( n \) = number of responses; \( V^- \) = percentage of non-vaccinated respondents; \( V^+ \) = percentage of vaccinated respondents; \( P \) = \( P \)-value associated with the Chi-square test. Statistically significant associations are printed in bold.
vaccinated against influenza mainly to concerns about adverse-effects. A substantial, but varying, fraction of respondents overestimated the incidence rates for most surveyed adverse effects of the vaccine. Respondents in all three professional groups who were unvaccinated during the current season were significantly more likely than the vaccinated respondents to overestimate several of the surveyed adverse-effect rates. Among physicians, there was a strong independent association between overestimating of the rate of prolonged absenteeism from work, overestimating of the rate of permanent neurological disability and poor knowledge about the vaccine; among nurses, between overestimating of the rate of prolonged absenteeism from work and overestimating the frequency of chills, while among administrators only female gender and overestimation of the rate of encephalitis were independently associated with failure to get vaccinated.

The rate of employees reporting concerns about adverse effect as the main reason for not getting vaccinated is in the range of 8–54% in similar surveys of hospital employees, summarized by Hofmann et al.15 This large variation might be explained by differences in the type of professionals surveyed and by effects of influenza vaccine promotions done in some studies.

As shown in figure 1, many respondents underestimated the rates of non-severe vaccine adverse effects. At first glance, surprising, this finding may be explained by lower rates for these adverse effects among the elderly (representing the usual recipients of the vaccine observed by health-care workers) compared with younger vaccine recipients.21 23

Another explanation for this finding could be that respondents were directly or indirectly aware of the results of the placebo-controlled trials conducted among healthy adults. These trials established that many symptoms perceived to be vaccination triggered are actually caused by concurrent upper respiratory infections that are very prevalent during the typical vaccination season.21 Therefore, the true rates for non-severe adverse effects caused by the vaccine are much lower than the rates reported in the vaccine licensing information, used as the reference rates for our survey.

There was a wide range in the rates of overestimated severe adverse-effect rates among respondents (14–70%). In particular, the actually low rates of vaccine-induced skin necrosis and severe hepatitis were overrated by a majority of respondents.

Due to the generally large differences in vaccination uptake among nurses and physicians,15 we stratified all our analyses by professional group. Our study might be potentially limited by selection bias introduced by the use of self-administered surveys. Despite the guaranteed anonymity, unvaccinated physicians and, especially, nurses were less inclined to complete the survey compared with vaccinated employees (Table 1). This potential bias could have resulted in an underestimation of the effect of misperceived adverse-effect rates on vaccine uptake.

We conclude that better education of hospital employees about the low rates of influenza vaccine adverse effects could substantially improve vaccine uptake among hospital employees. Low rate of absenteeism and the even lower rate of prolonged absenteeism from work should be especially emphasized in such educational programmes. Due to our finding of different misconceptions about adverse effects being associated with failure to get vaccinated among nurses and among physicians, targeted educational programmes for each of these two professional groups are warranted.

### Acknowledgements

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### Conflicts of interest

None declared.

### Key points

- In this survey of hospital employees, approximately two-fifths of the unvaccinated respondents attributed their lack of getting vaccinated against influenza mainly to concerns about adverse effects.
- Respondents who were unvaccinated during the current season were significantly more likely than the vaccinated respondents to overestimate adverse-effect rates.
- There was a strong independent association between overestimating of the rate of prolonged absenteeism from work among physicians and nurses. Overestimation of the rate of permanent neurological disability and poor knowledge about the vaccine were only among physicians, and overestimation of the frequency of chills was only among nurses independently associated with failure to get vaccinated.
- Due to our finding of different misconceptions about adverse effects being associated with failure to get vaccinated among nurses and among physicians, targeted educational programmes for each of these two professional groups are warranted.
References


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