Determinants of Influenza Vaccination, 2003–2004: Shortages, Fallacies and Disparities

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Background. The influenza outbreak of 2003–2004 received substantial media attention, including widespread reports of a severe season and vaccine shortages. Understanding the determinants of vaccine receipt is important for guiding immunization policies.

Methods. From February through June 2004, we administered a structured telephone survey to Tennessee residents, using random-digit dialing methodology.

Results. Questionnaires were completed by 4028 persons, of whom 2077 (52%) had received influenza vaccination during the previous outbreak season. Of these 2077 vaccine recipients, 63% received vaccine at a private medical clinic, 14% at a workplace, 11% at a health department, and 7% at a pharmacy. Three-fourths of respondents reported a risk factor for which the Centers for Disease Control and Prevention recommends vaccination; of those, 41% went unvaccinated, including 26% who had seen a medical provider for other reasons during the influenza season. More than 40% of persons aged ≥50, more than half of health care workers, and 70% of pregnant women were not immunized. Blacks, rural residents, and lower-income respondents were significantly less likely to be immunized than were comparison groups. Of respondents who were vaccinated, 6% reported difficulties obtaining vaccination (most commonly, they reported that vaccine was not readily available). One-fourth of unvaccinated persons had been offered vaccination but had declined it; of these, 35% thought it unnecessary and 33% believed it would make them ill. Of those not vaccinated, 8% reported requesting vaccination but not receiving it, most commonly because it was unavailable.

Conclusions. Many barriers contribute to disparities in rates of influenza vaccination, of which inadequate supply is only one component. Myths regarding influenza vaccination persist tenaciously. A multifaceted approach to increasing immunization rates is critical.
vaccine and the resulting shortages [17–19]. We performed a telephone survey to assess people’s knowledge, attitudes, and beliefs about vaccination and to assess how access issues may have impacted other determinants of vaccination rates.

METHODS

From February through May 2004 a survey of Tennessee residents was administered using the computer assisted telephone interviewing method. To reach a sample representative of the state population, respondents were identified through random selection of residential telephone numbers across all counties in Tennessee. A maximum of 5 attempts were made to reach each potential respondent, including telephone calls during evenings and weekends. The household member with the most recent birthday was selected as the subject for interview. After obtaining consent, trained interviewers administered the questionnaire. Persons over the age of 18 were interviewed directly. For persons under the age of 18, a primary caregiver was interviewed. Respondents were excluded if their primary residence was not in Tennessee or if they did not speak English.

The survey included questions focused only on demographic characteristics, influenza vaccination history and related experiences, and risk factors for influenza disease. Data were analyzed using EpInfo, version 6.2 (CDC) and SAS, version 8.0 (SAS Institute) software. Multivariate logistic regression was used to control for potential confounders and covariates and to identify variables independently associated with vaccination; adjusted odds ratios and 95% confidence intervals were used. The study was approved by the institutional review board of the Tennessee Department of Health.

RESULTS

Of persons successfully contacted by telephone, 88% agreed to participate. Fewer than 1% of interviews were terminated before completion. Interviews with 4028 respondents were completed. The mean age of respondents was 51 years (range, 0–102 years). Of these 4028 respondents, 2077 (52%) had been immunized against influenza during the 2003–2004 outbreak season, including 736 (78%) of 938 persons aged ≥65 years, and 1769 (59%) of 3020 persons who met at least 1 criterion for which the CDC recommends routine vaccination [2]. A substantial proportion of respondents (3016 [75%]) indicated that they had ≥1 condition for which the CDC recommends routine influenza vaccination [2], though many persons for whom it was indicated remained unvaccinated (table 1). Of the 2077 vaccinated respondents, 1839 (89%) reported a history of previous influenza vaccination.

The majority of immunized respondents were vaccinated in October (58%) and November (24%). Persons who were vaccinated in November or earlier had significantly fewer difficulties getting vaccine than those vaccinated later in the season (5.7% vs. 9.3%; P = .017).

Of the 2077 vaccinated respondents, 1312 (63%) were vaccinated in a physicians’ office or medical clinic, 279 (14%) in the workplace, 232 (11%) at a health department, and 145 (7%) at a pharmacy. Only 10 (0.5%) of the vaccinated respondents had received live attenuated intranasal influenza vaccine.

One-third of vaccinated persons said they were offered vaccination while seeking a medical provider for another reason; 650 (31%) of 2077 made a separate visit to the provider specifically for vaccination. Nine hundred seventeen (44%) stated that they had requested vaccination from the provider. Of the 2077 respondents ultimately vaccinated, 128 (6%) reported encountering difficulties getting the vaccine; 71 (55%) were told initially that vaccine was not available, and 41 (32%) were told to return later for vaccination. First-time vaccinees were no more likely to encounter problems than were repeat vaccinees, and children encountered no more problems than did adults.

Of the 1951 respondents who were not vaccinated in 2003–2004, there were 263 (13%) who reported that they had wanted to be vaccinated. Five hundred twenty-four (27%) of these 1951 said that a medical provider had offered vaccination to them. One hundred fifty-one (8%) reported having asked a provider for it, of whom 82 (54%) were told vaccine was unavailable and 12 (8%) were told vaccination was unnecessary. Two-thirds of all survey respondents stated that they wanted to be vaccinated against influenza the next year, including 476 (24%) of the 1951 who were not vaccinated in the 2003–2004 outbreak season.

Persons who were offered vaccine by a provider were more likely to have been vaccinated than those who were not offered it (55% vs. 50%; P = .004). Immunization rates did not differ significantly according to the sex or educational level of the respondents. After adjusting for other variables, we found that

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>No. (%) of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vaccinated</td>
</tr>
<tr>
<td>Nursing home resident</td>
<td>54 (72)</td>
</tr>
<tr>
<td>Age of ≥65 years</td>
<td>736 (78)</td>
</tr>
<tr>
<td>Age of 50–64 years</td>
<td>665 (57)</td>
</tr>
<tr>
<td>Age of &lt;50 years</td>
<td></td>
</tr>
<tr>
<td>Has a high-risk medical condition</td>
<td>169 (46)</td>
</tr>
<tr>
<td>Care for person at high risk</td>
<td>184 (37)</td>
</tr>
<tr>
<td>Is a health care worker</td>
<td>133 (49)</td>
</tr>
<tr>
<td>Is pregnant</td>
<td>25 (30)</td>
</tr>
<tr>
<td>No identified risk factor</td>
<td>308 (30)</td>
</tr>
</tbody>
</table>
the likelihood of having been vaccinated was greater among white persons than among respondents of other races, greater among urban/suburban residents than among rural residents, greater among persons aged ≥50 years than among persons aged <50 years, and greater among persons with risk factors for which CDC recommends vaccination than among persons without such risk factors (table 2). Among persons aged ≥50 years, those with annual household incomes of <$30,000 were more likely to get vaccinated (adjusted OR [adjusted OR], 1.3; P = .028) than were those with higher incomes, whereas the opposite was true among persons aged <50 (aOR, 0.58; P < .001).

The most common reasons unvaccinated respondents cited for not receiving vaccination included the belief that it was unnecessary, the belief that vaccination would cause illness, and failure to think about it (table 3). After adjusting for other variables, unvaccinated respondents who had a high-risk medical condition for which CDC recommends vaccination were less likely to believe vaccination was unnecessary (aOR, 0.69; P = .003) or to have never thought about it (aOR, 0.68; P = .007), and more likely to cite the belief that it would cause illness (aOR, 1.73; P < .0001) or cost barriers (aOR, 1.88; P = .038), compared with respondents who did not have such medical conditions. Unvaccinated persons with any condition for which CDC recommends vaccination were more likely than persons for whom vaccination is not routinely encouraged to cite the belief that vaccination would cause illness (aOR, 1.55; P = .004) but were significantly less likely to cite that they had never thought about vaccination (aOR, 0.67; P = .004).

**DISCUSSION**

It is unnecessary for 36,000 Americans to die each year from a potentially vaccine-preventable disease. This study demonstrates the complex reasons why so many people who should be immunized against influenza are not. Barriers to improving immunization rates include patient-specific factors and medical-care provider issues, as well as health care delivery system characteristics, all of which must be addressed in order to optimize delivery of one of the most fundamental and effective public health interventions available.

Patient-centered determinants are perhaps the most vexing of the myriad challenges to improving influenza immunization rates. Although vaccination rates among persons in this study aged ≥65 or with high-risk medical conditions were higher than were recent estimates of national rates [2], there remain substantial disparities in coverage among important target populations. Significant racial disparities exist in all high-risk categories; for example, white respondents aged ≥65 were >30% more likely to have been immunized than were black respondents. Strikingly, the belief that vaccination would cause illness was cited by significantly more unvaccinated persons in high-risk groups than by their counterparts in lower-risk groups. Earlier studies have found that as many as half of respondents believed that they would get influenza disease from the vaccine [5, 10, 20]. Although our findings suggest modest improvement, there remain substantial misperceptions about the risks of vaccination, which widespread educational efforts have not successfully overcome. Paradoxically, these misconceptions are more common among those most in need of vaccination.

Similarly, the belief that immunization was not necessary (cited by a third of unvaccinated persons), concerns about side effects, and simply never considering it were commonly cited reasons for lack of vaccination, which suggests that important educational messages are not successfully reaching at-risk populations, despite the efforts of the medical establishment. In contrast, although there has been recent attention to potential “mismatches” between the vaccine being given and the influenza strains in circulation [21], perceived ineffectiveness was cited as a concern by relatively few respondents, with no differences between various risk groups. Extensive reviews of strategies for implementing vaccine recommendations emphasize the need for continued evaluation of multifaceted approaches [22, 23]. These data suggest that particular attention must be given to targeting specific populations, and that a "one message fits all" approach will not be sufficient.

Health care delivery system characteristics also substantially
impact influenza immunization rates. More than half of unvaccinated persons who reported requesting vaccine were told it was unavailable, though this accounted for only 5% of all unvaccinated persons. These data suggest that vaccine shortages in 2003–2004 impeded at least some motivated persons from receiving it. Studies of prior vaccine shortages have suggested that overall vaccination rates were not adversely affected [14, 15]. These observations must be interpreted in the context of the unusual amount of media attention generated by perceived vaccine shortages, compounded by reports of an early and severe epidemic. The adage that the “best way to stimulate demand is to tell someone that they can’t have something” appears to have been borne out, with an “unprecedented demand” for influenza vaccine observed in 2003–2004 [2, p. 21]. In response to recent problems, the CDC, beginning this year, is establishing a national influenza vaccine stockpile [24]. Although manufacturers anticipate production of substantially more vaccine doses in 2004–2005, the challenge to the medical establishment will be to ensure that available supplies are administered. In typical influenza outbreak seasons in the past, 10%–20% of vaccine produced has gone unused [25]. It is reassuring that cost barriers were cited by few respondents to this survey. The efforts of influenza vaccination programs to overcome the financial barriers that hinder access to many other aspects of medical care appear to have been successful.

Provider-related factors, particularly a medical provider’s recommendation to get vaccine, also substantially affect immunization rates [10, 22, 26]. We observed slightly higher immunization rates among persons to whom a medical provider offered vaccine, compared with persons to whom it was not offered. Disturbingly, well over a third of persons at high risk had seen a medical provider during the influenza season but remained unvaccinated. Other studies have focused on missed opportunities [6, 27] and the effect of medical-care provider attitudes and practices on vaccination rates, and, in response, these studies have advocated interventions such as automatic prompts to clinicians, standing orders, and reminders sent to patients [8, 22, 26, 28–30]. Evidence (including the fact that >40% of health care workers in our survey had not been vaccinated) suggests that there is ample room for improvement in education and practices among providers that could increase immunization rates [2, 31].

This study had a number of limitations. Assessment of immunization status was based on self-report; however, this approach has been demonstrated to be reliable and is commonly used [26]. Our survey was limited to persons accessible by landline telephone, which may have excluded a certain segment of the population. Persons who use cellular telephones exclusively, for example, were not contacted. Nursing home residents were only contacted if they had personal telephones. Strengths of this study include the large and diverse population sampled. Although the study was limited to a single state, responses compared favorably with those of previous studies, and it is likely that these observations are generalizable. Intranasal vaccine was used by so few respondents that we were unable to assess the impact of the availability of this new product on attitudes toward and beliefs about vaccination. Introduction of a live-virus vaccine, with its occasional side effects of sore throat and nasal stuffiness, may complicate efforts to reassure the public that influenza vaccination cannot cause infection.

This study demonstrates that high-risk populations in the

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### Table 3. Primary reasons cited by respondents for not receiving influenza vaccination during the 2003–2004 outbreak season.

<table>
<thead>
<tr>
<th>Reason cited</th>
<th>All (n = 1951)</th>
<th>&gt;65 years (n = 202)</th>
<th>&lt;64 years (n = 1749)</th>
<th>Yes (n = 426)</th>
<th>No (n = 1525)</th>
<th>CDC risk factora</th>
<th>Yes (n = 1247)</th>
<th>No (n = 704)</th>
<th>Race</th>
<th>White (n = 1617)</th>
<th>Nonwhite (n = 326)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thought vaccination not necessary</td>
<td>641 (33)</td>
<td>55 (27)</td>
<td>596 (34)</td>
<td>116 (27)b</td>
<td>535 (35)</td>
<td>399 (32)</td>
<td>252 (36)</td>
<td>545 (34)</td>
<td>101 (31)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Believed vaccination would cause illness</td>
<td>409 (21)</td>
<td>59 (29)</td>
<td>350 (20)</td>
<td>122 (29)b</td>
<td>287 (19)</td>
<td>292 (23)b</td>
<td>117 (17)</td>
<td>321 (20)</td>
<td>87 (27)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never thought about it</td>
<td>403 (21)</td>
<td>40 (20)</td>
<td>363 (21)</td>
<td>68 (16)b</td>
<td>335 (22)</td>
<td>227 (18)b</td>
<td>176 (25)</td>
<td>318 (20)</td>
<td>84 (26)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Side effects not worth it</td>
<td>195 (10)</td>
<td>23 (11)</td>
<td>172 (10)</td>
<td>37 (9)</td>
<td>158 (10)</td>
<td>126 (10)</td>
<td>69 (10)</td>
<td>152 (9)</td>
<td>42 (13)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Believed vaccination not effective</td>
<td>171 (9)</td>
<td>18 (9)</td>
<td>153 (9)</td>
<td>38 (9)</td>
<td>133 (9)</td>
<td>108 (9)</td>
<td>63 (9)</td>
<td>140 (9)</td>
<td>30 (9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost barrier</td>
<td>50 (3)</td>
<td>4 (2)</td>
<td>46 (3)</td>
<td>17 (4)b</td>
<td>33 (2)</td>
<td>36 (3)</td>
<td>14 (2)</td>
<td>36 (2)</td>
<td>13 (4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No time</td>
<td>98 (5)</td>
<td>7 (3)</td>
<td>91 (5)</td>
<td>19 (4)</td>
<td>79 (5)</td>
<td>61 (5)</td>
<td>37 (5)</td>
<td>81 (5)</td>
<td>17 (5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vaccine was not available</td>
<td>95 (5)</td>
<td>9 (4)</td>
<td>85 (5)</td>
<td>27 (6)</td>
<td>67 (4)</td>
<td>66 (5)</td>
<td>28 (4)</td>
<td>86 (5)</td>
<td>8 (2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never saw provider to ask</td>
<td>32 (2)</td>
<td>1 (0)</td>
<td>31 (2)</td>
<td>4 (1)</td>
<td>28 (2)</td>
<td>21 (2)</td>
<td>11 (2)</td>
<td>29 (2)</td>
<td>3 (1)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a Any risk factor for which the Centers for Disease Control and Prevention specifically recommends vaccination.
b Significant difference (P<.05) compared to the group without the specified characteristic on multivariate analysis.
United States remain underimmunized against influenza, and substantial disparities in vaccination rates exist in certain groups. Although the public health establishment is very concerned about perceptions of vaccine effectiveness, this survey suggests that the population appears not to have major concerns in this area. In contrast, important misperceptions about adverse effects, which many may have hoped had been put to rest, persist. The notion that one can “get flu from the flu vaccine” remains common. Lack of a perceived need for vaccination also remains commonplace, even among high-risk persons. Studies such as this are necessary to identify the issues of true concern to vaccination candidates.

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References