Determinants of tetanus, diphtheria and poliomyelitis vaccinations among Hajj pilgrims, Marseille, France

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Background: It has been observed that Muslim pilgrims departing France for Mecca have low national immunization rates against tetanus, diphtheria and poliomyelitis (TdP). Our purpose is to identify immigration, socio-economic and socio-cultural determinants of vaccination coverage against TdP.

Methods: A cross-sectional survey study was conducted in late 2006 among 580 pilgrims in preparation who attended the Infectious and Tropical Medicine ward in Hôpital Nord at Marseille to receive their N. meningitidis vaccine required for travel to Mecca. Results: Total vaccination rates for tetanus (18.9%), diphtheria (14.7%) and poliomyelitis (15.0%) were comparable. Pilgrim’s characteristic lower socio-economic and social status, in addition to their unifying linguistic, cultural and religious identity defines them as a particularly disadvantaged group in France. French citizenship, higher level of education, better French fluency and no previous travel to country of origin were the strongest and most significant determinants of TdP vaccination status. Conclusion: These results suggest that the Muslim community in France is at risk from inequities of national preventive care efforts.

Keywords: diphtheria, French health care system, Hajj pilgrimage, health disparities, poliomyelitis, tetanus, vaccination

Introduction

Each year, over 2 million Muslims participate in Hajj pilgrimage, gathering with pilgrims from all over the world in Saudi Arabia. Health risks at the Hajj are a critical issue due to the extreme congestion of people during this time.1 Updating vaccination against tetanus, diphtheria and poliomyelitis (TdP) is recommended for all international French travellers.2 A low immunization rate against TdP among Hajj pilgrims departing from France to Mecca has been recently reported and suggests the importance of identifying the determinants that lead to such low vaccination coverage.3,4 National gaps in immunization coverage among immigrants and minorities are suggestive of neglected inequalities in health care quality provision and access5–7 often intertwined with national socio-economic stratifications.8–10 France hosts the largest Islamic community among all European countries and can serve as an observatory to better understand the implications of national efforts for integrating the Muslim community, of which health care can play an important role. Provence-Alpes-Côte d’Azur (PACA) is the third most immigrant-populated region in France,11 significantly dominated by those of Northern African origin. Originating from former French colonies, the Northern African Muslim community is particularly large, representing 35% of the total immigrant population in Marseille and its surrounding PACA regions12. With the aim to better understand potential determinants of the gaps in vaccination coverage within the Muslim community, we conducted a cross-sectional survey on Muslim Mecca pilgrims departing from Marseille. We evaluate whether indicators of immigration status, integration and socio-economic status are associated with vaccination coverage against TdP.

Methods

Study population

The survey was carried out in the vaccination unit of the Infectious and Tropical Disease Unit in the Hôpital Nord from November 4 to December 2006. Participants in this survey were pilgrims in preparation who attended the Meningococcal vaccination campaign to fulfill their compulsory vaccination requirement. Attendees older than 18 years were proposed to participate to the survey and recruited on a voluntary basis and participants were asked to sign a written consent form. Questionnaires were administered orally in French, in Arabic and in combined French and Arabic depending on the French level of fluency of participants.

Questionnaire

Participants were asked to self-report and if possible provide certificate confirmation of booster vaccination against TdP in the last 10 years. Vaccination coverage was defined as correct when individuals reported or provided certificate confirmation of last boosters <10 years ago. No seroprevalence test was performed for evaluating the vaccination coverage in the present study. Demographic indicators included age and gender. Indicators of immigration status were citizenship, source of citizenship and nativity. Integration indicators used were education level (less than the certificate of primary studies, certificate of primary studies, greater than or equal to baccalaureate), fluency in French (minimal represents unable to answer the questionnaire; moderate represents able to answer the questionnaire partly; competent represents able to answer the full questionnaire), travel to the country of

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origin or parents’ country of origin (if born in France) and previous travel to Mecca. Socio-economic status was evaluated by proxy-indicators including employment status (unemployed, currently working) and housing conditions (social housing tenant, non-social housing tenants; household rooms per person <1, household rooms per person ≥1).

**Analysis**

Statistical Package for the Social Sciences (SPSS) version 15.1 software program (SPSS, Inc., Chicago, IL, USA) was used to carry out all analyses. Chi-square bivariate statistics analysis was performed to evaluate the likely determinants of the vaccination statuses based on χ² significance (P ≤ 0.05). Multivariate logistic regression was used to calculate adjusted ORs (odd ratios) between each dependent and each independent variable while controlling for demographic variables (age, gender). Effect modification, which occurs when there is a significant difference of the association between the dependent and independent variable within different strata due to any of the demographic characteristics, was explored as well. Confounding and interaction terms within the ensemble of housing characterization factors were explored. A confidence level of 95% was setted for the study and a sample of 500 was calculated.

**Results**

**Baseline characteristics of the study population**

Out of 650, 580 vaccination attendees in preparation to travel to Mecca voluntarily participated in this study, thus yielding a response rate of 89.2%. Respondents had an average age of 58.2 ± 12.4 years (range of 20–85 years), F/M sex ratio of 1:1.3 (table 1). Participants aged 30–39 years holding the largest number of French citizenship are the largest work force and have the highest formal education compared to the rest of the age groups. The largest proportion of French nativity and social housing tenants prevails among the age group 20–29 years old. Age groups 60–69 and 70–79 years have the largest proportion living in household rooms per person of ≥1.

**Vaccination rates and participants’ demographics**

Total vaccination rates for tetanus (18.9%), diphtheria (14.7%) and poliomyelitis (15.0%) were comparable. Overall certificate confirmed vaccination rate for TdP was 4.5%. TdP vaccination coverage was highest for respondents in the age group of 30–39 years old and decreased with age (figure 1). Gender was significantly associated only with tetanus vaccination coverage, where 6.5% more males than females report being up-to-date with tetanus vaccination (P-value = 0.02).

**Immigration status**

Most participants were of North African descent and were predominantly citizens from Algeria (34.1%), Morocco (19.8%), Tunisia (10.0%) and France (34.7%). The proportion of French citizenship (34.7%) is larger than that of French nativity (6.4%), suggesting that many acquired French citizenship through avenues other than birth. Only citizenship remains significantly associated with TdP vaccination coverage after controlling for demographic characteristics. A French citizen has about 3 to 4.5 times significantly greater odds of being up-to-date with TdP vaccination when compared with non-French citizens (table 2).

**Integration indicators**

Independent of demographics, significantly higher TdP vaccination rate prevails among respondents with a higher level of education, better French fluency and no travel to country of origin. Respondents that completed a certificate of primary studies and greater than or equal to baccalaureate have about 3–5 times and greater TdP coverage when compared to those with an education less than the certificate of studies (table 3). Previous travel to Mecca has no association with TdP vaccination status. Not having travelled to country of

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![Figure 1 Age distribution of TdP vaccination coverage](https://example.com/figure1.png)

**Table 1** Comparison of French citizenship and nativity, current working status, highest level of education, number of social housing tenants and household rooms per person ≥1 across participants’ age groups

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>n</th>
<th>French citizenship (%)</th>
<th>French born (%)</th>
<th>Currently working (%)</th>
<th>Education greater than or equal to Baccalaureate (%)</th>
<th>Social housing tenants (%)</th>
<th>Household rooms per person ≥1 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20–29</td>
<td>21</td>
<td>15 (71.4)</td>
<td>13 (61.9)</td>
<td>11 (52.4)</td>
<td>10 (47.6)</td>
<td>14 (66.7)</td>
<td>12 (57.1)</td>
</tr>
<tr>
<td>30–39</td>
<td>30</td>
<td>24 (80.0)</td>
<td>13 (43.3)</td>
<td>23 (76.7)</td>
<td>21 (70)</td>
<td>13 (43.3)</td>
<td>14 (58.6)</td>
</tr>
<tr>
<td>40–49</td>
<td>59</td>
<td>33 (55.9)</td>
<td>7 (11.9)</td>
<td>31 (52.5)</td>
<td>18 (30.5)</td>
<td>28 (47.5)</td>
<td>26 (44.1)</td>
</tr>
<tr>
<td>50–59</td>
<td>156</td>
<td>53 (34)</td>
<td>3 (1.9)</td>
<td>37 (23.7)</td>
<td>13 (8.3)</td>
<td>75 (48.1)</td>
<td>109 (69.4)</td>
</tr>
<tr>
<td>60–69</td>
<td>196</td>
<td>57 (29.1)</td>
<td>0 (0.0)</td>
<td>10 (5.1)</td>
<td>8 (4.1)</td>
<td>99 (50.5)</td>
<td>170 (86.7)</td>
</tr>
<tr>
<td>70–79</td>
<td>102</td>
<td>13 (12.7)</td>
<td>0 (0.0)</td>
<td>1 (1.0)</td>
<td>4 (3.9)</td>
<td>39 (38.2)</td>
<td>86 (86.0)</td>
</tr>
<tr>
<td>80–89</td>
<td>5</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>2 (40.0)</td>
<td>4 (80.0)</td>
</tr>
<tr>
<td>Total*</td>
<td>569</td>
<td>195 (34.3)</td>
<td>33 (5.8)</td>
<td>113 (19.9)</td>
<td>74 (13.0)</td>
<td>270 (47.5)</td>
<td>421 (73.9)</td>
</tr>
</tbody>
</table>

*a: All these values are lower than those presented in the Results section because it does not include participants that did not report age.
Table 2 Indicators of immigration and socio-economic status and TdP vaccination status

<table>
<thead>
<tr>
<th>Vaccination coverage against</th>
<th>Citizenship</th>
<th></th>
<th>Nativity</th>
<th></th>
<th>Employment</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>French</td>
<td>Non-French</td>
<td>P-value</td>
<td>France</td>
<td>Other than France</td>
<td>P-value</td>
</tr>
<tr>
<td>Tetanus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n (%)</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Odd ratio (95% CI)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>n (%)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diphtheria</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Odd ratio (95% CI)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poliomyelitis</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Odd ratio (95% CI)</td>
<td></td>
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</tr>
</tbody>
</table>

Origin is significantly associated with higher fluency in French language and higher educational level, suggestive of its use as an integration indicator.

Socio-economic characteristics

Respondents currently employed have a significantly higher TdP vaccination coverage (table 2). However, after adjusting for demographics in multivariate logistic regression leads to only vaccination against poliomyelitis remaining significantly associated with employment status [OR = 2.45 (1.19–5.03)]. None of the housing characterization factors was associated with any of the vaccination rates.

Discussion

The French National Public Health Council recommends that adults and adolescents of age >16 years receive vaccinations against diphtheria, poliomyelitis and tetanus, with a booster every 10 years. Free vaccination is easily available from state vaccination centres. Self-reported TdP vaccination rates in our study have shown to be much lower than those reported from studies of French population cohorts. Up-to-date booster vaccination rate among our participants against tetanus (18.9%) is lower than those reported from a cohort of travellers (61%) and from a sample of 6275 adult patients across all France (66.1%). Likewise, our participants’ booster anti-poliomyelitis vaccination coverage of 15% is much lower than that obtained from a nationally representative sample (63.4%). The greater vaccination coverage for males (23.5%) compared to females (15.7%) against tetanus in our study is also found in nationally representative population studies as well as among 5355 travellers leaving from France. The male advantage for receiving anti-tetanus vaccination is due to its requirement in French military service, indicative that some respondents were in the military. The overall trend of decrease of TdP vaccination rate with increasing age in our study is also reproducible in studies of French participant cohorts, suggestive that there might be intrinsic failures in effective national strategies for recommended booster vaccinations among the adult population. In fact, according to a study published in 1990, it is considered that at least 10 million adults in France have not been vaccinated against tetanus and 17 million have not received anti-poliomyelitis vaccines. In France, living in social housing and having lower formal education is higher in immigrants when compared with the rest of the population. Among our participants 47.1% (compared to 32.4% of nationwide immigrants) are tenants of social housing, 13.1% participants (compared to 32% of nationwide immigrants) have an education greater than or equal to bachelor's degree. In respondents of age group 25–39 years, 78.9% of male and 20% of female participants (compared to 98% of nationwide immigrant males and 60% of immigrant females) are currently employed. Our participants’ characteristic lower socio-economic and social status, in addition to their unifying linguistic, cultural and religious identity defines them as a particularly disadvantaged group in France, and in other migrant-receiving countries, they would qualify as a minority group.

In different countries, minority groups have a lower access to preventive health care and consequently a higher rate of missing national recommended vaccination schedules. In France, social and socio-economic disparities have already been identified as determinants for lower health status, and in other countries these have been explicitly identified as determinants of lower vaccination rates. The significant higher likelihood that French citizenship, higher formal education and no travel to nativity country is correlated with better TdP vaccination rates among our participants, independent of demographics, supports the claim that patients’ input is necessary for the acquisition of TdP vaccination boosters. These findings parallel those from other countries where immigration status and lower social and socio-economic indicators are associated with gaps in nationally recommended immunization status.

TdP booster would most likely occur through occupational health requirements, such as for military service in the case of anti-tetanus vaccination, targeted vaccination campaigns as the one in our study, and overall patient–doctor encounters. The latter form of intervention would perhaps be the most common. We assume, under the context of universal health care, that having patients who are well informed about the advantages of vaccination boosters, general physicians who are active in preventive interventions and the presence of good quality continuity of care between physicians and patients would increase the likelihood of vaccination opportunities.

Studies of this nature should be able to facilitate design of surveillance schemes to monitor health status among foreign-born populations in French studies and encourage elaboration of health promotion programmes that are culturally and linguistically sensitive to minorities.

Limitations of this study

Our analysis is based on self-reported vaccination rates, and particularly for the case of TdP immunization statuses can be difficult to recall, which represents a source of bias. The older age group among the majority of our respondents might not be the most representative of the residing Muslim communities in PACA. The lack of access to direct

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measurements of socio-economic statuses limits our abilities to fully characterize the extent to which socio-economic status is a determinant of nationally recommended immunization coverage.

Conclusion

To our knowledge, this is the first study that elucidates the potential determinants of the Muslim community in France being at risk from inequities of national preventive care efforts. Universal health care, as it is for France, does not guarantee elimination of all inequities of access to health care. Despite France's national effort to mitigate disparities in preventive and curative health care via the High Committee on Public Health since 1994 and the establishment in 1998 of the Regional Programs of Access to Prevention and Care (PRAPS), there has been an absence of targeted immigrant health interventions. This study provides insight into possible ways in which community-based immunization recommendations can be generated in France, given that they have been undertaken in other immigrant-receiving countries. Vaccination campaigns as this one can become an important surveillance tool for nationally recommended vaccination coverage as well as centres for preventive health counselling for minorities in France.

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Conflict of interest: None declared.

Key points

- Muslim pilgrims departing France for Mecca have low immunization rates against tetanus, diphtheria and poliomyelitis.
- Their lower socio-economic and social status, in addition to their unifying linguistic, cultural and religious identity defines them as a particularly disadvantaged group in France.
- French citizenship, higher level of education, better French fluency and no previous travel to country of origin were the strongest and most significant determinants of TdP vaccination status.
- These results suggest that the Muslim community in France is at risk from inequities of national preventive care efforts.

References


