Low measles vaccination coverage among medical residents in Marseille, France: reasons for non-vaccination, March 2013

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Background: During 2008–12, France and Europe experienced large measles outbreaks, involving also healthcare workers (HCW). We aimed to estimate the vaccination coverage (VC) of measles among medical residents of the University of Aix/Marseille, in South-Eastern France. Methods: In March 2013, we conducted a cross-sectional study among all medical residents of the Medical Faculty of Aix/Marseille. We used a self-administered questionnaire to collect information on self-reported VC and reasons for vaccination and non-vaccination. We compared proportions, using the chi-squared test and prevalence ratios (PRs) with 95% confidence intervals (95% CIs). Results: Of 1152 eligible residents, 703 (61%) participated in the study and 95 (14%; 95% CI: 12–17%) reported having had measles in the past. Of all participants, 613 (93%; 95% CI: 91–95%) reported having been vaccinated against measles and 389 (76%; 95% CI: 73–80%) received two doses. Only 268 (38%) reported having visited an occupational health physician. Vaccinated individuals were more likely to report easy access to vaccination as the main motivation for measles vaccination, compared with unvaccinated residents (43%; 71% and 21%; 45%; P < 0.001, respectively). Conclusions: VC among the medical residents of the University of Aix/Marseille was well below the recommended 95% coverage for two doses of measles vaccination. The majority of the study participants had not visited an occupational health doctor. Lack of easy access seems to represent major barriers to measles vaccination. We recommend that the student union, occupational health services and hospitals co-operate and address these problems in order to improve VC in this group.

Introduction

Measles is a highly contagious disease that may lead to severe complications.1 2 Studies have shown that the risk of acquiring measles is higher among healthcare workers (HCW) than in the general population.3–5 Unvaccinated HCW are more susceptible to infection and can transmit the disease to their patients (infants, pregnant women, elderly and immunocompromised persons).5–9

References

Vaccination against measles is particularly recommended for healthcare personnel because of its contagiousness, complications, sequelae, absenteeism and the costs of its management.10–15

In France, measles cases were sporadic, but since the beginning of 2008, successive measles outbreaks have occurred, with more than 23,000 cases of measles being reported between 1 January 2008 and 31 December 2013. Of those, over 1000 had pneumonia, 54 experienced a neurological complication and 10 died.16 This epidemic has not spared HCW in contact with patients.3,4,15,17,18

The cumulative incidence of measles in Provence-Alpes-Côte d’Azur (Paca) region was 50/100 000 in 2011.19 The number of cases has decreased since the end of 2011, but measles virus still circulates especially in South-Eastern France.16 Between 1 January and 6 October 2013, 78 cases of measles were notified in Paca region, indicating an incidence of 1.6/100 000.20

One dose of measles vaccination has been introduced in the French national vaccination schedule in 1983 and a combined measles-mumps-rubella (MMR) vaccine is available since 1986. Two years before our study, in 2011 the High Council for Public Health (HCSP) recommended that everyone born after 1980 should receive two doses of MMR trivalent vaccine, regardless of the medical history of those three diseases.21

In France, there is no routine data collection system for vaccinations among adults. In addition, there are no routine mechanisms to assess the vaccination coverage (VC) among HCW who are targeted by specific immunization recommendations.22 So, information on VC among medical residents or HCW is limited in France. Neither is there data available on measles VC among medical residents in Paca. However, outbreak investigations and reviews have revealed the inadequate levels of vaccine prophylaxis among HCW, also in the Paca region.17,18,23 Moreover, surveys suggest that VC among HCW and/or medical students against measles is low in France.24–26

Medical education in France includes 6 years of under-graduate studies followed by a residency programme of 3–5 years (depending on the medical specialty). Medical residents train in different hospitals with a minimum period of 6 months in each hospital. According to the French Public Health code (clause L-3111-4),27 medical students and residents have the same obligations and recommendations for vaccinations as HCW in general. Vaccination against diphtheria, hepatitis B, poliomyelitis and tetanus is obligatory for HCW, whereas vaccinations against influenza, measles, varicella and pertussis are recommended.27 Since 2005, HCSP has recommended that HCW who do not have a history of measles or have not been vaccinated against measles receive one dose of MMR.21

In March 2013, we conducted a cross-sectional study to estimate measles VC among residents of the Faculty of Medicine of Aix/ Marseille, in South-Eastern France and identify factors associated with being vaccinated. We also estimated VC for hepatitis B, influenza and pertussis.

Methods

Data collection

We distributed a self-administered structured questionnaire during a 2-day meeting (organized by the Union of the Medical Residents), where medical residents chose their next residency assignments. The questionnaire collected information on (i) demographic characteristics (sex, specialty and year of residency); (ii) visit to the occupational health physician; (iii) measles history; (iv) self-reported measles vaccination status (number of doses, place of vaccination and side effects); (v) self-reported hepatitis B, pertussis and influenza vaccination status and (vi) reasons for being vaccinated or unvaccinated against measles. A simplified vaccination schedule was provided with the questionnaire. Information about sex, specialty and year of residency was collected also from those medical residents who refused participation.

Definitions

Residents were provided a simplified vaccination schedule with the questionnaire. Residents were considered fully vaccinated against measles if they had received two doses of measles containing vaccine. They were considered to be up-to-date with pertussis if they had a pertussis booster either at 11–13 years or 26–28 years of age.

Data analysis

We calculated percentages using the number of respondents as the denominator. We compared VC between different groups using the chi-squared test and prevalence ratios (PRs). Logistic regression models were constructed to identify factors associated with being vaccinated against measles. We constructed models using backwards selection starting with all the variables that showed P values < 0.2 in the univariate analysis. We calculated adjusted PR using binomial regression including all the variables of the final logistic regression model.

Data were entered using EpiData 3.1. Analysis was performed with Stata 12.0 (StataCorp, College Station, TX).

Ethical considerations

Participation to the survey was voluntary and no personal identifiable information was collected. The French Commission for Data Protection and Liberties (CNIL, Commission nationale informatique et libertés) approved the protocol.

Results

Description of the study population

The total number of medical residents registered in the union was 1152. Of those, 703 (61%) completed a questionnaire. One questionnaire was discarded due to inconsistent information. Eighteen residents refused to participate.

However, compared with the total population of medical residents, participants differed significantly in terms of year of residency and specialty. First year residents were over-represented, whereas the fourth year residents were under-represented (P value < 0.001); residents of paediatrics and gynaecology-obstetrics were less likely to participate, whereas residents of medical specialty were more likely to respond (P value < 0.01). Of all respondents, 436 (62%) were female.

Measles vaccination

VC for at least one dose of measles vaccination was 93% [613/660; 95% confidence interval (CI): 91–95%]; 43 participants did not provide an answer (table 1). VC was higher among residents of paediatrics and gynaecology-obstetrics and medical specialty (96% and 95%, respectively); however, no statistically significant differences were identified. Among the 509 residents who responded, 76% (95% CI: 73–80%) were vaccinated with at least two doses of measles (table 1). There were no significant differences in the VC for two doses between genders or among specialties or years of residency.

Seventy-five percent (460/613) reported having been vaccinated against measles by their family doctor (general practitioner), 14% (88/613) at primary school and 7% (41/613) either at the university or occupational health services. Five reported having been vaccinated before travelling.

Measles history

Among the 664 residents for which information was available, 14% (95) reported history of measles (table 2) and 12% (11/95) of those previous infections were laboratory confirmed. Eight percent of the
Table 1 Self-reported VC among medical residents of the university of Aix/Marseille, France, 2013

<table>
<thead>
<tr>
<th>Vaccination</th>
<th>Number</th>
<th>Totala</th>
<th>%</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measles 1 dose</td>
<td>613</td>
<td>660</td>
<td>93</td>
<td>91–95</td>
</tr>
<tr>
<td>Measles 2 doses</td>
<td>389</td>
<td>509</td>
<td>76</td>
<td>73–80</td>
</tr>
<tr>
<td>Hepatitis B</td>
<td>684</td>
<td>692</td>
<td>99</td>
<td>98–100</td>
</tr>
<tr>
<td>Pertussis up-to-dateb</td>
<td>467</td>
<td>596</td>
<td>78</td>
<td>75–82</td>
</tr>
<tr>
<td>Influenza 2012–13</td>
<td>350</td>
<td>698</td>
<td>50</td>
<td>46–54</td>
</tr>
</tbody>
</table>

aMissing values and ‘do not know’-answers were excluded.
bPertussis booster either at 11–13 years or 26–28 years of age.

Table 2 Characteristics of study participants, VC study, Aix/Marseille, France, 2013 (n = 703)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Number</th>
<th>%</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visited an occupational physician</td>
<td>268</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td>0.010</td>
</tr>
<tr>
<td>Female</td>
<td>183</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>84</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Year of residency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st</td>
<td>69</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>2nd</td>
<td>96</td>
<td>42</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>3rd</td>
<td>65</td>
<td>51</td>
<td></td>
</tr>
<tr>
<td>4th</td>
<td>34</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>Had a vaccination document</td>
<td>650</td>
<td>95</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td>0.045</td>
</tr>
<tr>
<td>Female</td>
<td>428</td>
<td>96</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>222</td>
<td>94</td>
<td></td>
</tr>
<tr>
<td>Had measles in the past</td>
<td>95</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Have children</td>
<td>44</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

Of all participants, 95% (650/688) reported that they kept a vaccination document. Women were more likely to have a document compared with men (96% vs. 92%, P < 0.05). Residents of surgical specialty were less likely to keep a vaccination document (88%, P < 0.03).

Reasons for not being vaccinated against measles

The most often cited reason for not being vaccinated against measles was history of measles (62%, 29/47). Nineteen percent (9/47) of unvaccinated residents reported lack of interest as the reason for non-vaccination; 11% (5/47) indicated that either they or their parents were opposed to vaccinations. Nine percent (4/47) stated that they considered that the risk of acquiring measles is low.

Motivating factors for measles vaccination

Both among vaccinated and unvaccinated participants, easy access to vaccination was the most commonly reported motivation for getting vaccinated for measles (table 3). Vaccinated individuals were more likely to report easy access to vaccination as the main motivation for measles vaccination, compared with unvaccinated residents.

Factors associated with being vaccinated against measles with two doses

Residents who reported easy access to vaccination or protection of their patients as their motivation for vaccination were more likely to be vaccinated against measles with two doses (table 4).

Upon multivariable analysis, three factors remained significantly associated with being fully vaccinated against measles (table 4). Medical residents who reported history of measles were 53% less likely to be vaccinated twice. VC for two doses of measles vaccine was 25% higher among residents who reported that their pertussis vaccination was up-to-date. Also, medical residents were 12% more likely to be fully vaccinated against measles if they reported that protection of patients was their motivation for being vaccinated.

Discussion

This study provided information on VC among medical residents in Marseille. VC against measles among medical residents was found low, especially for the second dose of the vaccine, which is below both the measles VC targets set in France (95% for one dose and 80% for two doses) as well as the WHO recommended ≤95% target for two doses of vaccine to ensure measles elimination in Europe.11,18,29 This coverage can neither prevent measles circulation for two doses of vaccine to ensure measles elimination in Europe.11,18,29 This coverage can neither prevent measles circulation in the community nor nosocomial transmission. This is of special concern, as medical residents like other HCW represent a population in risk of potentially transmitting measles to patients in health care settings with higher risk for serious complications due to age, pregnancy or immunodeficiency.3–7,14,15

Although VC data for medical residents and HCW are scarce in France, there are a few similar surveys that estimated the VC for obligatory and recommended vaccinations among HCW and health care students.

In a study conducted among medical residents in Paris region in 2009, the self-reported VC for measles among medical residents (63% for one dose and 14% for two doses) was found lower than in this study.24 VC (recorded from vaccination booklets) for two occupational physician than males (42% vs. 32%, P < 0.02). The proportion of residents who visited an occupational health physician increased with increasing year of residency, with the first year residents being less likely to have used occupational health services compared with older residents (table 2).
doses of MMR among medical students in Lille in 2011 was reported to be 78%, which is similar to our finding. In a smaller study among 157 medical students (41% response) in hospitals in Paris region in 2009, measles VC was reported to be 80% for one dose and 46% for two doses. Further studies are required at the national level to monitor VC among this population.

Easy access to vaccination was the most commonly reported motivation for getting vaccinated for measles, suggesting that lack of easy access may represent a major barrier to measles vaccination among medical residents. This is consistent with other findings, as lack of convenient access to vaccination has been cited as one of the major reasons for low influenza vaccine uptake among HCW, in several studies on influenza vaccine compliance.

Over 60% of non-vaccinated residents indicated that history of measles was the reason for not being vaccinated. Nevertheless, one-fifth of non-vaccinated residents did not report any history of measles and could therefore lack immunity for measles and pose a risk for themselves or their patients. The second most often reported reason for non-vaccination was lack of interest, whereas about one-tenth of residents reported that either they or their parents are opposed to vaccinations or that they considered that the risk of acquiring measles is low. Those are surprising findings as they reflect lack of awareness of the hazards of vaccine-preventable diseases. Since most residents grew up when vaccines were available, they may have little or no first-hand knowledge about the seriousness of the diseases prevented by these vaccines.

Table 3 Factors that motivated or would have motivated getting vaccinated against measles, VC study, Aix/Marseille, France, 2013 (percentages do not add to 100%, because multiple answers were possible.)

<table>
<thead>
<tr>
<th>Factor</th>
<th>Vaccinated (N = 613)</th>
<th>Unvaccinated (N = 47)</th>
<th>%</th>
<th>Unvaccinated %</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easy access to vaccination</td>
<td>435</td>
<td>71</td>
<td>21</td>
<td>45</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Close people with measles complications</td>
<td>149</td>
<td>24</td>
<td>15</td>
<td>32</td>
<td>0.245</td>
</tr>
<tr>
<td>Vulnerable people in the vicinity</td>
<td>252</td>
<td>41</td>
<td>21</td>
<td>45</td>
<td>0.632</td>
</tr>
<tr>
<td>Protection of patients</td>
<td>268</td>
<td>44</td>
<td>19</td>
<td>40</td>
<td>0.661</td>
</tr>
<tr>
<td>Better information</td>
<td>169</td>
<td>9.0</td>
<td>7</td>
<td>15</td>
<td>0.180</td>
</tr>
<tr>
<td>Other motivation</td>
<td>12</td>
<td>2.0</td>
<td>3</td>
<td>6.4</td>
<td>0.050</td>
</tr>
<tr>
<td>No motivating factor indicated</td>
<td>29</td>
<td>4.7</td>
<td>4</td>
<td>8.5</td>
<td>0.252</td>
</tr>
</tbody>
</table>

Table 4 Factors associated with being vaccinated against measles with two doses (univariate analysis and final binomial model), VC study, Aix/Marseille, France, 2013

<table>
<thead>
<tr>
<th>Factor</th>
<th>Univariate analysis</th>
<th>Multivariable analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vaccinated</td>
<td>Total</td>
</tr>
<tr>
<td>Have had measles</td>
<td>26</td>
<td>72</td>
</tr>
<tr>
<td>Pertussis vaccination up-to-date</td>
<td>300</td>
<td>364</td>
</tr>
<tr>
<td>No</td>
<td>55</td>
<td>98</td>
</tr>
<tr>
<td>Vaccinated against influenza*</td>
<td>219</td>
<td>270</td>
</tr>
<tr>
<td>No</td>
<td>169</td>
<td>236</td>
</tr>
<tr>
<td>Protection of patients</td>
<td>187</td>
<td>228</td>
</tr>
<tr>
<td>Easy access to vaccination</td>
<td>278</td>
<td>345</td>
</tr>
<tr>
<td>No</td>
<td>111</td>
<td>164</td>
</tr>
</tbody>
</table>

*Seasonal vaccination 2012–13.
VC among the medical residents of the University of Aix/Marseille was well below the recommended 95% coverage for two doses of measles vaccination. The majority of the study participants had not visited an occupational health doctor. Lack of easy access seems to represent major barrier to measles vaccination. To improve VC among medical residents and other HCW, the role of occupational health services needs to be strengthened, including provision of information about the current immunization policies, verification of vaccination status and subsequent administration of recommended vaccines. In addition, those services will also have to provide education about the importance of preventing measles and other vaccine-preventable diseases among HCW. The unions of medical residents may play a more active role in improving vaccination uptake among its members. Vaccination uptake could be improved if immunization services are provided during union gatherings (e.g. when residents are gathered to choose residency places twice a year). Establishing co-operations between the union of medical residents, occupational health services and hospitals would be beneficial to identify effective approaches for improving access to vaccinations in order to protect both medical residents and their patients.

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Conflicts of interest: None declared.

Key points

- Measles VC among medical residents in Marseille, France, below recommendations: 93% for one dose and 76% for two.
- Less than half of the residents used occupational health services during residency.
- Facilitating easy access to vaccinations is the key to improve VC among residents.

References


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**The role of conspicuity in preventing bicycle crashes involving a motor vehicle**

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**Background:** Bicycle use, despite its proven health and other benefits, is rarely part of everyday travel for many people due to the perceived risk of injury from collision crashes. This article investigated the role of physical vs. attention conspicuity in preventing bicycle crashes involving a motor vehicle in New Zealand. **Methods:** The Taupo Bicycle Study involved 2590 adult cyclists recruited in 2006 (43.1% response rate) and followed for bicycle crash outcomes through linkage to four national databases. A composite measure of physical conspicuity was created using latent class analysis based on the use of fluorescent colours, lights and reflective materials, and the main colour of top, helmet and bike frame. Attention conspicuity was assessed based on regional differences in travel patterns and the amount of riding in a bunch. Cox regression modelling for repeated events was performed with multivariate adjustments. **Results:** During a median follow-up period of 6.4 years, 162 participants experienced 187 bicycle–motor vehicle crashes. The crash risk was not predicted by the four latent classes identified and the amount of bunch riding but was higher in Auckland, the region with the lowest level of bicycle use relative to car use. In subgroup analyses, compared to other latent classes, the most physically conspicuous group had a higher risk in Auckland but a lower risk in other regions. **Conclusion:** Conspicuity aids may not be effective in preventing bicycle–motor vehicle crashes in New Zealand, particularly in Auckland, where attention conspicuity is low.

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**Introduction**

About one-third of the world’s adult population is not sufficiently active partly due to an increase in the use of ‘passive’ modes of transport. Bicycle use, if integrated into daily life, provides health, environmental and economic benefits yet, it is rarely part of everyday travel in many countries. One of the major deterrents to engaging in such activity is fear of motorized traffic.

According to police reports in New Zealand (2007–2011), an average of 10 cyclists are killed and 817 are injured in collisions with a motor vehicle each year. Collision crashes often result from the driver’s failure to detect the cyclist who has the right-of-way and are termed the ‘looked-but-failed-to-see’ phenomenon. Features contributing to drivers failing to see a bicycle on the road include the relative rarity of cyclists, small size, slow speed and low level of perceived threat suggesting that increasing the conspicuity of cyclists may reduce the risk of collisions.

Conspicuity can be classified into: physical conspicuity (distinction of an object due to its physical characteristics) and attention conspicuity (distinction of an object based on the observer’s interest and experience). The former may be enhanced by using conspicuity aids such as fluorescent materials, lights and reflectors. Such measures improve drivers’ detection and recognition time in experimental settings but their effect on cyclist safety is inconclusive. The attention conspicuity, on the other hand, may be improved by creating a more balanced transport mix. The ‘safety in numbers’ effect suggests that if more people cycle and less drive, cyclists will be safer as drivers are more likely to pay attention to the presence of cyclists. However, riding in a bunch may provoke negative interactions with other road users, e.g. if cyclists spread across the road.