Rubella susceptibility among pregnant women in North London, 1996–1999

Pat A. Tookey, Mario Cortina-Borja and Catherine S. Peckham

Abstract

Background Rubella infection and congenital rubella are currently rare in the United Kingdom, although sporadic cases occur, often associated with travel abroad. Uptake of the combined measles, mumps and rubella (MMR) vaccine has declined in recent years, and there is a danger that rubella infection could start to circulate again, with serious implications for susceptible pregnant women. This could be a particular problem in communities where there are relatively high rubella susceptibility rates because of either poor vaccine uptake over several years or the presence of significant numbers of recent immigrants from countries without routine rubella vaccination programmes.

Methods Routinely collected data on rubella susceptibility in pregnant women in the former North West Thames region were available for 1996–1999. Associations between year of delivery, maternal age, parity and ethnic group, and rubella susceptibility were explored.

Results Overall rubella susceptibility declined significantly from 2.6 per cent to 2.4 per cent between 1996 and 1999. Whereas less than 2 per cent of British-born women were susceptible, overall susceptibility for other women was about 5 per cent. African and Asian women had particularly high susceptibility rates, and patterns of susceptibility by age and parity varied across ethnic groups.

Conclusions If rubella were to re-establish itself in the United Kingdom, women who had come to Britain in later childhood or adult life would be at higher risk of acquiring infection in pregnancy than indigenous women. Appropriate local and national strategies should be devised to ensure that all such women are offered rubella vaccination at the earliest opportunity.

Keywords: rubella, routine data, pregnancy, inequality

Background

Diagnosed congenital rubella infection is currently rare in the United Kingdom, and the few cases reported to the national surveillance programme in the last decade are disproportionately associated with recent arrival in the country, or travel abroad in early pregnancy.1,2 Most recently reported infants had multiple rubella defects recognizable close to the time of birth, and their mothers acquired infection very early in pregnancy. However, it is possible that congenital rubella is underdiagnosed, especially among infants whose mothers were infected after the third month of pregnancy, who may have sensorineural hearing loss as a single defect.3

Since the early 1970s screening for rubella susceptibility has been routinely undertaken in the United Kingdom at antenatal booking to identify women who should be offered rubella vaccination in the post-partum period to protect future pregnancies. National data indicate that overall about 2 per cent of pregnant women are susceptible to rubella, but this varies with age and parity; there is also evidence of higher rates of rubella susceptibility among Asian women than among non-Asian women.4

The selective rubella vaccination programme introduced in the United Kingdom in 1970 for all schoolgirls (effectively covering those born after 1958) allowed for the continuing circulation of rubella infection among children and the acquisition of natural rubella immunity for the majority of individuals. However, the strategy changed in 1988 when MMR vaccine was introduced for all children in the second year of life. In 1994, as part of an attempt to avert a predicted measles epidemic, all 5–16-year-olds were offered combined measles/rubella vaccine. In 1996 a second dose of MMR was introduced for 4-year-olds, and the schoolgirl rubella vaccination programme was discontinued. As a consequence of these changes in the vaccination strategy, the circulation of wild rubella virus has been at extremely low levels in the United Kingdom in recent years, and an increasing proportion of individuals are protected by vaccine-induced immunity.

Parental and professional concerns about possible links between measles-containing vaccines, bowel disease and autism5,6 have led to a decline in MMR vaccine uptake from a high of 92 per cent by age 24 months in 1996–1997 in England,7 to 84 per cent in the last quarter of 2001.8 Uptake is lowest of all in the London region, declining over the same period from 86 per cent to 73 per cent.7,8 Despite subsequent studies that specifically set out to investigate the link between MMR vaccine, autism and
bowel disease, and concluded that there was no such associ-
ation,9,10 and a consensus amongst most experts that the original studies were flawed,11,12 there is as yet no sign of any substantial recovery in vaccine uptake rates. If vaccine uptake does not improve, rubella infection could start to circulate again among children. This could have particularly serious implications in areas where susceptibility rates among pregnant women are high because of either low vaccine uptake in the past or the presence of individuals who have entered the country without immunity and remain unvaccinated.

In this paper we present results from antenatal rubella screening in an ethnically diverse London population where the proportion of recent entrants to the United Kingdom is higher than in the rest of the country.

Methods

The data were derived from the St. Mary's Maternity Information System (SMMIS) database for the years 1996–1999. This clinical database includes routinely collected data on pregnant women attending the majority of hospitals in the former North West Thames Region. The database includes about 90 per cent of deliveries in this area, about half in hospitals in inner and outer London, and the other half in hospitals in the adjoining, mainly urban, area.

Data on rubella susceptibility at antenatal booking, age at delivery (in 5-year bands), parity and ethnic group were extracted. Parity was categorized as 0, 1 and 2+. Ethnic group and country of birth were self-reported, and not recorded separately on the SMMIS database, but combined in one variable with a large number of possible values. For these analyses they were grouped under six main headings: white, black, Asian, Mediterranean (mainly women from north Africa, Greece, Turkey and the Middle East), Oriental (mainly women from China, Japan and Vietnam), and other/not known. For some analyses differences were explored within these groups to identify subgroups at higher risk of being rubella susceptible.

Analyses were carried out in S-Plus. The data were explored by univariate analysis and several logistic regression models were then fitted to test hypotheses on trends in rubella suscepti-
bility by year of delivery, parity, maternal age at delivery and ethnic group. The best model was chosen using a stepwise pro-
cedure. It included ethnic group, year of delivery, both linear and quadratic terms for age, parity as an ordered factor, and interactions between ethnic group and parity, and ethnic group and age.

Results

Results of antenatal rubella screening were available for 137 398 (94.6 per cent) of the 145 284 women whose details were entered on the SMMIS database (see Table 1). About a quarter of women with rubella test results were from ethnic minority groups, including 16670 Asian women (12.1 per cent of the tested population), 9006 black women (6.6 per cent), 3715 Mediterranean women (2.7 per cent) and 1896 Oriental women (1.4 per cent); 44.3 per cent of women were having their first baby, 19.3 per cent were aged under 25 and 16.9 per cent were aged 35 or over at delivery. Overall rubella susceptibility was 2.5 per cent with a small but significant decline over the 4 years from 2.6 per cent in 1996 to 2.4 per cent in 1999 ($p = 0.015$). Univariate analysis showed that susceptibility rates varied significantly both with parity ($p <0.001$) and with age ($p = 0.001$). In most ethnic groups, rubella susceptibility was highest in women having their first baby and lowest in those having their second (Fig. 1). Although patterns of susceptibility with age were more variable, in most groups susceptibility was higher among women aged 35 and over than among those aged 25–34 (Fig. 2).

Overall, less than 2 per cent of white women were susceptible to rubella, compared with about 5 per cent of Asian and black women, nearly 4 per cent of Mediterranean women, and about 8 per cent of Oriental women (Table 1). However, analysis by age and parity revealed even greater variability between specific groups of women (Table 2). The median age of primiparous women ranged from 21 years for Bangladeshi women to 30 for Oriental women. Susceptibility among black British women having their first baby was 2.0 per cent, virtually identical to primiparous white British women (1.9 per cent). In contrast, 3.2 per cent of primiparous black Caribbean women and 8.4 per cent of black African women were rubella susceptible. There was even greater variation among Asian and Oriental women, ranging from an overall susceptibility rate of 4.1 per cent for Pakistani women to 14.9 per cent for Sri Lankan women. Sus-
ceptibility rates were particularly high for women having their first baby; for example, 9.4 per cent in Bangladeshi and Oriental women and 23.3 per cent in Sri Lankan women.

Logistic regression

In view of the varying patterns of rubella susceptibility with age and parity within ethnic groups, we fitted logistic regression models including interaction terms for these factors. Figure 3 shows the probabilities of susceptibility by parity, age and ethnic group, for women having babies in 1999, predicted by the best model. In all age and ethnic groups, women having a second or subsequent baby had a significantly lower risk of susceptibility than women having their first baby. There were three patterns with respect to age: older white and Oriental women had higher susceptibility rates than younger women; Asian and Mediterranean women had higher susceptibility rates at each end of the age range; whereas older and younger black women had higher susceptibility rates than those in the middle age range.

Discussion

National monitoring of rubella susceptibility has consistently shown that pregnant Asian women have higher rubella suscept-
ibility rates than non-Asian women, and that parous women
Table 1 Rubella susceptibility by ethnic group, year of delivery, parity and age

<table>
<thead>
<tr>
<th>All women</th>
<th>All tested women</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>% with rubella results</td>
</tr>
<tr>
<td>All women</td>
<td>145 284</td>
</tr>
<tr>
<td>Ethnic group</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>102 236</td>
</tr>
<tr>
<td>Asian</td>
<td>17 465</td>
</tr>
<tr>
<td>Black</td>
<td>9737</td>
</tr>
<tr>
<td>Mediterranean</td>
<td>4046</td>
</tr>
<tr>
<td>Oriental</td>
<td>2022</td>
</tr>
<tr>
<td>Other/not known</td>
<td>9778</td>
</tr>
</tbody>
</table>

137 398 women with rubella results

Year of delivery
- 1996: 35 883 (2.6%)
- 1997: 35 244 (2.6%)
- 1998: 34 310 (2.5%)
- 1999: 31 961 (2.4%)

Parity
- 0: 60 873 (3.1%)
- 1: 47 192 (1.7%)
- 2+: 29 333 (2.5%)

Age group
- <20: 6414 (2.2%)
- 20–24: 20 043 (3.0%)
- 25–29: 41 036 (2.4%)
- 30–34: 46 704 (2.3%)
- 35–39: 19 894 (2.8%)
- 40+: 3307 (3.3%)

Figure 1. Rubella susceptibility by ethnic group and parity.
generally have lower susceptibility rates than women in their first pregnancy. The diverse nature of this antenatal population allowed us to explore the association of parity and age with rubella susceptibility among women of different ethnic groups and from different countries, and to identify groups who might be at particular risk of acquiring rubella infection in pregnancy. Unfortunately, because ethnic group and country of birth were not recorded separately, it was not possible to distinguish certain groups, for example, women from Eastern European countries. British-born Asian women, who are likely to have a similar susceptibility rate to other British-born women, could also not be distinguished, and their inclusion in other Asian groups might have lowered the apparent susceptibility rates in those groups. The independent association of older age with higher susceptibility rates in the British-born population could be attributable to the fact that women born in Britain before 1958 are unlikely to have been offered schoolgirl vaccination. There is also some evidence that in a vaccinated population

Table 2 Rubella susceptibility by ethnic group

<table>
<thead>
<tr>
<th>Ethnic Group</th>
<th>All tested women</th>
<th>Primiparous women</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>% susceptible</td>
</tr>
<tr>
<td>White British</td>
<td>94626</td>
<td>1.6</td>
</tr>
<tr>
<td>White other</td>
<td>2480</td>
<td>3.4</td>
</tr>
<tr>
<td>Pakistani</td>
<td>4312</td>
<td>4.1</td>
</tr>
<tr>
<td>Indian</td>
<td>8469</td>
<td>4.4</td>
</tr>
<tr>
<td>Bangladeshi</td>
<td>2171</td>
<td>6.1</td>
</tr>
<tr>
<td>Sri Lankan</td>
<td>763</td>
<td>14.9</td>
</tr>
<tr>
<td>Asian other</td>
<td>955</td>
<td>5.9</td>
</tr>
<tr>
<td>Oriental</td>
<td>1896</td>
<td>8.0</td>
</tr>
<tr>
<td>Black British</td>
<td>235</td>
<td>2.1</td>
</tr>
<tr>
<td>Black Caribbean</td>
<td>3242</td>
<td>3.1</td>
</tr>
<tr>
<td>Black African</td>
<td>4878</td>
<td>6.2</td>
</tr>
<tr>
<td>Black other</td>
<td>651</td>
<td>4.3</td>
</tr>
<tr>
<td>Mediterranean</td>
<td>3715</td>
<td>3.7</td>
</tr>
<tr>
<td>Other/not known</td>
<td>9005</td>
<td>2.7</td>
</tr>
</tbody>
</table>
immunity levels decline with age, and it is possible that immunity levels might have dropped below the screening cut-off level disproportionately among older women.

The different patterns of rubella susceptibility according to age and parity among women from different ethnic groups probably relate to different patterns of exposure to infection in childhood and to schoolgirl and post-partum vaccination, according to whether women were born in Britain, or arrived many years ago or relatively recently, and whether their older children were born in Britain or elsewhere. Some women would have arrived from countries with established and successful rubella vaccination programmes. Others would have come from situations where rubella vaccine was not routinely offered, or where established programmes have been seriously disrupted by war, economic instability or environmental disaster.

Conclusions

We have identified specific groups of women, particularly women originating from Africa and Asia, who would be at high risk of acquiring rubella infection in pregnancy if rubella re-established itself in the United Kingdom. It is possible that women arriving in the United Kingdom from countries or regions that were not identifiable in this database (e.g. Eastern Europe) are also at higher risk. It was not possible to assess susceptibility in these subgroups because of the way ethnic group and country of birth data were collected and categorized, and it would be helpful if these were collected as separate variables in future.

Appropriate local and national strategies should be devised to ensure that all women who are at higher risk of being rubella susceptible can be identified, preferably before they become pregnant, and offered rubella vaccination at the earliest opportunity.

Acknowledgements

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References

4 Miller E, Waight P, Gay N, et al. The epidemiology of rubella in England and Wales before and after the 1994 measles and rubella


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