Measles in a West African nomadic community*

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A serological survey was conducted among Tuareg nomads to determine their level of immunity to measles. More than half (57.9%) of the children under 10 years of age did not have detectable antibodies to measles, suggesting that transmission of the disease is low in this mobile population. Mothers’ reports of their children’s history of measles were accurate (positive predictive value 93.9% for under-5-year-olds). Nomads are a reservoir of susceptible individuals who require immunization strategies adapted to their particular life-styles. These can be implemented at relatively low cost.

In developing countries, measles remains one of the major killers of children. Since 1976, the WHO Expanded Programme on Immunization (EPI) has been very successful in promoting measles immunization of all children in their first year of life (1). However, many children are still not reached by immunization programmes, particularly in rural Africa. Among rural populations, nomadic communities are the least reached by any health services, and no satisfactory strategy has been devised to immunize children in such communities. Furthermore, the epidemiology of common diseases such as measles in dispersed and mobile populations is still not well understood, although it is essential if appropriate strategies are to be developed.

To provide baseline data on the distribution of measles in an isolated nomadic Sahelian population, we conducted a serological survey on a group of Tuareg nomads in central Niger, West Africa. To our knowledge this is the first time that such a survey has been carried out on a nomadic population, and the results should help define a strategy both for routine immunization efforts and in epidemic situations.

Materials and methods

In June 1986, a total of 83 related families who lived in an area 150 km to the north of the town of Tahoua, central Niger, were surveyed (Fig. 1). The families were grouped in nine camps, about 60 km apart. All were Tuareg shepherds of the Kel Eghlal group, belonging to the Iullemmeden Kel Dinnik tribe. Living by herding camels, cattle, sheep and goats, they move in search of pasture and water in this arid environment. Tuareg, as well as other Sahelian nomads, reside in small family units clustered in scattered camps widely separated from one another. Each household consists of a leather tent pitched about 100 m from its nearest neighbour. People from different camps meet at the wells where animals are watered. Contacts with non-nomadic populations and health services are few and occur at markets located in the few villages in this pastoral zone. Heads of families go to the market once a month, on average.

The study sample consisted of all the 202 children under 10 years of age in the camps of the 83 families, together with 120 persons aged 10–60 years from 48 of the 83 families. The male:female ratio was 1.1 for those <10 years of age and 1.2 for the older group.

Fig. 1. Map showing the study area.

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With their informed consent, all the study individuals (or their parents) were interviewed using a standard questionnaire. Ages were determined from a calendar of local events. Fingerprick blood samples were collected on pure cotton-lint filter-paper (Schleicher & Schuell #903 paper). The filter-papers were dried, placed in plastic bags with absorbent tablets, and stored in freezers at −20 °C.

Measles IgG antibody titres were determined using a commercially available test kit (Measlestat®, Whittaker Bioproduct Inc., Walkerville, MD, USA) based on an enzyme-linked immunosorbent assay (ELISA) (2). The test values are reported as a predicted index (the ratio of each test sample's absorbance value to the low-positive standard value). Values are classified as negative for a predicted index <1, low-positive for a predicted index of 1.00–2.69, and positive for a predicted index >2.7. Low-positive sera were considered to have been obtained from seropositive individuals. The data were entered using dBase III Plus software and the statistical analysis was performed using Epi5 software (WHO–CDC).

Results

A total of 42% of sampled individuals (136/322) were seronegative for measles. Fig. 2 shows the seroprevalence by age group. There was an increase in prevalence from 26.3% among under-2-year-olds to 50.5% among children aged 5–9 years. A total of 65.4% and 57.9%, respectively, of all under-5-year-olds and under-10-year-olds showed no detectable IgG antibody titres to measles. Among those aged ≥ 40 years the prevalence of seropositivity was 91.2%; however, 15.4% (14/91) of the population aged >20 years had no detectable antibodies. There were no significant differences when the distribution was analysed by sex. Among those who were seropositive (low-positive and positive), the proportion of low-positive IgG levels was higher (67.3%) among over-10-year-olds than among those under this age (35.3%). All children in 39% of the 59 families with two or more children under 10 years of age were seronegative to measles. In 32.2% of such families (19/59) all children were positive, while the remaining families had both seronegative and seropositive children. No entire family (adults included) was seronegative and no stratification by group of families (camp) could be established.

There was good agreement between individuals who reported a history of measles and seropositivity (Table 1). Among under-10-year-olds, the sensitivity and specificity of oral reporting, using serology as the gold standard, were 77.6% and 94%, respectively. The highest sensitivity and specificity occurred among under-5-year-olds (83.8% and 97.1% respectively). With 31 seropositives out of 33 under-5-year-old children who had a history of measles, the positive predictive value of oral reporting was high (93.9%) in view of the relatively low prevalence of seropositivity (34.6%). For the 5–9-year-olds the positive predictive value was lower (87.5%), although the prevalence of seropositivity was higher (50%). For over-10-year-olds the positive predictive value increased to 96.3%, which was probably related to a marked increase in the prevalence of seropositivity (84.2%).

Table 1: Agreement between measles IgG antibody serostatus and parents’ reports of their children’s history of measles

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Measles history</th>
<th>IgG antibodies to measles:</th>
<th>Present (n)</th>
<th>Absent (n)</th>
<th>K statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–4</td>
<td>Positive</td>
<td></td>
<td>31</td>
<td>2</td>
<td>0.83</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td></td>
<td>6</td>
<td>68</td>
<td>(0.64–1.0)*</td>
</tr>
<tr>
<td>5–9</td>
<td>Positive</td>
<td></td>
<td>35</td>
<td>5</td>
<td>0.62</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td></td>
<td>13</td>
<td>42</td>
<td>(0.42–0.82)</td>
</tr>
</tbody>
</table>

* Figures in parentheses are the 95% confidence intervals.
Discussion

A substantial proportion of Tuareg nomads has not been exposed to measles: 65.4% of under-5-year-olds and 50.5% of 5–9-year-olds were seronegative. About 15% of the adults (over-20-year-olds) were seronegative. This could explain the reports by local health professionals of cases of measles among adults during epidemics. These findings suggest a low level of transmission and the ability of individuals to remain unexposed to the disease, even when adults. The susceptible population increases until the virus is introduced into the community by contacts at a local market. However, its spread to neighbouring camps is retarded or even stopped by the distance between the camps and by their transient nature. In addition, because measles is feared, nomads tend to avoid certain markets or wells for months until an epidemic is over. In a previous survey of Wodaabe nomads in the same geographical area, only 3.9% of under-5-year-olds and 27.9% of 5–9-year-olds reported a history of measles (3, 4). This suggests an even lower level of transmission of measles, which could be explained by a life-style that is even more mobile and more dispersed than the Tuareg.

The absence of clusters of seronegative families or individuals by age categories within camps suggests a high level of mobility of individuals and of families within the community itself. The number, location, and composition of the camps vary over the year. Thus, each time measles is introduced, the geographical distribution and family composition of the camps are different. The situation therefore differs from that in other isolated, but more settled communities. In villages of Indians surveyed in the Amazonian basin, measles seropositivity was nearly absent (5). In Kenya, among recently settled Turkana nomads, none of the under-20-year-olds in one isolated village had measles antibodies, suggesting no major infection for the last 20 years (6). Transmission of measles is more frequent when communities are larger and closer to each other: for example, seropositivity has been reported to be 55% in rural Mali (7) and 87% in rural Uganda (8) among 5-year-olds. In urban environments measles is acquired at an earlier age: 90% of all cases of measles involve children under 24 months of age, and by 2 years of age all have been in contact with measles (9).

Tuareg parents reported accurately on their children's history of measles. Verbal reports of measles for under-5-year-olds had the highest sensitivity and specificity (83.8% and 97.1%, respectively) and the highest positive and negative predictive value (93.3% and 91.9%, respectively). This is of particular interest for rapid assessments of population exposure to measles.

The large proportion of children susceptible to measles, even among older age groups, increases the risk of outbreaks in nomadic communities. This reservoir of susceptibles may jeopardize efforts to control measles in neighbouring villages. At times of drought and famine, when destitute nomads gather in refugee camps and food distribution centres, immunization programmes should be a high priority. Measles is inevitably introduced with devastating effects in such high-risk groups. Providing regular immunization to mobile populations is, however, a difficult task. Mobile teams have limited success. During the smallpox eradication campaign in Mali, mobile teams systematically visited all nomadic camps, using wells as focal points; the cost per nomad immunized was 11 times that for a non-nomadic individual (10). Other workers have confirmed the limited efficiency of mobile teams in view of the logistic problems and their high cost (11). Efforts have been made to immunize every person entering markets (12). This was manageable for smallpox eradication, but would be difficult for EPI.

The prevention of measles among nomads therefore requires the development of an integrated effort combining early reporting from health auxiliaries, routine immunization in market villages, and outreach immunization at specific times and locations. This could be implemented at relatively low cost. Since measles spreads from markets into nomadic communities, market villages should be screened regularly for measles cases and measles vaccine should be offered to susceptible young populations and to adults with no history of the disease at each and every contact they have with health services. Since under-5-year-olds rarely go to markets, outreach visits should be organized with the full participation of the local nomadic communities around defined gathering points, such as wells. A surveillance system should be established, based on a network of health auxiliaries. Niger has established an extensive network of such auxiliaries, also covering nomadic populations. In the case of an epidemic outbreak, containment strategies should then be implemented, such as those reported to be successful in other parts of Africa (13).

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Résumé

La rougeole dans une communauté nomade d'Afrique de l'Ouest

L'épidémiologie de la rougeole dans les populations nomades est fort mal connue. Aussi, afin de déterminer sa distribution, l'ensemble des 202 enfants âgés de moins de 10 ans présents dans les campements de 83 familles ont été examinés. Il s'agit d'éleveurs nomades Touareg appartenant au même clan, dispersés loin des villages dans une aire de plus de 60 km de diamètre au centre du Niger. Un autre groupe de 120 éleveurs âgés de 10 à 60 ans, membres des mêmes familles, a été inclus dans l'étude. Un questionnaire a été systématiquement administré, et un échantillon de sang prélevé par piqûre au bout du doigt. Les taux d'anticorps (IgG) pour la rougeole ont été déterminés par une méthode ELISA (Whittaker Bioproduct Inc.).

Plus de la moitié des enfants (57,9%) de moins de 10 ans n'avaient pas d'anticorps détectables contre la rougeole. La proportion était de 65,4% dans la classe d'âge de moins de 5 ans et de 15,4% dans la population de plus de 20 ans. Dans 32,2% des familles tous les enfants étaient porteurs d'anticorps, les familles restantes incluaient des enfants positifs et négatifs. On observe une bonne concordance entre la notion d'une rougeole et la séropositivité, particulièrement chez les enfants de moins de 5 ans pour lesquels la valeur prédictive positive est de 93,9%.

Cette étude sérologique donne à penser que le mode de vie des éleveurs nomades retarde la pénétration des épidémies de rougeole dans ces communautés dispersées et mobiles. De ce fait une part importante des enfants, voire même des jeunes adultes, reste non-immune et constitue un réservoir d'individus susceptibles, bien souvent non touchés par les programmes de vaccination. Il est temps de mettre sur pied une stratégie de vaccination adaptée, utilisant les marchés ou se rendent régulièrement les nomades et un réseau d'auxiliaires de santé nomades pour compléter le système de surveillance des épidémies et le réseau de points de vaccinations en dehors des principaux villages.

References