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Immunity to measles, diphtheria and tetanus in residents of homeless shelters in Marseilles, France

Dear Editor,

From 2009 to 2010, countries on several continents, including Europe, experienced large outbreaks of measles. In Marseilles, this outbreak was predominantly associated with older children and young adults, including health care workers.^{1,2} Since its resurgence in the 1990s, diphtheria incidence has decreased in Europe, but circulation continues in some countries in eastern Europe with sporadic cases reported elsewhere.³ Four imported cases were reported in France from 2002 to 2008,⁴ and one autochthonous case in an unvaccinated individual was reported in 2011.⁵ Tetanus occurs everywhere in the world, almost exclusively in individuals who are inadequately immunized. In France, from 2007 to 2009, the reported yearly number of tetanus cases remained stable (8 cases), and there were 14 cases in 2010. Because of their poor living conditions, homeless people have poorer health and higher mortality than the general population.⁶ They have limited access to health-care⁷ because of many barriers which could delay their presentation for healthcare and limit their access to immunization services. Consequently, vaccination coverage may be lower in the homeless population compared with the general population.

In 2010, in a prospective study of adult homeless individuals sheltered at two homeless shelters in the city of Marseilles, France, we evaluated the immunity of homeless individuals to measles, diphtheria and tetanus. Blood samples were collected and used to test for the presence of IgG antibodies against measles virus and the diphtheria and tetanus toxins. This study was approved by the local ethics committee under number 10-005.

Measles-specific IgG titers were determined and semi-quantified using an enzyme-linked immunosorbent assay (ELISA), as recommended by the manufacturer [Enzygnost Anti-Measles Virus/IgG, Dade Behring-Siemens, Marburg, Germany]. Antibody titers above 400 mIU/mL were considered to be protective. The serum diphtheria and tetanus antitoxin IgG titers were determined using commercially available ELISAs [Diphtheria IgG ELISA and Tetanus IgG ELISA, IBL International GmbH, Hamburg, Germany], as recommended by the manufacturer. For diphtheria and tetanus, antitoxin titers above 0.1 IU/mL were considered to be protective.

Of 170 people that were included in the study, blood samples were obtained from 147 (86.4%). Measles-specific IgG titers were determined in 134 samples. A subset of 87 samples was selected to also determine the diphtheria and tetanus antitoxin titers. A detailed description of the study participants' characteristics is provided in [Table 1](#).

IgG titers at a level assumed to be protective against measles virus infection (>400 mIU/mL) were detected in 127 (94.8%) of the individuals tested ([Table 1](#)). Susceptibility to measles was significantly associated with a younger age (mean age 28.4 ± 6.0 years for non-immune homeless

Table 1 Immune status for measles, diphtheria and tetanus among homeless participating in the study, in the two homeless shelters of Marseilles, France.

	Total	No. (%) of donors protected against ^a		Total	No. (%) of donors protected against ^b	
		Measles			Diphtheria	Tetanus
Gender:						
Male	118	111 (94.1)		71	61 (85.9)	57 (80.3)
Female	16	16 (100)		16	13 (81.2)	12 (75.0)
Age group (years):						
<25	7	5 (71.4)		5	5 (100)	5 (100)
25–50	71	66 (93.0)		39	33 (84.6)	32 (82.1)
>50	56	56 (100)		43	36 (83.7)	32 (74.4)
Birthplace:						
Northern Africa	59	56 (94.9)		37	30 (81.1)	22 (59.5)
Metropolitan France	37	36 (97.3)		22	18 (81.8)	21 (95.5)
Eastern Europe	21	18 (85.7)		13	11 (84.6)	12 (92.3)
Sub-Saharan Africa	8	8 (100)		9	9 (100)	8 (88.9)
Other	9	9 (100)		6	6 (100)	6 (100)
Living in France since:						
<5 years	47	42 (89.4)		27	21 (77.8)	20 (74.1)
>5 years	53	52 (98.1)		39	37 (94.9)	29 (74.4)
Duration of homelessness:						
<5 years	99	92 (92.9)		66	57 (86.4)	52 (78.8)
>5 years	31	31 (100)		18	14 (77.8)	15 (83.3)

^a Titer >400 mIU/mL.

^b Titer ≥0.1 IU/mL.

individuals vs. 48 ± 15.8 years for immune homeless individuals; $p = 0.001$). Overall, 7.1% of the individuals who had been homeless for less than 5 years were susceptible to measles. By contrast, none of the individuals who had been homeless for more than 5 years were susceptible to measles. There was a significant difference in the mean age of the individuals in these two groups (44.8 years in the <5 year group vs. 52.4 years in >5 year group; $p = 0.016$).

Seventy-four subjects (85.1%) had a protective diphtheria antitoxin titer (≥ 0.1 IU/mL) (Table 1); all of these subjects had a diphtheria antitoxin titer between 0.1 and 1.0 IU/mL. The proportion of individuals protected against diphtheria decreased as age increased (Table 1). However, there was no statistically significant difference in the proportion of protected individuals among the different age groups.

In total, 69 subjects (79.3%) had a protective tetanus antitoxin titer (≥ 0.1 IU/mL) (Table 1); 21 subjects (24.1%) had a tetanus antitoxin titer between 0.1 and 1.0 IU/mL, and 48 subjects (55.2%) had a titer between 1.0 and 5.0 IU/mL. The proportion of subjects with protective titers decreased as age increased (Table 1). The Pearson correlation coefficient was negative when age and tetanus antitoxin titer were compared ($r = -0.370$; $p < 0.001$).

In our study, about 95% of the subjects surveyed had protective measles-specific antibody titers. This is comparable to the results obtained in a 2010 study of 154 healthcare workers (HCWs) in public hospitals in Marseilles, France,² which demonstrated that 6.5% of the HCWs were not protected against measles. It should be noted that the WHO-UNICEF estimate of immunization coverage for MCV (measles-containing vaccine) in France were

approximately 90% in 2010. In both homeless individuals and healthcare workers, all susceptible subjects were less than 40 years old (mean age: 28.3 years for homeless individuals vs. 23.9 years for HCWs).

Considering that the surveyed subjects were primarily born in North Africa (47.6%) or metropolitan France (26.5%), our findings for diphtheria vaccination coverage (85.1%) are comparable with those obtained in France (86.4%)⁸ and in Algeria (83%)⁹ but are higher than those reported in Morocco (29.4%).¹⁰

Our results for tetanus vaccine coverage (79.3%) are also consistent with those reported in Morocco (76.1%)¹⁰ but are lower than those reported in France (98.5%).⁸ It should be noted that the WHO-UNICEF estimates of immunization coverage for DTP (diphtheria toxoid, tetanus toxoid and pertussis vaccine) in France were approximately 99% in 2010.

The serological profile of diphtheria immunity did not correlate with profile of tetanus immunity. Only 71.3% of the homeless individuals had protective antibody titers to both diseases (Table 2). Moreover, 8% of adults were protected against tetanus but were not protected against diphtheria.

In conclusion, this study highlights the need to improve the measles immunization status of homeless individuals less than 25 years of age. Migrants and refugees from countries at increased risk for diphtheria could be the source of an outbreak in the homeless population. Therefore, vaccination against diphtheria is recommended for all homeless individuals older than 25 years of age and all homeless migrants. Booster vaccinations against diphtheria should be considered for all adult homeless individuals. Furthermore, as recommended by the WHO, Combined

Table 2 Distribution of the protection against diphtheria and tetanus (≥ 0.1 UI/mL) in the homeless population.

Immune status	All	No. (%) of donors age group, years		
		<25	25–50	>50
Diphtheria protected ^a / Tetanus protected ^a	62 (71.3)	5 (100)	29 (74.4)	28 (65.1)
Diphtheria protected ^a / Tetanus unprotected ^b	12 (13.8)	0 (0)	4 (10.3)	8 (18.6)
Diphtheria unprotected ^b / Tetanus protected ^a	7 (8.0)	0 (0)	3 (7.7)	4 (9.3)
Diphtheria unprotected ^b / Tetanus unprotected ^b	6 (6.9)	0 (0)	3 (7.7)	3 (7.0)
Total	87 (100)	5 (100)	39 (100)	43 (100)

^a Titer ≥ 0.1 UI/mL.^b Titer < 0.1 UI/mL.

tetanus and diphtheria vaccine should be used, when a tetanus booster is required.

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Conflict of interest

No conflicts of interest exist.

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Seroepidemiology of Saffold cardiovirus (SAFV) genotype 3 in Japan

Dear Editor,

A new virus, Saffold cardiovirus (SAFV) belonging to genus *Cardiovirus* of family *Picornaviridae* has been identified and characterized, but its pathogenesis is not yet fully understood.^{1,2} SAFV type 3 (SAFV3) is thought to be the major genotype and is relatively frequently detected in patients with acute gastroenteritis and respiratory illness.^{3–5} In attempts to elucidate the pathogenesis, we conducted a seroepidemiological study of SAFV3 in Japanese people.

A total of 114 serum samples from subjects aged 0–66 years were collected in Gunma prefecture, Japan, in 2010. Subjects aged ≤ 5 years showed no evidence of infectious disease with minor congenital cardiac defect or inguinal