

Need for vaccination of sewer workers against leptospirosis and hepatitis A

Gaston De Serres, Benoit Levesque, Robert Higgins, Michel Major, Denis Laliberté, Nicole Boulianne, Bernard Duval

Abstract

Objectives—This study compared the prevalence of *Leptospira interrogans* and hepatitis A virus (HAV) antibodies in serum samples from sewer workers and controls.

Methods—A blood sample was obtained from 76 of the 101 municipal sewer workers (75%) of Quebec City and from two controls matched to each for age and sex. Testing was done for antibodies against serovars of *Leptospira icterohaemorrhagiae*, *bratislava*, *hardjo*, *grippotyphosa*, and *kennewicki* (*pomona*) and hepatitis A.

Results—Sewer workers had a greater prevalence of antibodies against leptospirosis than controls (12% *v* 2%, $P = 0.003$). In contrast, antibodies to HAV were not significantly more prevalent among workers than among controls (54% *v* 49%, $P = 0.51$). Prevalence of HAV antibodies increased significantly with age both among workers and controls (χ^2 for trend, $P < 0.001$). In contrast with younger workers, prevalence of HAV antibodies was greater among workers ≥ 40 years than among their controls (81% *v* 65%, $P = 0.04$).

Conclusion—Leptospirosis continues to be a problem to sewer workers but hepatitis A is apparently no longer a risk. The likely explanation is that leptospira are still abundant in the sewage system in contrast with HAV, which is only rarely to be found in sewage as a result of the generalised decrease in incidence of hepatitis A in the past three decades. The decision to vaccinate sewer workers against hepatitis A should take into account that it is impossible to avoid all contact with sewage fluid and, despite the fact that the actual incidence of hepatitis A is low, there is a real possibility of sporadic exposure during a future outbreak.

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Sewer workers are traditionally assumed to be at greater risk of acquiring infections than the general population.¹ Leptospirosis has long been recognised among sewer workers^{2,3} and is transmitted by infected rats. These contaminate sewer water with their urine, which may

contain large numbers of leptospira. Clinical manifestations of leptospirosis vary from non-specific symptoms of infections (fever, headache, myalgia) to an icterohaemorrhagic fever caused by hepatorenal dysfunction, or to aseptic meningitis and, in rare cases, death. It has also been reported that sewer workers seem to be at greater risk of hepatitis A.⁴ Hepatitis A virus (HAV) is excreted in stools and is likely to be encountered in water contaminated with faeces.⁵ Hepatitis A is a mild disease in young children, but it causes appreciable morbidity in adults.

Even if sewer workers use boots, coats, and gloves, they have contact with sewage fluids either accidentally or through routine maintenance operations. Sewer cleaning operations are mechanised in many countries and use a machine that propels water in pipes under high pressure to clear the silt. This operation produces large amounts of aerosols that come out through manholes. Generally, workers do not wear full face protection and they must look in the manhole to drive the machine. During this operation, their face is soaked by aerosols, and they experience cutaneous, respiratory, mucosal, and oral contact with sewage fluids.

The aim of this study was to compare the prevalence of *Leptospira interrogans* antibodies as well as HAV antibodies in serum samples from sewer workers with controls from the general population to evaluate the necessity of improving personal protection and providing vaccines for these workers.

Materials and methods

All municipal sewer workers from Quebec city area were contacted. Those who agreed to participate completed a questionnaire and had a blood sample drawn at work after signing a consent form approved by the Ethics Committees of the Centre Hospitalier de l'Université Laval and of the Hôpital Saint-Sacrement, Québec. Information sought included the number of years in this type of work; history of jaundice, hepatitis, leptospirosis, meningitis, or any stay in hospital for infection; and risk factors for leptospirosis (previous work in a farm, butchers, or slaughterhouse, and the presence of pets at home). Two control serum samples, matched for age and sex, were selected for each sewer worker. These anonymous, unlinked serum samples came from outpatients who had undergone lipid testing.

Leptospiral antibodies were detected with

Centre de santé
publique de Québec,
2601 De la Canardière
Québec, Québec,
Canada G1J2G3
G De Serres
B Levesque
D Laliberté
N Boulianne
B Duval

Faculté de médecine
vétérinaire, Université
de Montréal,
Montréal, Québec,
Canada
R Higgins

Ministère de
l'Agriculture, des
Pêcheries et de
l'Alimentation du
Québec, Québec,
Canada
M Major

Correspondence to:
Dr Gaston De Serres,
Centre de santé publique de
Québec, 2050 Boul René
Lévesque Ouest, Ste-Foy,
Québec, Canada G1V 2K8.

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Proportions of workers and controls with leptospiral and HAV antibody by age

Age group (y)	Leptospirosis		Hepatitis A	
	Workers n (%)	Controls n (%)	Workers n (%)	Controls n (%)
30-34*	0	1/28 (4)	2/14 (14)	7/28 (25)
35-39	2/21 (10)	0	7/21 (33)	16/42 (38)
40-44	5/15 (33)	0	10/15 (67)	16/30 (53)
45-49	0	0	11/13 (84)	18/26 (69)
50-54	1/7 (14)	1/14 (7)	5/7 (71)	7/14 (50)
≥ 55	1/6 (17)	1/12 (8)	6/6 (100)	11/12 (92)
Total	9/76 (12)	3/152 (2)	41/76 (54)	75/152 (49)

*Includes one sewer worker aged 29 years and his two controls.

the microscopic agglutination test (MAT). Titres of 1:50 or greater were considered positive. Serovars tested were *icterohaemorrhagiae*, *bratislava*, *hardjo*, *grippotyphosa*, and *kennewicki (pomona)*. The serovars were chosen according to those prevalent in animals and included in the veterinary surveillance programme of the Ministry of Agriculture of Canada.^{6,7} *Icterohaemorrhagiae* is well associated with rats, but all those tested could be found in rodents. The HAV antibody was measured with IM HAVAB microparticle enzyme immunoassay (Abbott Laboratories, Abbott Park, IL) according to the manufacturer's instructions.

STATISTICAL ANALYSES

Proportions were compared with χ^2 or Fisher's exact test and trends were evaluated by χ^2 for trend. Confounding was assessed by multivariate logistic regression.

Results

Of the 101 workers 76 (75%) agreed to participate in this study. Those who refused did not differ from participants by their age or number of years of employment. All participants except two were men and all were born in Canada. Mean (range) age was 41 (28-64) years and the time at this work was 10 (1-30) years. No worker reported a history of leptospirosis but five recalled having had jaundice before their employment. Information about previous use of pipe cleaning machines was lacking but the foremen reported that most workers used them sometime during their employment.

Sewer workers had a greater prevalence of antibodies against leptospirosis than controls

(12% *v* 2%, $P = 0.003$). All positive subjects had a titre of 1:50 except one worker, who had a titre of 1:100. Among the 12 subjects with leptospiral antibodies, seven were positive for *bratislava*, four for *hardjo*, one for *grippotyphosa*, and none for *icterohaemorrhagiae* or *kennewicki (pomona)*. None of the workers with leptospiral antibodies reported symptoms compatible with this disease during the past five years. The proportion of workers who were positive was not associated with age or the number of years at this work.

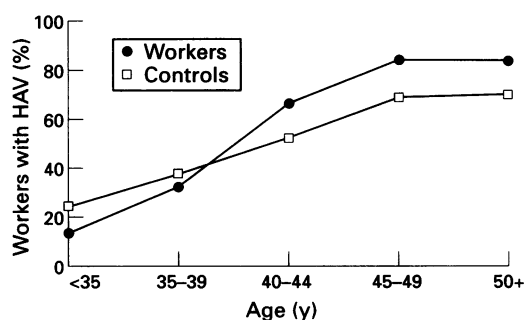
Overall, the proportion of workers with HAV antibodies was not significantly greater than among controls (54% *v* 49%, $P = 0.51$, table), but among both workers and controls, the proportion of positive subjects increased significantly with age (χ^2 for trend, $P < 0.001$, figure). In contrast with younger workers, the proportion of workers aged ≥ 40 years who had HAV antibody was significantly greater than among controls (81% *v* 65%, $P = 0.04$). In multivariate analysis, the proportion of workers who were positive was associated with age but not with the number of years at this work.

Discussion

This study shows that infection by leptospirosis continues to occur among sewer workers but that the risk of contracting hepatitis A has apparently been low for all sewer workers in recent years. The controls chosen in this study can reasonably be assumed to represent a valid sample of the overall population as testing for lipids is widely used in screening and is recommended for all healthy adults. Greater access to health care by higher socioeconomic class makes it possible that they might be less affected by both hepatitis A and leptospirosis. This is unlikely because health care is totally free in Canada. Moreover, prevalence of antibodies against HAV is lower in controls than in workers older than 40 years of age and the opposite is true for those younger than 40 years. This inversion of the risk suggests that our controls are not more "health conscious" or more at risk of hepatitis A than the general population would be.

In contrast with HAV, leptospiral antibodies do not persist for life. In fact, even if these antibodies can be found sometimes two to 10 years after an infection, generally antibody titres fall over weeks or months.⁸ Thus, the prevalence of leptospiral antibody does not have a lifelong cumulative incidence similar to HAV but is more likely to represent the incidence of only the recent years.⁹ False positive results are very unlikely with a titre of 1:50 in the MAT test, especially with *bratislava* and *hardjo*.^{8,10} This test is serovar specific, and cross reactivity with non-pathogenic serovars found in surface water, such as *Leptospira biflexa*, is not a problem.⁸ The greater risk of infection by leptospirosis in workers than in controls is similar to that mentioned in other studies.^{4,11} In our study, however, the increased risk of hepatitis A among sewer

Proportion of workers and controls with HAV antibody/age group.



workers was only found among those older than 40 years, in contrast with other countries where the increased risk was found within all age groups.^{4,12-14} The decreased risk of hepatitis A in our younger workers is unlikely to be attributable to improved working procedures because, unlike hepatitis A, we found that leptospiral infection continues to be a risk for sewer workers regardless of their age. The more likely explanation of our results is that leptospira are still abundant in the sewage system unlike HAV which has only a small probability of being found in sewage as a result of the generalised decrease in incidence of hepatitis A in the past three decades in the developed countries.¹⁵

Personal protection of these workers should be improved, especially for those who operate pipe cleaning machines. It is unlikely that even this will totally avoid the risk of infections. Leptospiral vaccines exist, but they are serovar specific, must be repeated every year, and are associated with a high incidence of painful swelling, especially after revaccination.¹⁶ Better vaccines should be developed before they can be widely used. In contrast, a safe and effective vaccine exists against hepatitis A. The decision to vaccinate sewer workers against hepatitis A should take into account that it is impossible to avoid all contact with sewage fluid and, despite the fact that the actual incidence of hepatitis A is low, there is a real possibility of sporadic exposure during a future outbreak.

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