

Is there a higher risk for hepatitis A in Flemish health care workers?

A seroprevalence study

by

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Abstract

During 1996-1997 the authors performed a serological survey to investigate the prevalence of hepatitis A virus (HAV) antibodies in a sample of 5,064 Flemish hospital employees. Additional data were collected by means of a questionnaire. The association between seropositivity and selected variables was investigated in order to identify riskgroups. The reliability of disease recall as a predictor of immunity was assessed. Statistical analysis was performed by calculating overall and age-specific prevalence rates, prevalence ratio's (PR) and their 95 percent confidence intervals (95% CI). Sensitivity, specificity, positive and negative predictive values (PPV and NPV) of the history were computed. The prevalence rate of HAV seropositivity was 35.6%. Significantly higher seropositivity rates were observed in older age groups. HAV seropositivity was signifi-

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cantly higher among workers from foreign origin and among catering personnel. The presence of HAV antibodies was significantly associated with jobs related to a lower educational level. No significant difference in HAV seropositivity was found between paediatric nurses and nurses of other clinical departments. No association was found between HAV seropositivity and a history of bloodtransfusion. The PPV and NPV of a history of hepatitis were 72.5 and 69.2%.

The authors did not find an increased risk for HAV infection in this sample of Flemish health care workers. In addition, comparisons within the sample did not reveal an increased occupational risk in paediatric nurses or other occupational subgroups. A positive history of infective jaundice was a good predictor of immunity.

Keywords

HAV, health care workers, occupational risk, seroprevalence study.

Introduction

Hepatitis A is the most common form of acute viral hepatitis in many parts of the world (1). It is caused by the HAV, a single stranded RNA virus (Picornavirus) of the genus hepatovirus. Faeco-oral transmission is the predominant way of spreading the disease. Theoretically, transmission by transfusion of blood or bloodproducts is possible, but rare (1, 2).

The most frequently reported sources of infection in industrialised countries are household or sexual contact with a person with hepatitis A, day care contact, international travel, food or waterborne outbreaks. In 50 percent of cases there is no known source (2).

Usually, in most of the children the HAV infection is asymptomatic, whereas in adults it causes clinically apparent disease, often with jaundice. Acute liver failure is a complication of hepatitis A that is more frequent in middle- aged and older people and in those with underlying chronic liver disease (1, 2).

Higher serpositivity rates are observed in older age groups (2-9). The prevalence rate of HAV seropositivity is inversely related to socio-economic status and hygiene (2, 4). This is the main reason for the differences in prevalence rates between regions, countries and nationalities (2, 9).

Prevalence data collected in Belgium since 1979 show an epidemiological shift with decreasing HAV antibody prevalence rates in the youngest age groups (4, 5). Improvement in socio-economic conditions and hygiene in Western Europe since World War II has led to a decline in the incidence of HAV infections in childhood, leaving a larger proportion of adolescents and adults susceptible to infection (4, 5). The age shift of infection will increase the proportion of cases with clinical disease, and may increase the case fatality rate.

So far as hepatitis A as an occupational hazard is concerned, opinions differ. Because contact with stools is important for transmission, traditionally, sewage workers, employees of day care centres and institutions of mentally retarded, and health care workers are considered to be at higher risk (1, 10). According to the CDC recommendations for prevention of hepatitis A, there is not enough evidence that there is a significantly increased risk for these professions (2). Nevertheless, in a Belgian sero-epidemiological survey it was suggested that there could be a slightly increased risk for hepatitis A in certain age groups of day care nursery workers (7).

With the development of a safe and efficient vaccine against the HAV (2, 11), it would be of interest to know if there is a risk for hepatitis A in health care workers.

In order to obtain a more precise estimate of the prevalence of HAV seropositivity in Flemish health care workers and to identify riskgroups, a seroprevalence study was set up.

Data from this study have already been compared with the estimated age-specific seroprevalence rates of HAV antibodies in the general population in Flanders by Vranckx et al. (12). They demonstrated a significantly lower prevalence of HAV antibodies in health care workers for the age groups 25 – 34, 35 – 44 and 45 – 54 years. This was attributed to different socio-economic parameters. We performed a more detailed analysis of the occupational aspects in order to identify riskgroups within health care. In addition, we compared the results of serological testing to these of the reported history of hepatitis.

Methods

During 1996-1997, a sample of 5,064 employees in 21 general hospitals and one large university hospital (Leuven), geographically distri-

buted over the Flemish and Brussels region, was tested for the presence of HAV and other viral antibodies (hepatitis B virus, hepatitis C virus and varicella zoster virus).

The hospitals were selected among the client-hospitals of the Occupational Health Service IDEWE. Due to practical circumstances, it was impossible to obtain a representative sample from all of the Flemish and Brussels hospitals, but a reasonable regional spread was aimed at. The blood tests for HAV antibodies were performed during the annual occupational medical examinations of the employees. Approximately 95% of all hospital employees are submitted to a yearly medical exam. In order to avoid any type of selection, a fixed percentage of all the employees in each hospital were requested to participate. To reach the proposed number, the first 35% to show up in each hospital were considered eligible for the study. Because systems for convocation of the workers vary largely between hospitals, the sample could be considered as approximating a random selection. Informed consent was obtained, and information was gathered by means of a self-administered questionnaire regarding age, gender, department, history of hepatitis (infective jaundice) and bloodtransfusions as well as the tasks and duties performed.

The total number of eligible employees in the 22 hospitals was 15,609. A total of 5,243 people were requested to participate. One hundred and seventy-five individuals refused to participate (3,3%) but no occupational pattern was discovered in this sample. Four bloodsamples were too small for analysis, thus 5,064 persons were finally tested.

The presence of anti-HAV/IgG was investigated using the radio-immuno-assay (RIA), AB-HAVK (DiaSorin, Saluggia, Italy). The prevalence rate of HAV seropositivity was calculated and compared among different groups by calculating the PR, defined as the ratio of the group with the highest to the lowest prevalence. 95 percent confidence intervals of the prevalence rates were calculated using the normal approximation of the binomial distribution (14), 95 percent confidence intervals of the PRs using the test-based method (14). Sensitivity, specificity, PPV and NPV of a history of hepatitis were calculated. Sensitivity was defined as the ability of a positive answer on historical enquiry to identify all immune subjects. Specificity was defined as the ability of a negative answer to identify all subjects susceptible to HAV. PPV is the probability, given a "yes" answer to the historical enquiry, that the individual will be immune to HAV by serology. NPV is the probability, given a "no" answer to the historical enquiry, that the individual will be non-immune to HAV by serology.

Results

Table 1 shows the distribution of selected demographical and occupational variables in the study population. The mean age was 37.2 years (SD: 8.5). 80.6 percent were females and 1.6 percent were of foreign origin. The majority (60.8 percent) was nursing staff. The mean and median number of years of employment were 12.5 and 11 years respectively.

A comparison of our sample with the total population of health care workers in hospitals under medical surveillance of IDEWE (26,654 employees in 1996) revealed that the frequency distribution of sexes was comparable (80.6 percent females in the sample as compared to 79.9 percent in the population), that younger age groups were slightly under-represented in the sample (41.0 percent younger than 35 years in the sample as compared to 46.7 percent in the population), and that nursing duties were comparable (60.8 percent with nursing duties in the sample as compared to 60.3 percent in the population).

The prevalence of HAV seropositivity in this sample of Flemish health care workers was 35.6 percent (95 percent confidence interval 34.3 – 36.9). In table 1 the PRs according to selected variables are shown. Significant PRs were found for age, country of origin, job and history of bloodtransfusion. Significantly higher seropositivity rates were observed in older age groups. After stratification into the age groups < 37 years and \geq 37 years (based on the median age), the association between HAV seropositivity and history of bloodtransfusion became non significant. HAV seropositivity was higher among workers from foreign origin and among catering personnel. For 367 participants (7.2 percent) the country of origin was unknown. The prevalence rate of HAV antibodies of this group was 29.4 percent, suggesting that most of them were of Belgian origin. There was no statistically significant difference between sexes.

Table 2 compares higher educational level jobs (nursing, administration, laboratory, physiotherapy) with lower educational level jobs (technical jobs, maintenance, catering). We found a statistically significant higher HAV seropositivity among lower educational level jobs. After stratification in ten-year age groups (table 2), this difference was significant only among the younger persons, especially those < 25 years. From 45 years on, persons with a higher educational level caught up with the overall prevalence rate.

There was no statistically significant difference between paediatric nurses and nurses of other clinical departments (PR 1.05, 95 percent

TABLE 1
Prevalence ratios (PR) and their 95 percent confidence intervals (95% CI)
according to selected variables in the study population (n = 5,064)

Variable		n	%	Prevalence of anti-HAV (%)	PR	95% CI (PR)
<i>Age Group:</i>	< 25 years	253	5.0	7.51	1.00	
	25 – 34 years	1,822	36.0	17.34	2.31*	1.53 – 3.48
	35 – 44 years	1,894	37.4	38.44	5.12*	3.69 – 7.10
	45 – 54 years	935	18.4	65.56	8.73*	6.73 – 11.32
	≥ 55 years	130	2.6	89.23	11.88*	8.61 – 15.99
	Unspecified	30	0.6	36.67		
<i>Gender:</i>	Male	983	19.4	35.81	1.01	0.88 – 1.15
	Female	4,081	80.6	35.56	1.00	
<i>Country of origin:</i>	Belgium	4,615	91.1	35.36	1.00	
	Other	82	1.6	76.83	2.17*	1.79 – 2.63
	Unspecified	367	7.2	29.43		
<i>Job/Task:</i>	Nursing staff	3,081	60.8	32.98	1.26	0.80 – 2.00
	Administrative	426	8.4	37.32	1.43	0.90 – 2.28
	Maintenance and technical	1,016	20.1	40.16	1.54	0.99 – 2.40
	Catering	282	5.6	42.55	1.63*	1.03 – 2.57
	Laboratory	52	1.0	28.85	1.11	0.57 – 2.18
	Physiotherapy	46	0.9	26.09	1.00	
	Unspecified	161	3.2	45.34		
	<i>Bloodtransfusion:</i>	Yes	547	10.8	41.86	1.20*
No		4,493	88.7	34.85	1.00	
Unspecified		24	0.5	33.33		
Total:		5,064	100.0	35.60		

* = Significant on the 5% level.

confidence interval 0.81 – 1,36). Stratification in age groups < 37 years and ≥ 37 years did not change this result.

In comparing a reported history of hepatitis (infective jaundice) and serological testing, the PPV was found to be 72.5 percent (411/567), while the NPV was 69.2 percent (3,094/4,474). The sensitivity of the history to predict immunity by serological testing was 22.9 percent (411/1,791) and the specificity of history to predict susceptibility was

TABLE 2
*Prevalence of HAV seropositivity according to educational level
 (higher level = nursing staff, administrative, laboratory, physiotherapy;
 lower level = maintenance and technical, catering) for all ages and
 for ten-year age groups (n = 4,903)*

Educational level	n	Prevalence of anti-HAV (%)	PR	95% CI (PR)
All ages				
Lower	1,298	40.68	1.22*	1.12 – 1.32
Higher	3,605	33.34	1.00	
< 25 years				
Lower	73	13.7	3.00*	1.27 – 7.07
Higher	175	4.57	1.00	
25 – 34 years				
Lower	364	18.41	1.11	0.86 – 1.44
Higher	1,411	16.65	1.00	
35 – 44 years				
Lower	517	42.17	1.14*	1.00 – 1.30
Higher	1,320	37.12	1.00	
45 – 54 years				
Lower	295	65.76	1.01	0.94 – 1.08
Higher	600	64.83	1.00	
≥ 55 years				
Lower	42	90.48	0.99	0.81 – 1.21
Higher	78	91.03	1.00	

For 28 persons, the age group was unspecified.

* = Significant on the 5% level.

95.2 percent (3,094/3,250). Of the 214 persons who reported a history of hepatitis A, 193 (90.2 percent) were HAV seropositive.

230 (4.7 percent) participants reported former vaccination against hepatitis A. Vaccinated persons tended to be younger, higher educated and of Belgian origin. Of them, 62.6 percent had detectable HAV antibodies.

Discussion

Table 3 compares our results to the age-specific prevalence rates of HAV antibodies that were available in the literature (5-7). The increase of the prevalence rate of HAV antibodies with age (2-9) was confirmed by our data. This rise is due both, to an age and to a cohort effect. Improvement in socio-economic conditions and hygiene in Western

Europe since World War II have led to a decline in the incidence of HAV infections in childhood, resulting in lower prevalence rates in the younger age groups (4, 5). In all age groups, the prevalence rate was lower in our study as compared to the results of the other investigators (5-7). Partially, this can be explained by a cohort effect, because our study is more recent. Particularly, this might explain the different results of Gay et al., whose study was performed 10 years earlier (6). When comparing the same birth-cohorts, the differences in prevalence rates decline and are even reversed in the older age groups. Another explanation is found in the differing study populations. We studied a healthy working population. Other investigators (5, 6) studied a sample of patients in which more diseases are to be expected. Beutels et al. (5) analysed bloodsamples of patients admitted to hospitals of the same region as our study population. In order to avoid a selection of hepatitis cases, they only recruited patients admitted to the departments of general surgery, traumatology, orthopaedics and the emergency units. The age-specific prevalence rates of HAV antibodies were significantly higher as compared to our results, even when considering only participants from Belgian origin in the Beutels study (5). Apart from the difference in time period, the explanation could be that the socio-economic status of a healthy working population is higher than among patients, particularly when a disproportionate number of them was living in urban areas as mentioned by the authors (5). The age-specific prevalence rates in our study might also underestimate these of the general population because of this difference in socio-economic level (12). Jacques et al. (7) compared nursery workers to blood donors and found a significantly higher prevalence rate of HAV antibodies in 35 to 44 year old nursery workers. The prevalence rates for all age groups were lower in our study compared to those of blood donors and nursery workers. This can be explained by a cohort effect or by a higher exposition to the HAV for the nursery workers.

The significantly higher HAV antibody prevalence rate in workers from foreign origin is confirmed in the literature (2, 3, 5, 9).

Bloodtransfusion theoretically is considered to be a low risk for HAV infection (1, 2). After stratification in age groups, there was no relationship between a history of bloodtransfusions and HAV seropositivity. We did not find epidemiological studies concerning this issue.

Comparing jobs, no difference was found between workers with a nursing task as compared to personnel with an administrative task. After adjustment for age, the differences remained non-significant. This result compares with another recent European investigation of Domart et al. (9),

but is opposite to results of Germanaud et al. (8) The higher prevalence rate of HAV antibodies in catering personnel in our study can be due to the lower socio-economic status of these workers rather than to differences in exposure to HAV in the workplace (12). The inverse relationship of the prevalence rate to socio-economic status can explain the difference we found between jobs linked to a lower or higher educational level (2, 4). The disappearance of this difference after 45 years could be due to the overall lower socio-economic status of people a few decennia ago (4).

No significant difference was found between paediatric nurses and nurses of other clinical departments. Other investigators confirmed this result (8, 9, 15). However, Van Damme et al. (16) found a higher prevalence rate of HAV antibodies in workers at a children's hospital compared to workers of two general hospitals. The authors only standardised for age but not for socio-economic factors. This could explain the different result.

Although the travel history and the number of young children in a household could be related to the prevalence of HAV antibodies, this information was not gathered by this questionnaire, because this study focused on occupational risk factors and blood born viral hepatitis.

The PPV of a history of infective jaundice was 72.5 percent. Therefore, it probably will be cost-effective to test persons with a positive history before vaccination. This applies even more when a person specifies he has a history of hepatitis A (PPV 90.2 percent).

Only 62.6 percent of participants, who reported former vaccination against HAV, had detectable antibodies. After vaccination, concentrations of antibodies are 10 to 100- fold lower than those produced after natural infection and these are often below the detection level of commercially available diagnostic assays (2). A recall bias, the mistaking of other vaccinations for a vaccination against HAV, could be another explanation.

Finally, when assessing the association between occupational exposure and the risk of HAV infection, the limitations of a seroprevalence study have to be taken into consideration. A cross-sectional study design is not able to prove or disprove a causal association between occupational exposure and the risk of infection, because it is affected by an unknown degree of selection bias (healthy worker effect). Following up changes in the seroprevalence of a cohort of workers would give more insight into causality.

TABLE 3
Age-specific prevalence rates of HAV antibodies, reported in the literature

Author	Country	Year	Population	n	Prevalence of HAV antibodies (%)					
					Overall	< 25 years	25 – 34 years	35 – 44 years	45 – 54 years	≥ 55 years
This study	Belgium	1996-7	Health care workers	5,064	35.6 (#)	7.5	17.3	38.4	65.6	89.2
Beutels et al. (5)	Belgium	1993-4	Belgian patients of general hospitals 15 – 64 years (*)	2,350	57.1	17.5	31.7	60.8	73.4	84.0
Jacques et al. (7)	Belgium	1991	Nursery workers	560	47.5	14.8	33.0	71.5	81.8	100.0
	Belgium	1991	20 – 64 years Blood donors	560	42.8	10.6	31.1	55.6	77.8	92.3
Gay et al. (6)	GB	1986-7	Patients public health laboratories	2,765	42.4	29.3	38.8	47.8	76.8	75.8
			20 – 60 years (*)							

(*) Only working age groups were included in the calculations.

(#) Significantly different from the prevalence rates of the other studies ($p < 0.001$).

Conclusion

We conclude that the prevalence rate of HAV antibodies is low in Belgian (Flemish) health care workers and that there is no evidence for an increased occupational risk for HAV infection in this population. However, due to the changing epidemiology, the number of susceptible people working in health care, will increase in future. Good hygiene will be very important to prevent outbreaks of hepatitis A among workers and patients in hospitals. Case reports are available to underline that hepatitis A can be a major problem in health care when hygiene fails (17,18). Vaccination of health care workers has to be considered, when poor hygienic working conditions can't be excluded.

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Samenvatting

In de loop van 1996-1997 werd een serologisch onderzoek naar de aanwezigheid van hepatitis A virus (HAV) antistoffen uitgevoerd bij een steekproef van 5 064 tewerkgestelden in Vlaamse ziekenhuizen. Door middel van een vragenlijst werden bijkomende gegevens verzameld. Het verband tussen HAV seropositiviteit en een aantal variabelen werd onderzocht om eventuele risicogroepen op te sporen. De predictieve waarde van de anamnese werd geëvalueerd. De statistische analyse bestond uit de berekening van algemene en leeftijdsafhankelijke prevalenties en prevalentie-ratio's en hun 95% betrouwbaarheidsintervallen. De sensitiviteit, specificiteit, positieve en negatieve predictieve waarde (PPV en NPV) van de anamnese werden berekend. De prevalentie van HAV seropositiviteit bedroeg 35.6% en was significant hoger in de oudere leeftijdscategorieën. De prevalentie van HAV antistoffen was significant hoger bij werknemers van vreemde origine en bij personeel tewerkgesteld in de catering. Er was een significant verband tussen de aanwezigheid van HAV antistoffen en jobs refererend naar een lager opleidingsniveau. Er werd geen significant verschil gevonden in HAV seropositiviteit tussen pediatrische verpleegkundigen en verpleegkundigen van andere klinische afdelingen. Er werd geen verband gevonden tussen een voorgeschiedenis van bloedtransfusie en HAV seropositiviteit. De PPV en de NPV van een voorgeschiedenis van hepatitis bedroegen 72.5 en 69.2%.

Er werd geen verhoogd risico voor HAV infectie gevonden bij deze steekproef van Vlaamse gezondheidswerkers. Bijkomende analyses binnen de steekproef konden geen

verhoogd beroepsrisico op HAV infectie aantonen bij pediatrische verpleegkundigen of andere professionele subgroepen. Een voorgeschiedenis van besmettelijke geelzucht was een goede voorspeller van immuniteit.

Résumé

Au cours de l'année 1996-1997 une recherche sérologique a été réalisée afin d'investiguer la présence d'anticorps contre le virus de l'hépatite A (VHA) en faisant un échantillon auquel 5064 employés d'hôpitaux flamands ont participé.

Des données supplémentaires ont été réunies au moyen d'un questionnaire. Le rapport entre la séropositivité pour le VHA et quelques variables a été investigé afin d'identifier d'éventuels groupes à haut risque. La valeur prédictive de l'anamnèse a été évaluée. L'analyse statistique a été réalisée en calculant les prévalences générales et âge-dépendants et les rapports de prévalences et leur interval de confiance à 95%. La sensibilité, la spécificité, la valeur prédictive positive et négative (VPP et VPN) de l'anamnèse ont été calculées. La prévalence de la séropositivité pour le VHA s'élevait à 35.6% et augmentait significativement avec l'âge. La prévalence d'anticorps contre le VHA était plus haute de façon significative chez des employés d'origine étrangère et chez le personnel employé dans la restauration collective. Il y avait un lien significatif entre la présence d'anticorps contre le VHA et des jobs exercés par des personnes qui ont eu un bas niveau de formation. On n'a pas trouvé de différence significative concernant la séropositivité pour le VHA entre les infirmiers de pédiatrie et les infirmiers d'autre sections cliniques. On n'a pas trouvé un rapport entre des antécédents d'une transfusion de sang et la séropositivité pour le VHA. La VPP et VPN des antécédents de l'hépatite s'élevaient à 72.5% et 69.2%. Dans cet échantillon d'employés d'hôpitaux flamands, on n'a pas trouvé de risque surélevé de l'infection HAV. Des analyses supplémentaires dans l'échantillon n'ont pas pu démontrer un risque professionnel surélevé pour l'infection avec le VHA chez des infirmiers de la pédiatrie ou chez d'autres sous-groupes professionnels. Des antécédents de la jaunisse contagieuse ont été une bonne prédiction d'immunité.

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