The presence of hepatitis A antibodies in dental workers

A seroepidemiologic study

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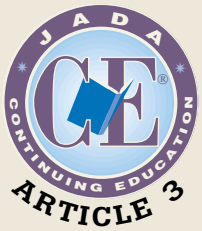
Hepatitis A virus, or HAV, is an infectious disease with an important worldwide impact. The reported annual incidence of hepatitis A, or HA, in the United States is about 15 per 100,000, with numerous communitywide outbreaks. For example, in Denver County, Colo. (during the years 1991-1993), and Pierce County, Wash. (during the years 1987-1989), rates of HA infection increased fourfold and 13-fold, respectively.[1,2] The infection is more common in Israel, with a reported annual rate of about 70 per 100,000.[3] The true rates obviously are higher, since passive reporting is incomplete; in a prospective study, it was documented that only 19 percent of cases of clinical HA seen by physicians were reported.[4]

This study suggests that hepatitis A virus can be considered a hazard to dental workers, with risk increasing as the number of years in dentistry increases.

Although usually self-limited, HA infection causes significant morbidity, with long absence from work (usually several weeks) and hospitalization. It sometimes causes even mortality, which results mainly from acute fulminant hepatitis.[5] Severity of the infection is age-dependent. While infants and young children usually—in more than 90 percent of cases—are asymptomatic, hospitalization rate is 23 percent in patients aged 15 to 39 years and 42 percent in people aged 40 years or more.[5] Acute fulminant hepatitis develops in 2.1 percent of patients aged 40 years or more,[5] necessitating urgent liver transplantation to prevent death.

The higher severity of HA with increased age is of

ABSTRACT



Background. The licensing of hepatitis A vaccine in the United States and other countries in the 1990s raised the question of vaccine candidates. The authors undertook a study to evaluate the presence of antibodies against hepatitis A virus, or HAV, in dental workers.

Methods. The authors recruited 115 members of the dental staff of Tel Aviv University: 82 dentists, 21 dental assistants, eight dental hygienists and four laboratory technicians. The subjects completed a structured questionnaire regarding demographic information (such as age, sex, number of siblings, number of children) and occupational characteristics. Venous blood was obtained and examined for presence of immunoglobulin G antibodies to HAV by microparticle enzyme immunoassay.

Results. Univariant analysis (χ^2 and Student *t* test) and multivariate stepwise logistic regression analysis were used to identify variables that were associated with seropositivity. Greater number of years of occupation in dentistry were independently and significantly ($P = .0004$) associated with seropositivity to HAV. The calculated odds ratio showed that each year of work increased the likelihood of being seropositive by 1.06 (6 percent). Subjects tended to have higher seropositive rates if they were older, had a greater number of children, had a greater number of siblings, had worked in hospitals and worked with children (pediatric dentists and orthodontists).

Conclusions. This study suggests that HAV can be considered a hazard to dental workers, with risk increasing as the number of years in dentistry increases. More studies with larger sample sizes are needed.

Clinical Implications. As HAV infection is associated with morbidity and mortality, dentists—especially those working in areas of endemic HAV (such as Africa, Asia and Latin America)—are encouraged to consider receiving the active vaccine to prevent HAV infection.

major importance. With improvements in sanitation and socioeconomic conditions in developed countries, infections in infancy and childhood that often are subclinical have decreased around the world, thus reducing the prevalence of HAV antibodies in young adults.[6-10] In Israel, seropositivity decreased from 64 percent in 1977 to 46 percent in 1987 and then to 38 percent in 1996.[10] This global seroepidemiologic trend has resulted in a growth in the population of seronegative adults, who are susceptible to severe HA infection.

The development and licensing in the United States and many other countries of a very safe and efficacious active HA vaccine in the 1990s raised the question of vaccine candidates.[11] Although it has been recommended that populations with significant occupational exposure to HAV be vaccinated, these populations have not been defined yet.[12] Saliva certainly can transmit HAV,[13-15] but the actual risk of this for dental workers is unclear.[16]

In a two-year nationwide study in Israel, researchers found that physicians and dentists, when compared with the general population, had a significant 3.8-fold increased rate of clinical HA.[17] However, clinical infection is only one aspect of exposure. The prevalence of antibodies to HAV is of prime importance: "seropositivity" means previous exposure to the virus and "seronegativity" means susceptibility to the infection. We undertook a study to determine the seroprevalence of HAV antibodies among members of the dental team, the variables that are associated with seropositivity and the implications for preventive measures.

There has been a growth in the population of seronegative adults, who are susceptible to severe hepatitis A infection.

SUBJECTS AND METHODS

Study population. We asked members of the staff of the Maurice and Gabriela Goldschlager School of Dental Medicine, Tel Aviv University, Israel, to participate in the study. They included dentists (residents and faculty staff members), dental assistants, dental hygienists and laboratory technicians. We did not include members of the administrative staff. We excluded from the study employees who had received active HAV vaccine in the past or immunoglobulin in the previous six months. The study was approved by the local and central ethics committees of the Israel Ministry of Health. After we obtained written informed consent from each subject, he or she filled out a questionnaire (described below) and provided 8 milliliters of venous blood.

Questionnaire. We gave each subject a structured questionnaire designed to assess variables associated with exposure to HAV. The questionnaire included information on two groups of characteristics:

- demographic characteristics—age, sex, religion (Jewish or non-Jewish), marriage status, birthplace, current residence (urban or rural), number of years of education, army service, number of siblings, number of children and history of jaundice;
- occupational characteristics—profession (dentist, dental assistant, dental hygienist, laboratory technician), dental subspecialty (of the nine available), years of work in dentistry, years of in-hospital work (if any), and average number of hours worked each week.

Serum analysis. Microbiologists at the Rabin Medical Center, Petach Tikva, Israel, conducted the serum analysis. The 8 mL of blood were collected in dry tubes. After clotting and centrifugation, sera were separated and stored at –20 C until tested. The presence of immunoglobulin G, or IgG, antibodies to HAV was determined blindly in the serum specimens by microparticle enzyme immunoassay (MEIA, Abbott Laboratories). Cutoff values were established according to the instructions of the manufacturer by reference to control sera. The sensitivity and specificity of the assay were higher than 99.7 percent.[18]

Statistical analysis. We performed univariant analysis by using the χ^2 test to determine the significance of differences among proportions (rate of seropositivity for HA) and Student t test for continuous variables (such as years of work). We then examined variables significant by univariate analysis using multivariate stepwise logistic regression analysis to identify variables that were independently associated with seropositivity. We conducted the analyses using the SPSS software 9.0 for Windows (SPSS Inc.).

RESULTS

Study population. One hundred fifteen dental workers participated in the study. They included 82 (71.3 percent) dentists (34 general dentists,

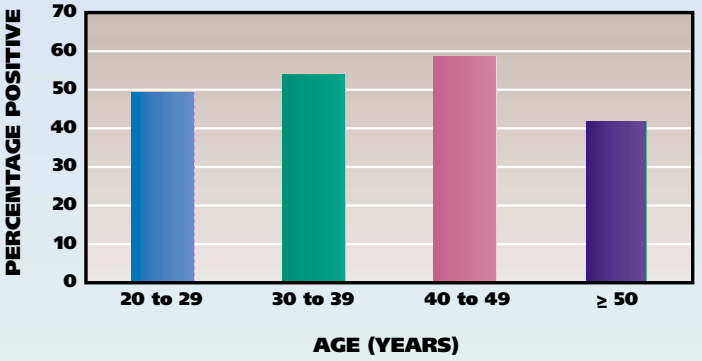


Figure 1. The association between age and hepatitis A virus seropositivity among dental workers.

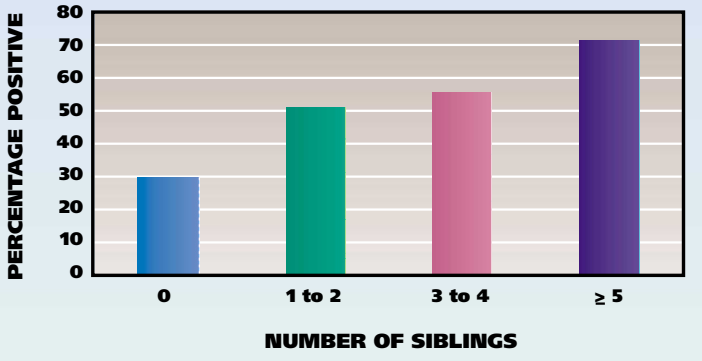


Figure 2. The association between dental workers' number of siblings and hepatitis A virus seropositivity.

including residents, and 48 specialists in the various fields of dentistry), 21 (18.2 percent) dental assistants, eight (7 percent) dental hygienists and four (3.5 percent) technicians (two from the dental radiology department and two from the oral biology laboratory). Fifty percent (82 of 164) of all dentists (faculty members and residents) of the dental school participated in the study, while 83 percent (29 of 35) of the dental assistants and hygienists, all dental radiology technicians (2 of 2) and most of the laboratory technicians (2 of 3) participated. The main reasons for not participating in the study were having received active HAV vaccine in the past and not working on the two days of enrollment in the study.

Sixty-two (53.9 percent) of the subjects were male and 53 (46.1 percent) female. Overall, 59 (51.3 percent) of the dental workers had IgG antibodies to HAV.

Sociodemographic variables associated with seropositivity. *Age.* Figure 1 shows the association between the age groups and HAV antibodies. The rate of seropositivity in the study population increased steadily from 50 percent in the group aged 20 to 29 years to 61.1 percent in the group aged 40 to 49 years. However, the rate of seropositivity decreased in dental workers aged 50 years or older, and the overall association with age was not statistically significant.

Number of siblings. The association between the subjects' number of siblings and HAV antibodies is shown in Figure 2. The rate of seropositivity increased steadily from 30 percent when the subjects had no siblings to 72 percent when the number of siblings was five or more. This tendency, however, was not statistically significant.

Number of children. The association between the subjects' number of children and HAV seropositivity is shown in Figure 3. There was a tendency toward higher seropositivity rates among subjects who had a greater number of children, from 47 percent among those who had no children to 100 percent among those who had five children. This tendency was not statistically significant.

Other sociodemographic variables. These are summarized in Table 1. The only variable that was significantly associated with HAV seropositivity was being married ($P = .0161$). The other variables had no significant association, although for some variables the numbers in certain categories were low (that is, rural residence, non-Jewish religion, history of jaundice).

Occupational variables associated with seropositivity. *Duration of work.* The association between years of occupation in dentistry and rates of seropositivity to HAV is shown in Figure 4. Seropositivity increased steadily, from 37 percent of those who had worked less than 10 years to 100 percent of those who had worked 40 years or more, and the increase is highly significant ($P = .0004$). In addition, years of occupation (mean ± standard deviation) are significantly higher in seropositive workers than in seronegative workers (31.0 ± 10.7 years vs. 20.9 ± 10.9), but this did not reach statistical significance.

Type of occupation. Of the dentists, 50.0 percent (41 of 82) were HAV-seropositive, while of the nondentist workers, 54.5 percent (18 of 33) were seropositive (P = nonsignificant). No significant differences were found between dentists with or without a subspecialty. Pediatric dentists and orthodontists, specialists who work with children, had a higher rate of seropositivity (16 of 23; 69.6 percent) than the other specialists

(13 of 27; 48.1 percent), but the difference was not statistically significant.

Ninety of the dental workers who did not work in a hospital had a lower seropositivity rate (43 of 90; 47.7 percent) than those who worked in a hospital, especially those who had worked in that setting for six years or more (nine of 11; 81.8 percent). The difference did not reach statistical significance.

Multivariate logistic regression analysis. This analysis is summarized in Table 2. The duration of work in dentistry was the major variable that was independently and significantly associated with HAV seropositivity. The calculated odds ratio showed that each year of work increased the likelihood of being seropositive by 1.06 (6 percent). Being married is the only other variable that was significantly (P = .0459) associated with increased HAV seropositivity—5.17-fold more significant than among unmarried subjects, in fact. The other variables, including age, were not significant independent variables.

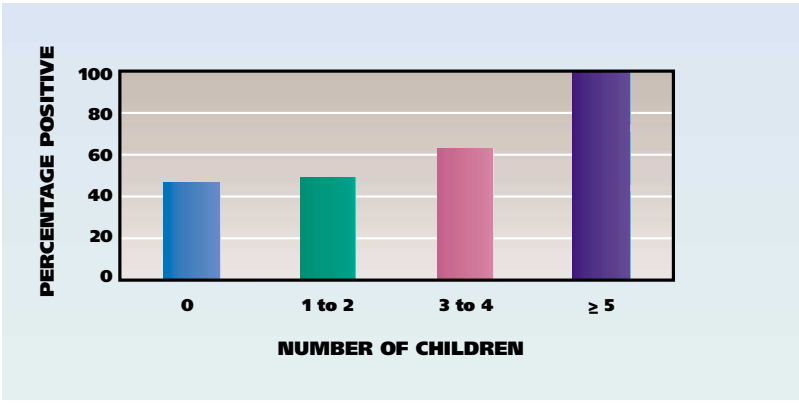


Figure 3. The association between dental workers' number of children and hepatitis A virus seropositivity.

DISCUSSION

HAV risk among dental workers. Our study shows a positive correlation between number of years spent in dentistry and associated roles and the prevalence of HAV antibodies. The association was significant in both univariate and multivariate analyses, thus indicating that this variable was independently associated with seropositivity. We were able to calculate the increase rate associated with each year of work. Moreover, pediatric dentists and orthodontists, whose patients are children (who more often excrete HAV asymptomatically[5]), had a higher seropositivity than other specialists.

Our study shows a positive correlation between number of years spent in dentistry and associated roles and the prevalence of hepatitis A virus antibodies.

A previous two-year nationwide study in Israel showed that physicians and dentists had a significant rate of clinical HA infection, 3.8-fold greater than that among the general population.[17] Taken together, the increased rates among dentists of both clinical HA and HAV seropositivity suggest increased exposure to HAV among dental workers.

Significant sociodemographic factor. Of the multiple sociodemographic variables we examined, the only one significantly associated with HAV antibodies was being married. Being married, in our study population, involved older age, increased exposure to children and living with a greater number of people per room, all of which factors are known to be associated with increased rates of HAV antibodies.

Disadvantages of the study. Our study had some disadvantages. First, the study population was relatively small. This may reduce its power to find significant associations between HAV seropositivity and other variables (that is, sociodemographic variables). Therefore, more studies, ideally with larger sample sizes, are needed. In addition, comparison with other working groups matched for age, ethnicity and socioeconomic factors is warranted. However, these two disadvantages do not reduce the significance of our finding.

Route of HA infection in dentistry. The exact route of HA infection in the dental office is not completely clear. HAV usually is transmitted via the fecal-oral route; transmission occurs when virus shed in the feces of an infected person is ingested by a susceptible person. Therefore, the main route of transmission is close personal contact with patients with HAV during their asymptomatic periods. The infection rates are increased by exposure to populations of low socioeconomic status, such as immigrants,[19] and to children, since children can be asymptomatically infected more often than adults.[5] Thus, dental workers' close contact with an infected child—sometimes even before taking precautions by wearing gloves, mask and glasses—can transmit the infection to the dental team.

Indeed, in our study, pediatric dentists and

TABLE 1

UNIVARIATE ANALYSIS OF SOCIODEMOGRAPHIC VARIABLES ASSOCIATED WITH HEPATITIS A VIRUS SEROPOSITIVITY AMONG DENTAL WORKERS.

VARIABLE	NO. TESTED FOR HAV*	NO. (%) TESTING POSITIVE FOR HAV	SIGNIFICANCE
Sex			
Male	62	32 (51.6)	NS†
Female	53	27 (50.1)	
Marriage Status			
Married	100	56 (56)	$P = .0161$
Unmarried	15	3 (20)	
Religion			
Jewish	110	58 (52.7)	NS
Non-Jewish	5	1 (20)	
Country of Birth			
Israel	61	30 (49.1)	NS
Other	54	29 (53.7)	
Place of Residence			
Urban	111	54 (48.6)	NS
Rural	4	2 (50)	
Years of Education			
Eight-12	23	12 (52.2)	NS
13 or more	92	47 (51.1)	
Army Service			
Yes	87	44 (50.6)	NS
No	28	15 (53.6)	
History of Jaundice			
Yes	5	4 (80)	NS
No	110	55 (55)	

* HAV: Hepatitis A virus.
† NS: Not significant.

orthodontists who worked mainly with children showed higher seropositivity to HAV; dentists who were employed in hospitals, where they well may have been exposed to people from low socioeconomic levels, also showed a higher seropositivity than dental faculty members working in private practice only (81.8 percent vs. 47.7 percent). This is in contrast to infection with hepatitis B, or HB; research has shown a higher prevalence of HB surface antigen among oral surgeons, periodontists and endodontists, who are more exposed to blood than are other specialists.[19-20]

Another route of infection in the dental office may include infection by blood, saliva or saliva contaminated with blood. Contamination by saliva can spread not only by treatment but also by dental instrument and equipment. It has been shown that HAV can be found in the blood of infected people, and outbreaks related to blood exposure have been reported.[22] HAV also has been detected in the saliva of a chimpanzee orally inoculated with HAV,[23] meaning that saliva can transmit the infection.

Other studies of HAV in dental workers. A comprehensive survey of the dental literature in English revealed only a few surveys of HAV antibodies among dental workers. In one non-

serologic study, investigators sent a mail questionnaire to 274 dentists in Auckland, New Zealand. The dentists were asked whether they had suffered acute viral hepatitis during the past seven years. Two of the 274 dentists reported infections with HA, an incidence of 0.1 per 100 dentists per year.[9] Another seroepidemiologic study of HA infection was conducted among dentists in the Philippines.[14] The investigators found a very high rate—85.9 percent—of seropositivity to HAV antibodies among the subjects. The HAV seropositivity rate increased with age; at age 20 to 24 years, 57.1 percent of the dentists were seropositive; at age 25 to 29 years, 79.3 percent; at age 30 to 34 years, 88 percent; at age 35 to 39 years, 100 percent; at age 40 years or older, 90 to 95 percent. However, the researchers could not determine the occupational risk of acquiring HAV, since data on the HAV seropositivity rates among the general population in the Philippines and data on the correlation between years in occupation and seropositivity among Filipino dentists were not available.

Lower incidence, but similar trend, of HAV seropositivity was found among Japanese dentists in another study, and the positive rate increased in a manner similar to that of the general population's positive rate.[15] In both the Filipino and Japanese studies, the authors concluded that there was no link between HAV exposure and dentistry. However, in none of the above-mentioned studies did researchers investigate variables in dentistry that are associated with HAV seropositivity. Our study is the first to show that dental workers are at risk of exposure to HAV.

Dentist-to-patient transmission. The risk of a patient's being infected by his or her dentist is still not clear. Maulitz[24] reported on 161 patients who were exposed to HA by an oral surgeon during the contagious period. He studied 75 percent of those 23 to 41 days after exposure and detected among them no case of clinical or anicteric hepatitis. This is compatible with the concept that the major mode of HAV infection is fecal excretion.

Vaccines. The active HA vaccines are based on viral inactivation. The licensed ones are very safe, with only minor adverse effects, and are highly immunogenic, with a nearly 100 percent serologic response. The protective efficacy, as shown in field studies, is 94 to 100 percent.[25,26] The Centers for Disease Control and Prevention has recommended that workers in occupations that place them at risk of acquiring HA infection be vaccinated.[27] We believe that our seroepidemiologic study of dental workers and the previous finding of increased clinical HA among dentists[17] together justify vaccinating dentists at risk, mainly those who are seronegative for HAV and work with children, in a hospital or both.

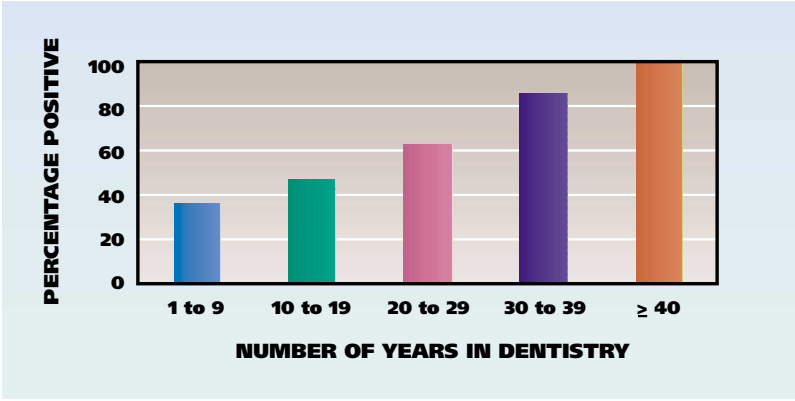


Figure 4. The significant association between dental workers' number of years in dentistry and hepatitis A virus seropositivity (*P* = .0004).

CONCLUSION

Our study confirms the assumption that HAV can be considered as a hazard to dental workers, with risk increasing as their number of years in dentistry increases. HAV infection is a major health problem, associated with morbidity, costs of pro-

TABLE 2

MULTIVARIATE LOGISTIC REGRESSION ANALYSIS OF VARIABLES ASSOCIATED WITH HEPATITIS A VIRUS SEROPOSITIVITY AMONG DENTAL WORKERS.

VARIABLE	ODDS RATIO	SIGNIFICANCE
Number of Years in Dentistry	1.06 per year	$P = .0031$
Being Married	5.17	$P = .0459$
Age	0.986	$P = .4528$*

* Not significant.



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viding medical care, hospitalization, preexposure and postexposure prophylaxis, and coverage for work loss.[27] Therefore, dentists—especially those in areas of endemic HA (such as Africa, Asia and Latin America)—are encouraged to consider undergoing active vaccination to avoid becoming infected with HAV. ■

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