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Are municipal solid waste collectors at increased risk of Hepatitis A Virus infection? A Greek cross-sectional study

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SUMMARY

Municipal solid waste collectors are reportedly at risk for Hepatitis A virus infection (HAV) as an occupational hazard. We aimed to investigate the prevalence and possible risk factors of HAV infection among solid waste collectors in a municipality of the broader region of Attica, Greece. A cross-sectional sero-prevalence study was conducted. Fifty (n=50) waste collectors participated in the study (response rate: 95%). The group of municipal waste collectors was compared to a convenient sample of workers not exposed to solid waste (n=83). Municipal solid waste collectors recorded a higher- but not statistically significant- prevalence of anti-HAV(+) in comparison to subjects without occupational exposure to waste (40% vs 34% respectively p=0,4). No significant associations were found between inappropriate work practices and anti-HAV (+). Education was the only factor independently associated with the risk of HAV infection. This study did not corroborate previous reports of an increased prevalence of Hepatitis A Virus infection among municipal solid waste collectors.

Keywords: Hepatitis A, municipal, waste collectors, solid waste, occupational hazard.

INTRODUCTION

Municipal solid waste collectors are routinely exposed to various biological occupational hazards [1-4]. Municipal Solid Waste Collectors may be at risk of infection from Hepatitis A Virus (HAV) via contact with waste contaminated by infected fecal matter. The transmission of HAV infection could be enhanced by the activation of the fecal-oral route through inappropriate work practices like smoking, eating during work without adherence to universal precautions [5]. In the past, Greece has had a high burden of HAV infection. There is some evidence that during the 70's, HAV infection was hyperendemic in Greece [6]. Later studies have shown a drastic decline in the HAV infection rate [7]. It is well known that HAV is highly resistant to the environment and can persist for extended periods on environmental surfaces [8]. The aim of this cross-sectional study was to investigate the prevalence and possible risk factors of HAV infection among solid waste collectors in a municipality of the broader region of Attica, Greece.

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PATIENTS AND METHODS

The present study was part of a wider research project on prevalence and risk factors of viral

hepatitis A and B among municipal waste collectors in Greece [9-11]. Detailed methodology of the study has been described elsewhere [10]. In brief, a cross-sectional sero-prevalence study was conducted during the period January - August 2008 in a municipality of the broader Region of Attica, Greece. Out of 60 municipal waste collectors, five reported vaccination against HAV and HBV. These 5 workers were excluded from the final sample. A total of fifty (n=50) waste collectors participated in the study (response rate: 95%). The group of municipal waste collectors was compared to a convenient sample of 90 employees not exposed to waste. Finally 83 members of this control group accepted to participate in (response rate: 92%). A questionnaire was used to obtain information from the participants on socio-demographic variables (sex, age, education, occupation and duration of employment). In addition, participants were asked to report travel to Asia (except Japan) (yes, no), shellfish consumption (often/sometimes, no), country/region of origin, and previous history of vaccination against HAV. Finally, participants were asked about their exposure to smoking, drinking, eating during waste collection (never/almost, never/rarely/sometimes/frequently/almost, always). Waste collection workers who reported smoking or drinking during waste collection frequently/almost always were considered as "high exposure". Questionnaires were completed through a face to face interview. All collected serum samples were tested for total anti-HAV antibodies by enzyme linked immunosorbent assay (ELISA). All participants gave their informed consent for participation without any monetary incentives being offered. The protocol of the study was approved by the Steering Committee of the Postgraduate Program: Applied Public Health and Environmental Hygiene of Medical Faculty University of Thessaly. This article presents the results of a secondary data analysis [10].

Statistical analysis

Qualitative data were presented as absolute (n) and relative frequencies (%) while quantitative data were presented as mean (Standard Deviation). Statistical analysis (univariate) of the qualitative data collected was conducted by the use of Chi-square test, and the univariate analysis of quantitative data was performed by the use of Student's t-test. A logistic regression model was used for the multivariate analysis of anti-HAV (+) with selected risk factors. Odds Ratio (OR) and 95% Confidence Intervals (95% CI) were calculated. The level of statistical significance was set at 0.05. Statistical analysis was performed with Epi Info software.

RESULTS

Table 1 presents the socio-demographic profile of the participants. The mean age was 43.5 years (SD=8.2). Males were 51.1% of the participants and 48.9% were females. Regarding formal education status, 48.1% reported ≤9 years of education and 51.9% reported >9 years of education. Regarding occupation, 50 (38%) were municipal solid waste collectors while 83 (62%) worked in various occupations without exposure to municipal solid waste (*e.g.*, office workers, and blue collar workers). The mean duration of employment was 12.3 years (SD=6.1). The group of employees without exposure to solid waste did not differ significantly in comparison to waste collectors in terms of sex, age and duration of employment. Educational status was different between the two groups, with waste collectors having attended less years of formal education than members of the control group.

Univariate analysis of anti- HAV (+) (among all participants)

Table 2 shows univariate analysis between several possible risk factors and anti-HAV positivity.

Table 1 - Socio-demographic profile of participants.

Characteristics	*No (%)*
Sex	
Male	68 (51%)
Female	65 (49%)
*Age**	43.5 (8.25)
Duration of employment (years)*	12.3 (6.1)
Education	
≤9 years	64 (48.1%)
>9 years	69 (51.9%)
Occupation	
Exposed to waste	83 (63%)
Non exposed	50 (37%)

*Mean, standard deviation.

Table 2 - Univariate analysis of anti-HAV (+).

Characteristics	*anti- HAV (+) No (%)*	*anti- HAV (-) No (%)*	*P value*
Sex			
Male	32/67 (48%)	35/67 (52%)	
Female	16/64 (25%)	48/64 (75%)	0.011[b]
Age (years)[a]	46.7 (8.5)	41.6 (7.5)	0,001[c]
Duration of employment (years)[a]	14.1 (6.5)	11.4 (5.86)	0.022[c]
Occupation			
Exposed to waste	20/50 (40%)	30/50 (64%)	
Non exposed	28/83 (34%)	55/83 (66%)	0.4
Educational status			
≤9 years	38/64 (59%)	26/64 (41%)	<0.001[b]
>9 years	10/69 (14.5%)	59/69 (85.5%)	

[a]Mean, standard deviation; [b]χ^2 test, [c]Student's-t- test.

Males recorded a higher prevalence (48%) of anti-HAV positive than females (25%), with difference being statistically significant (p-value=0.011). Age was found to be a significant risk factor in terms of anti-HAV status. The mean age of participants with anti-HAV (+) was significantly higher in comparison to those with anti-HAV (-) (46.7 years vs 41.6 years, respectively, p<0.001). Duration of employment was also significantly associated with anti-HAV positivity. In particular, anti- HAV (+) participants recorded a higher mean duration of employment than their colleagues with anti-HAV negative status (14.1 vs 11.4, respectively, p<0.022). Lower level of education was a risk factor for anti-HAV (+). Specifically employees with less than 9 years of education recorded a higher prevalence of anti-HAV (+) in comparison to their colleagues with more than 9 years of education (59% vs 14.5% respectively p=0.001). Municipal solid waste collectors recorded a higher - but not statistically significant - prevalence of anti-HAV(+) in comparison to their counterparts without occupational exposure to waste (40% vs 34%, respectively, p=0.4). Travel to Asia and shellfish consumption were not associated with the prevalence of anti- HAV infection.

Multivariate analysis of anti-HAV (+) (among all participants)

Table 3 shows that education was the only variable independently associated with anti-HAV positivity. Workers with less than 9 years of formal education recorded 6.76 times more likelihood of anti-HAV positivity in comparison to those with education more than 9 years(OR=6.76; 95% CI =2.79-16.35).

Table 3 - Multivariate analysis of anti-HAV (+).

Risk factor	*Odds Ratio (OR)*	*95% Confidence Interval (CI)*
Sex		
Female	1.0 (ref)	
Male	1.91	0.82.-4.44
Age group		
≤42 years	1.0 (ref)	
>42 years	1.84	0.76-4.47
Education		
>9 years	1.00 (ref)	
≤9 years	6.76	2.79-16.35
Duration of employment		
≤12 years	1.00 (ref)	
>12 years	1.71	0.71-4.14

Univariate analysis (homogeneous exposure group of municipal cleaners)

Further analysis (Table 4) among the homogenous exposure group of municipal cleaners indicated that, educational status, age and duration of employment were significantly associated with an increased prevalence of anti-HAV (+). No association between poor working practices (*e.g.*, eating/smoking during waste collection) and prevalence of HAV infection was found. In particular, among municipal solid waste collectors exposed to waste (n=50), 60% (12/20) of the anti-

Table 4 - Univariate analysis of anti-HAV (+) among the homogeneous exposure group of municipal cleaners.

Characteristic	*anti- HAV (+) No (%)*	*anti- HAV (-) No (%)*	*P value*
Sex Male Female	 16/35 (46%) 4/15 (27%)	 19/35 (54%) 11/15 (73%)	 0.2[b]
Age (years)a	47	42	0.043[c]
Duration of employment (years)[a]	13.00	7.00	0.05[c]
Educational status ≤9 years >9 years	 17/34 (50%) 3/16 (19%)	 17/34 (50%) 13/16 (81%)	 0.035[b]

[a]Median; [b]χ^2 test; [c]Mann- Whitney test.

HAV(+) waste collectors reported poor working practices vs. 60% (18/30) of the anti-HAV(-) waste collectors (p=ns).

DISCUSSION

Our results indicated that municipal solid waste collectors recorded a higher - but not statistically significant - prevalence of hepatitis A virus infection (anti-HAV positivity) in comparison to the control group (40% vs. 34%, respectively). Previous studies from Athens and Central Greece recorded high prevalence of anti-HAV positivity among municipal solid waste collectors. In particular, Dounias and co-workers in a cross-sectional study of municipal workers found that the prevalence of anti-HAV (+) was significantly higher among municipal solid waste collectors (62.5%) in comparison to the reference group (37.5%) [11]. Similar findings have been reported by Rachiotis and colleagues in a cross-sectional study among municipal workers in a municipality of Central Greece [5]. They found a prevalence of anti-HAV positivity at 61% among waste collectors and at 27% among municipal gardeners (p<0.001). Two other studies also reported on the prevalence of anti-HAV (+) among municipal solid waste workers; however these studies didn't include a control group. In particular, a descriptive study by Mariolis and colleagues reported a prevalence of 53.6% (anti-HAV IgG) among waste collectors in a municipality of the Attica region in Greece [12]. Moreover, a seroprevalence study from Thailand indicated that the total prevalence for anti-HAV (+) was 89.2% and 81.1% for public cleaners and public garbage collectors, respectively [13]. Education was the only determinant of health independently associated with the risk of HAV infection. Participants within the mandatory 9 year formal schooling (Elementary plus Gymnasium) were more at risk compared to those who had continued beyond the mandatory 9 years (Lyceum and/or College). This finding should be interpreted in view of the social-determinants-of-health (SDH) framework which accounts for social and structural environmental factors that contribute to the increasing burden and worsening health disparities for viral hepatitis [14]. In contrast to our previous study, we found no association between poor working practices (e.g. eating/smoking during waste collection) and the prevalence of HAV infection [5]. A possible explanation for this finding could be that in the present study the smaller sample of municipal solid waste collectors (n=50) in comparison to our previous study in Central Greece (n=100) prevented results from reaching statistical significance. The present study has several limitations including the cross-sectional design and the local applicability of results. The small number of study population as we have noted above, and in particular of waste collectors, produced large 95% Confidence Intervals for the estimate of association. Further, the small sample could have reduced the power of the study to detect statistically significant associations.

CONCLUSION

Secondary data analysis did not corroborate previous reports of an increased prevalence of hepatitis A virus infection among municipal solid

waste collectors. Education as a determinant of health was the only factor independently associated with the risk of HAV infection. No association between poor working practices (*e.g.*, eating/smoking during waste collection) and the prevalence of HAV was found

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