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Prevalence of *Helicobacter pylori* infection in a cohort of Italian military students

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SUMMARY

In 1990, to study regional prevalences and risk factors of *Helicobacter pylori* infection in healthy young adult males, sera were collected from a nationwide sample of 1659 males (mean age 20·7 years) at introduction into the Air Force School for military students in Caserta, Italy. An enzyme-linked immunosorbent assay was used to detect *H. pylori* specific immunoglobulin G antibodies. The observed overall seropositivity rate was 17·5% (95% CI 15·7–19·4). Prevalence was higher in southern Italy and in the Italian islands as compared with northern Italy and central Italy (21·3% *vs.* 9·5%). Multiple logistic regression analysis showed that residence in southern areas and islands was the strongest predictor of the likelihood of *H. pylori* seropositivity; number of siblings in the household was marginally associated; years of father's schooling was not a significant predictor. *H. pylori* positive subjects were more likely positive for antibodies to hepatitis A virus infection (anti-HAV) than those *H. pylori* negative (35·4% *vs.* 24·9%; Odds Ratio 1·7, 95% CI 1·3–2·2). Adjustment for the confounding effect of sociodemographic variables weakened this association (OR 1·3, 95% CI 1·0–1·7). These findings suggest that differences in environmental conditions rather than in socioeconomic status may have played the major role in the different spread of *H. pylori* infection across the country.

INTRODUCTION

Helicobacter pylori is one of the most common bacterial infections worldwide. There is evidence that *H. pylori* is causally related to chronic superficial gastritis [1], peptic ulcer disease [2], gastric adenocarcinoma [3], primary gastric B-cell lymphoma [4], and possibly to ischaemic heart disease [5]. Thus the burden of morbidity and mortality diseases related to *H. pylori* is tremendous in both developing and developed countries. The infection can persist for decades in most untreated persons [6] and spontaneous eradication rarely (1% or less) occurs [7].

With the development of sensitive and specific serologic tests to identify subjects exposed to *H. pylori*, the epidemiology of this infection has been investigated [8]. Current knowledge about the extent of *H. pylori* in Italy is scarce and limited to subjects living in restricted geographical areas [9].

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Table 1. *Prevalence of* Helicobacter pylori *infection by socio-demographic characteristics among males military students in Italy, 1990–1. Crude OR estimated by univariate analysis and adjusted* OR estimated by multiple logistic regression analysis*

Variable	Number of subjects†	*H. pylori*+ (%)	Crude OR	(95% CI)	Adjusted OR	(95% CI)
Age (years)						
17–18	126	(19·8)	1		1	
19–20	661	(18·2)	0·9	(0·6–1·5)	0·9	(0·6–1·6)
21–22	649	(16·6)	0·8	(0·5–1·3)	0·9	(0·5–1·5)
23–24	222	(16·7)	0·8	(0·5–1·4)	0·8	(0·5–1·5)
Area of residence						
North-Center	525	(9·5)	1		1	
South-Islands	1134	(21·3)	2·6	(1·8–3·6)	2·3	(1·6–3·3)
No. of siblings						
$\leqslant 1$	737	(14·4)	1		1	
$\geqslant 1$	897	(20·3)	1·5	(1·2–2·0)	1·3	(1·0–1·7)
Years of father's schooling						
$\geqslant 8$	985	(15·7)	1		1	
$\leqslant 8$	620	(20·0)	1·3	(1·0–1·7)	1·2	(0·9–1·6)

* Each variable is adjusted for the confounding effect of all other listed in the Table.
† A complete data set was not available for every subject.

Army inductees provide a rare opportunity to study the epidemiology of this infection because these individuals are apparently healthy and come from all regions of the country. Serologic surveys among military trainees are a better reflection of the general population than are localized geographic or hospital-based studies.

To determine whether there have been regional differences in *H. pylori* infection rates in Italy, we have blood tested military students representing all regions of the country. Moreover, because the low socio-economic condition of subjects has been associated with *H. pylori* infection [10–11], the effect, if any, of surrogate markers of socio-economic status such as number of siblings and father's years of education on *H. pylori* prevalence was also evaluated. Finally, because these subjects were tested even for antibodies to hepatitis A virus (anti-HAV) [12], we have evaluated if the two infections would occur together more frequently than would be expected by chance.

METHODS

We examined 1659 Italian military male students attending the Italian Air Force's School for non-commissioned officers in Caserta, Italy, corresponding to 87·9% of those attending the course. The ages ranged from 17–24 years (mean age 20·7 years). A questionnaire including information on number of siblings and father's years schooling was administered.

There were no differences in sociodemographic characteristics between those who did and those who did not participate into this study.

The study period was October 1990 to June 1991.

SEROLOGICAL ASSAYS

After informed consent, blood samples were taken at the time of medical interview. Sera were stored at -70 °C and thereafter tested by ELISA for *H. pylori* IgG antibodies (RADIM, Pomezia, Italy). Positivity was assigned according to kit instructions. IgG antibodies to HAV were determined by ELISA (Abbott Lab. North Chicago Ill.).

In a validation study the assay had a sensitivity of 95·8%, a specificity of 96·2%, in identifying *H. pylori* infected persons, diagnosed on the basis of culture from gastric biopsy material, histopathology and the rapid urease test (Dr V. Olivieri, Radim, Pomezia, Italy, personal communication).

STATISTICAL ANALYSIS

The association between each socio-demographic variable and *H. pylori* infection was evaluated by estimating the Odds Ratios (OR). The reference category for OR estimates was that at the most favourable level of exposure (highest years of schooling, lowest number of siblings, youngest age). To

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Table 2. *Association between* Helicobacter pylori *and hepatitis A virus infections among military students in Italy, 1990–1*

		Hepatitis A virus				
		Positive	Negative	Total	OR	(95% CI)
Helicobacter pylori	Positive	103 (35·4%)	188 (64·6%)	291	Crude 1·7	(1·3–2·2)
	Negative	340 (24·9%)	1028 (75·1%)	1368	Adjusted* 1·3	(1·0–1·7)

* Adjusted for age, area of residence, number of siblings and years of father's schooling.

estimate the independent effect of each sociodemographic variable on *H. pylori* infection, adjusted OR were calculated by multiple logistic regression analysis [13].

The crude and adjusted OR for the association between *H. pylori* and HAV seropositivity were also done.

RESULTS

The overall crude prevalence rate of *H. pylori* infection was 17·5% (291/1659), (95% CI 15·7–19·4). The crude prevalence was 9·5% (95% CI 7·1–12·1) in Northern and Central regions and 21·3% (95% CI 18·9–23·7) in Southern area and Islands, respectively.

Area of residence in the South, two or more siblings in the household, and less than 8 years of father's schooling were all variables associated to *H. pylori* seropositivity at the univariate analysis; increasing age was unassociated. After adjustment for the confounding effect of all considered variables by multiple logistic regression analysis, area of residence in the South/Islands (OR 2·3; 95% CI 1·6–3·3) was independent predictor of the likelihood of *H. pylori* seropositivity; having 2 or more siblings in the household was a minor risk factor (OR 1·3; 95% CI 1·0–1·7); while the number of years of father's schooling was no longer associated (OR 1·2; 95% CI 0·9–1·6) (Table 1).

Overall 443 of the 1659 subjects (26·7%) had antibodies to hepatitis A.

H. pylori positive subjects were more likely anti-HAV positive than those *H. pylori* negative (35·4% *vs.* 24·9, OR 1·7; 95% CI 1·3–2·2).

Adjustment for the confounding effect of age, area of residence, number of siblings, and years of father's schooling weakened the association (OR 1·3, 95% CI 1·0–1·7) (Table 2). No significant interaction between risk factors was detected.

DISCUSSION

Large sero-epidemiological studies have not been completed to determine the basic demographic characteristics of *H. pylori* infection in Italy.

Prevalence of *H. pylori* was 18% among subjects 25–34 years old and 48% among those 55–65 years old in the Florence area [9]; it was 51·0% among 2237 subjects 18 years of age or older in the Republic of San Marino, located in Northern Italy [14].

By screening over 1650 military recruits, we estimated the prevalence of this infection in subjects coming from all regions of the country. Moreover, this study is the first in Italy on a national scale that uses a well defined population and the same laboratory for the entire country. For all these reasons, we believe that it provides a good basis for reasonable inferences.

We found the *H. pylori* seropositivity rate in healthy young male adults to be 17·5%, a rate quite similar to the corresponding figure of 20·8% found in a cohort of US army recruits aged 17–26 [15].

Our primary interest was in detecting regional differences in the prevalence of *H. pylori* infection and in quantifying the relationship of other factors associated with risk of infection.

We are aware of some limits concerning the population enrolled in this study: subjects encompass a narrow age range and only male sex; moreover, they come mostly from lower socio-economic class, which is an important determinant of sero-positivity. However, because subjects were comparable by age, sex, and socio-economic level and they were exposed to similar recruitment procedures, the observed geographical differences can be considered reliable.

In regard to *H. pylori* infection, Italy is divided by

the difference in prevalence between northern central regions and southern areas.

The definite relationship between area of residence and prevalence of *H. pylori* infection is partially explained by potential confounding, but it remains, although reduced somewhat, after multiple adjustment for age, father's education, and number of siblings. This pattern is similar to that previously reported for HAV and hepatitis B virus (HBV) infections [16, 17], reflecting inequalities in hygienic and environmental conditions in Italy over the past years.

Socio-economic conditions have been shown to be inversely related to the seroprevalence of *H. pylori* [10, 11]. Family size and years of schooling are both considered good surrogate markers of socio-economic status. Area of residence may be considered a proxy of environmental risk factors. In this study, number of siblings in the household and years of father's education were both weak predictors of seropositivity, after controlling for age and area of residence. In contrast residence in the South/Islands is the sole strong predictor of sero-positivity after adjustment for the confounding effect of socio-economic indicators by multiple logistic regression analysis. It suggests that differences in environmental conditions rather than in socio-economic status may have played the major role in the different spread of *H. pylori* infection across the country. Modes of *H. pylori* transmission are not well established, especially regarding the oral–oral or faecal–oral route. HAV infection is known to be a sensitive, marker of faecal–oral exposure.

Thus it may be expected that the prevalence of HAV correlate with that of *H. pylori* if the faecal–oral route is significant in the transmission of *H. pylori*. Comparisons of prevalences of these 2 infections have been made in unpaired sera [18, 19] or in the same individuals [20, 21] with conflicting results.

Because the same military students had been tested also for anti-HAV (12), we have evaluated if the 2 infections would occur together more frequently than would be expected by chance. Primary analysis of our data shows that *H. pylori* seropositive subjects were more likely anti-HAV positive than those *H. pylori* negative. After adjusting for the confounding effect of all socio-demographic variables considered, the association weakened, resulting only marginal (OR 1·3% CI 1·0–1·7).

Despite from these type of data is not easy to draw firm conclusions regarding modes of transmission, it would appear that faecal-oral transmission of *H. pylori*, in a manner similar to the spread of hepatitis A, cannot be ruled out.

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