# Prevalence and risk factors of hepatitis A among blood donors in Qazvin, central Iran

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## ABSTRACT

**Introduction: The hepatitis A virus (HAV) is a major global health problem, especially in developing countries. Although children aged 5–14 years are the most infected age group, all age groups are equally affected in an HAV epidemic. The aim of this study was to determine the prevalence and related risk factors of HAV among blood donors in Qazvin, central Iran.**

**Methods: A cross-sectional study was performed in April 2008 on a total of 351 blood donors aged 17 to 60 years. Information on demographic variables and probable risk factors was recorded. The blood samples were investigated for antibodies to HAV (HAV Ab). Data was analysed using the t-test, chi-square test and Fisher's exact test to examine the factors related to HAV Ab positivity.**

**Results: Out of the 351 blood donors, 49.0 percent (n is 172) were regular blood donors, 94.0 percent (n is 330) were male and 71.0 percent (n is 248) were married. HAV Ab was found in 94.9 percent (n is 333) of the total sample. The prevalence of HAV Ab was higher among married and older participants. It was lower among those with a high school or vocational level of education (p is less than 0.05) than among those with a lower level of education.**

**Conclusion: This study reveals a high prevalence of HAV Ab among adult blood donors in Qazvin, which indicates a high level of childhood contact with HAV in the area.**


**Keywords: blood donors, hepatitis A virus, Iran, prevalence, risk factors**

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## INTRODUCTION

The hepatitis A virus (HAV) is a global problem.[1] It is often passed through the faecal-oral route. Endemic areas tend to have poor general hygiene and sanitation, as well as a lower community socioeconomic status. HAV is highly endemic in South America, Africa, India, the Middle East and Asia, while it is much less common in industrialised countries, such as the United States and Japan. From time to time, the United States experiences a large outbreak, but such cases are beginning to occur less frequently. Except for community-level outbreaks, the populations that are most affected by the virus are school-aged children and young adolescents. In order to effectively address this problem on a national level, all children should be vaccinated at a young age.[2] HAV is usually contracted through sexual contact, faecal-oral transmission within the household (22%–26%), contact with daycare attendees or employees (14%–16%), while travelling abroad (5%), or ingestion of contaminated food and water (5%). However, in almost half of all instances, the route of HAV infection is unknown.[3]

As mentioned above, the geographical patterns of HAV infection vary greatly, not only between countries but also within each country.[4] In the latter, the disease spreads most quickly in highly populated areas with poor sanitation infrastructure and a shortage of water. Infections occur most commonly among children under the age of ten, and in most cases, the victim displays no symptoms.[5] In most of the developed world, HAV is more likely to be contracted by older adolescents or adults.[6] They tend to experience a comorbidity of jaundice and more severe HAV symptoms, whereas young children are unlikely to experience jaundice, and often display no HAV symptoms at all.[7] HAV is endemic in Iran. The aim of this study was to determine the seroprevalence of HAV among blood donors in Qazvin, central Iran.

## METHODS

This study utilised a cross-sectional analytical design and was conducted in April 2008. During this period, 612 participants were referred to the Qazvin Blood Transfusion Centre for blood donation. 127 of them were rejected for

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**Table I. General characteristics of the study participants and the HAV Ab positive participants (n = 351).**

| Variable | No. (%) | | p-value |
|---|---|---|---|
| | Participants | HAV Ab +ve | |
| Gender | | | |
| Female | 21 (6.0) | 21 (100.0) | 0.272 |
| Male | 330 (94.0) | 312 (94.5) | |
| Marital Status | | | |
| Single | 103 (29.3) | 91 (88.3) | < 0.001* |
| Married | 248 (70.7) | 242 (97.6) | |
| Type of blood donor | | | |
| First-time donor | 105 (29.9) | 99 (94.3) | 0.305 |
| History of several donations | 74 (21.1) | 68 (91.9) | |
| Regular donor | 172 (49.0) | 166 (96.5) | |
| Level of education | | | |
| Without a high school diploma | 125 (35.6) | 121 (96.8) | 0.397 |
| Illiterate | 3 (0.9) | | |
| Below high school level | 122 (34.8) | | |
| High school graduate | 146 (41.6) | 136 (93.2) | |
| University or higher | 80 (22.8) | 76 (95.0) | |
| Associate degree | 33 (9.4) | | |
| Bachelor degree | 40 (11.4) | | |
| Graduate degree | 7 (2.0) | | |
| Occupation | | | |
| Training and education | 37 (10.5) | 31 (83.8) | 0.022* |
| Pupil | 4 (1.1) | | |
| University student | 27 (7.7) | | |
| Clergyman | 2 (0.6) | | |
| Educator | 4 (1.1) | | |
| Private jobs | 184 (52.4) | 176 (95.7) | |
| Business owner | 116 (33.0) | | |
| Labourer | 63 (17.9) | | |
| Driver | 3 (0.9) | | |
| Farmer | 2 (0.6) | | |
| At home | 36 (10.3) | 36 (100.0) | |
| Homemaker | 19 (5.4) | | |
| Unemployed | 9 (2.6) | | |
| Retired | 8 (2.3) | | |
| Employee | 94 (26.8) | 90 (95.7) | |
| Conscript | 7 (2.0) | | |
| Military personnel | 12 (3.4) | | |
| Staffer | 75 (21.4) | | |

* Denotes statistical significance.
HAV: hepatitis A virus

donation and were consequently excluded from the study due to either of the two reasons: (a) They had a risk factor for transmitting blood-borne infections, such as a history of intravenous drug use (IDU), unsafe sexual contact, blood transfusion, surgery, endoscopy or a spouse with a history of IDU; or (b) A blood donation would have been too risky for the donor due to hypertension, iron overload, anaemia, a history of drug consumption, a common cold, a cardiovascular disease, an endocrine disorder or a chronic disease, or the donor had plans to travel. Of the remaining 485 cases, 351 were available and agreed to complete the information forms, which formed the study population. The sample size was large enough, considering that HAV is endemic in Iran.

Information was collected through a questionnaire and included sociodemographic data. The questionnaires were filled out by trained general practitioners, who also interviewed the participants. The demographic data collected included age, gender and marital status, while the socioeconomic data included the level of education, occupation, family income, number of household members, region of residence before ten years of age, and the availability of a bathroom and warm water in the home. Additional questions included information about the family history of jaundice and the number of blood donations.

Blood specimens were collected and tested by enzyme-linked immunosorbent assay (ELISA) for antibodies to HAV (HAV Ab) (Diasorin, Madrid, Spain), antibodies to the human immunodeficiency virus (HIV Ab)

**Table II. HAV Ab positivity among participants in the different job categories.**

| Job Category | p-value | OR | 95% CI | |
|---|---|---|---|---|
| | | | Lower limit | Upper limit |
| Training and education | 0.030 | 0.230 | 0.061 | 0.868 |
| Private jobs | 0.971 | 0.978 | 0.287 | 3.335 |
| At home | 0.998 | $7.2 * 10^7$ | 0.000 | - |
| Employee* | 0.060 | 1 | - | - |
| Constant | 0.000 | 22.500 | - | - |

* Reference group
HAV: hepatitis A virus; OR: odds ratio; CI: confidence interval

(Biotest, Eppelheim, Rhein-Neckar-Kreis, Germany), hepatitis B surface antigen (HBsAg) (Diasorin, Madrid, Spain), and antibodies to the hepatitis C virus (HCV Ab) (Avicina, Tehran, Iran).

Data from the study was analysed using the Statistical Package for the Social Sciences version 15 (SPSS Inc, Chicago, IL, USA) using descriptive statistics presented in terms of percentages as well as the mean and standard deviation. The *t*-test, chi-square test and Fisher's exact test were employed to determine the factors related to HAV Ab positivity. A p-value < 0.05 and a critical $\alpha$ level of 0.05 were considered to be statistically significant.

## RESULTS

Of the 351 blood donors in this study, 172 (49.0%) were regular donors, while the rest were first-time donors or had already made several donations. 330 (94%) participants were male and 21 (6%) were female. The enrolled male vs. female ratio was not reflective of the male vs. female ratio of the population of Qazvin. 248 (70.7%) participants were married and 103 (29.3%) were single. 146 (41.6%) participants were high school graduates and 125 (35.6%) had an education level lower than high school. 116 (33%) participants had a private business, 75 (21.4%) were staffers and 63 (17.9%) were labourers (Table I).

There were no significant differences among the participants with respect to gender, type of blood donation, level of education and HAV Ab positivity. With regard to gender, this may have been due to the low number of female participants enrolled. On the other hand, the prevalence of HAV was higher among married participants than singles (odds ratio [OR] 5.319; 95% confidence interval [CI] 1.939–14.591). We categorised the vocations of the participants into four groups, according to the type of healthcare received (e.g. employees were obliged to perform routine checkups, whereas those with private jobs did not). Participants in education and training-related jobs showed a lower prevalence of HAV Ab positivity (OR 0.23; 95% CI 0.061–0.868), while those who stayed at home were all positive for HAV Ab (Table II).

According to the results of the serologic tests, all the blood donors (100.0%) were HIV negative, one (0.3%) was HBsAg positive and one (0.3%) was HCV Ab positive. Out of the 351 blood donors, 333 (94.9%) were HAV Ab positive and 18 (5.1%) were HAV Ab negative. There was high HAV Ab seropositivity in the study population although the high-risk populations were excluded; this is important from a public health standpoint. There was no statistically significant difference between the availability of a bathroom and a hot water system at home, the region of residence before ten years of age, a family history of jaundice and HAV Ab positivity (Table III). The mean number of household members of blood donors who were HAV Ab positive and HAV Ab negative was 4.4 ± 1.8 and 4.1 ± 1.3, respectively. The mean monthly family income of the two groups was 279 ± 189 and 357 ± 2,430,000 Rials, respectively. There was no significant difference with regard to the number of household members, family income and HAV Ab positivity. However, older participants showed a higher prevalence of HAV Ab (Table IV).

## DISCUSSION

HAV is a major public health problem worldwide, but the disease is of particular concern in less developed countries because of overcrowding, poor or inadequate water supply and other problems associated with low socioeconomic status.[8] In such areas, almost all children develop a natural immunity to HAV, often by contracting and carrying the disease without displaying any symptoms.[9] Iran is one of these highly endemic areas; unfortunately, there has been a gross lack of research on HAV in this country. Previous research in Iran's major cities has found high rates of HAV Ab, especially among children and young adolescents. A study conducted in 204 patients who were referred to a liver clinic in Shiraz, southern Iran during a six-month period in 2005 found a very high prevalence of HAV Ab (98%) and negative titres in mostly younger patients.[10] Another study of 1,018 children (six months to 15 years of age) in four major paediatric hospitals

**Table III. Socioeconomic factors and HAV seropositivity among the participants.**

| | No. of participants (%) | | p-value |
|---|---|---|---|
| | HAV +ve | HAV −ve | |
| Availability of bathroom at home* | | | |
| Yes | 319 (97.6) | 18 (100) | 0.999 |
| No | 8 (2.4) | 0 (0) | |
| Region of residence before 10 years of age* | | | |
| Urban | 225 (68.8) | 15 (83.3) | 0.192 |
| Rural | 102 (31.2) | 3 (16.7) | |
| Availability of hot water system at home* | | | |
| Yes | 317 (96.9) | 18 (100) | 0.999 |
| No | 10 (3.1) | 0 (0) | |
| Family history of jaundice† | | | |
| Yes | 6 (1.8) | 0 (0) | 0.999 |
| No | 319 (98.2) | 18 (100) | |

* Data is missing for 6 participants. † Data is missing for 8 participants.
HAV: hepatitis A virus

**Table IV. Number of household members, family income, age and HAV Ab positivity.**

| | Mean ± SD | | p-value |
|---|---|---|---|
| | HAV Ab +ve | HAV Ab −ve | |
| Number of household members | 4.4 ± 1.8 | 4.1 ± 1.3 | 0.430 |
| Family income† | 2.7 ± 1.8 | 3.5 ± 2.4 | 0.198 |
| Age | 32.6 ± 9.2 | 24.5 ± 5.6 | < 0.001* |

* Denotes statistical significance. † Income is indicated in millions of Rials per month.
SD: standard deviation; HAV: hepatitis A virus

in Tehran reported an immunity rate of 22.3%.[11] Finally, a cross-sectional study in the Isfahan province conducted on 816 participants who were above six years of age revealed that only 8.3% were HAV Ab positive, contrary to other studies on HAV in Iran. The authors suggested that the lower prevalence of HAV in Isfahan compared to other regions in Iran could be attributed to the presence of a proper sanitation infrastructure and waste disposal system, as well as a higher level of health-related knowledge and education.[12]

Substantial research has been conducted on the prevalence of HAV infection around the world. In Delhi, Indian researchers found that 80% of subjects up to five years of age were HAV Ab positive.[13] Turkey has been reported to be a middle endemic area in terms of HAV infection.[14] A study conducted in western Turkey reported a prevalence rate of 44% among 711 children and adolescents aged 2–16 years.[15] In Edirne, a city in the westernmost part of Turkey, 4.4%, 25.0%, 37.3% and 43.2% of those in the 2–5 year, 6–10 year, 11–14 year and 15–19 year age groups, respectively, were found to be HAV Ab positive.[14] However, a study of 210 healthy children in the Kunya province in central Turkey found that the prevalence rate of HAV Ab was 67.8% and 25.8% in the rural and urban areas, respectively.[16] The rate of HAV infection has been reported to be much higher in Palestine and Syria. An HAV Ab prevalence rate of 93.7% was found in 396 school children in a Palestinian study, and a prevalence of 50.0% and 95.0% was found in the 1–5 year and 11–15 year age groups, respectively, in a Syrian study.[17,18] In Madrid, a study investigating the prevalence and risk factors of HAV infection in 90 children and 467 blood donors reported a 41.5% overall prevalence of HAV infection. Furthermore, the prevalence rate increased significantly with age from the youngest to oldest age groups. The prevalence rate was also higher for those with a lower level of education.[19]

A study of high-risk populations in Victoria, Australia, found that 45% of 2,175 prison inmates and 51.0% of 293 IDUs were seropositive for HAV compared to only 30.0% of the 2,995 blood donors and a general decline in the larger populations. This suggests that both prison inmates and IDUs should be targeted for HAV vaccination.[20] In a study of 5,025 samples from blood donors in Portugal, none of the samples tested positive for HAV, leading the authors to conclude that the detection technique used for the study sample (real-time polymerase chain reaction) is easy to implement and should be a standard procedure in all blood banks.[21] Thus, it is possible that the HAV Ab test is not the preferred screening test in regions with

a very low prevalence of HAV, while serologic tests are preferred over molecular tests in HAV endemic areas, as they are more economical and easier to perform. In a 1999 study of healthy Chilean adults, researchers evaluated the prevalence of HAV Ab in 215 voluntary blood donors and 295 medical students and health personnel. Most blood donors (90%) tested positive for HAV Ab, whereas only 54% of the health personnel and students tested positive, most likely because of their generally higher socioeconomic status.[22]

Our study found a high prevalence of HAV Ab among adult blood donors in Qazvin, which indicates a high level of childhood contact with HAV in the area. The prevalence was found to be higher among older and married participants, and lower among those with higher levels of education or job training. Improvements to the sanitation infrastructure, the promotion of improved health education programmes as well as enhancements to the waste disposal system are preventive strategies that can be employed to decrease the prevalence of HAV in Qazvin. These are believed to be the main reasons for the low prevalence of HAV in Isfahan compared to the other parts of Iran.[12]

The hepatitis A vaccine is a proven and effective method of prevention. A study in Japan confirmed that awareness of HAV and the availability of vaccinations are important to prevent the spread of the disease.[23] In two neighbouring villages in Slovakia, with a total population of 5,000, researchers gave school children the first commercially available HAV vaccine in an attempt to control the progress of a community-wide epidemic. The vaccine was more successful at slowing the outbreak than other techniques like postexposure immunoglobulin.[24] Another study investigated the immunogenicity and safety of the HAV strain GBM vaccine among 40 children who were enrolled in a daycare centre in Sao Paulo, Brazil. The results not only revealed that the dead HAV vaccine was safe and effective in areas where HAV infection was highly prevalent, but also found that vaccination should not be ruled out in areas of lower risk, where daycare centres play an important role in promoting the spread of HAV.[25] Active vaccinations have also been proposed to be a useful technique for prevention. For instance, in order to stop an outbreak of HAV among children living in a refugee camp in Croatia, 34 children aged 1–15 years were vaccinated (an array of general preventative measures were taken as well).[26] In our study, the most at-risk cases were excluded from the sample, and thus the prevalence rates of HBV, HCV and HIV were quite low among our participants. Indeed, the population as a whole in Iran has been experiencing lower rates of HAV infection over time.[27]

Routine vaccinations against HAV are recommended in children, adolescents and high-risk adults, as there is no specific treatment for hepatitis A. The results of cost-effectiveness studies in several developed countries are also in favour of vaccination for children, and to some extent, for adolescents and high-risk adults as well.[28] The prevalence of hepatitis A is directly related to personal and community hygiene. Taking into consideration the high prevalence of the disease in Iran, which indicates a low average level of hygiene in the country, it is necessary to educate individuals in every socioeconomic class about HAV and to encourage them to take responsibility for the problem. Moreover, it is crucial to improve upon the sanitation infrastructure and waste disposal systems in order to decrease the prevalence of HAV in areas such as Qazvin. We also suggest a cost-effectiveness analysis study of the HAV vaccine in Iran. It may even be necessary to carry out a well-designed national vaccination programme against HAV.

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