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Hepatitis A Antibody Seroprevalence in a Selected Kenyan Pediatric Population

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Abstract

The incidence of infection by Hepatitis A virus shows regional variation being highest in developing countries. Determination of age specific Hepatitis A virus (HAV) seroprevalence and the associated risk factors would help better plan for national preventive strategies including vaccination. We carried out a cross-sectional study on 300 children from Nairobi city, Kenya during the years 2003-2004. The age range of the children was 2 - 14 years and were from low and high socioeconomic status (SES) families. The indicators of SES included employment status, residence, number of children per patient's household, parents' level of education and source of drinking water. SES was encoded and analysed using Statistical Program for Social Sciences (SPSS) version 16.0. Seroprevalence increased significantly with advancing age. Seropositivity of HAV antibodies was significantly higher among children of low SES, 77.6% by the age of 14 years compared to children of high SES, 38.9% by the same age. Crowded household and parental education were significantly associated with high seropositivity and seronegativity respectively. There is significant rate of seronegativity amongst the studied population especially those from richer backgrounds making them more susceptible to severe infection in future with concomitant complications. We propose that revision of national vaccination program should be considered to include Hepatitis A vaccination.

Keywords

Seroprevalence, Hepatitis A, Pediatrics

1. Introduction

The infection due to Hepatitis A virus (HAV) is on epidemiological transition globally

with changing patterns in respect with economic fortunes. Certain regions of the world are known to have the highest endemicity including Asia, Africa and parts of the Caribbean, South, Central America. Economic factors leading to high endemic levels include lack of proper housing and water sanitation, overcrowding and poverty [1] [2]. The virus is transmitted via the feco-oral route and its exact impact is always underestimated due to mildly symptomatic or asymptomatic nature of the infection [3] [4]. There is considerable variation in the rates of seroprevalence by region, country and intra-country with marked fluctuations from time to time but in general the underdeveloped countries bear the greatest disease burden amongst children at an earlier age. Coincidentally, these infections are mild to asymptomatic and most of the children attain immunity by the time they reach adolescence [5]. On the contrary, developed countries are characterized by low antibody seroprevalence of HAV during childhood which continues to adulthood where roughly 50% of the adult population is seronegative and consequently at risk of severe forms of hepatitis A infection [6] [7].

With improving economic fortunes of most developing nations, the epidemiologic pattern of HAV is expected to shift and may demonstrate patterns similar to those of developed countries. This has the potential of putting the adult population at risk of severe hepatitis A infection [8]. Although Hepatitis A virus infection can easily and effectively be mitigated through vaccination [9], this has not been fully implemented and included in the national vaccination programs of many countries including Kenya. As a result, there is likelihood of witnessing more adult morbidity and mortality resulting from HAV infection. This study aimed at determining the age specific HAV antibody seroprevalence and the associated risk factors which would help better plan for national preventive strategies including vaccination.

2. Patients and Methods

Three hundred children from Nairobi, Kenya aged between two and fourteen years without a history of vaccination against hepatitis A, signs of hepatitis or jaundice and had lived in the present accommodation or similar one in Nairobi from birth were included in the study. This study was done between year 2003 and 2004 in Nairobi City, Kenya. Three hundred children were included in this study but only 256 were analysed. The sample size was calculated based on prevalence of previous studies and considering 80% power. The children were subdivided into three age groups: 2 - 4, 5 - 9, 10 - 14 years.

Permission to carry out the study was obtained from Kenyatta National Hospital/ University of Nairobi Ethics and Review committee and the Aga Khan University Hospital Education committee. Informed consent obtained from the parents before the children were included in the study. A structured questionnaire developed by the principal investigator in this study and his team was used to collect demographic data and evaluate the socioeconomic status (SES) of the subjects after pilot and proper validation of the tools. The indicators of SES included employment status, residence, number of children per patient's household, parents' level of education, source of drinking water.

Socioeconomic status (SES) was encoded and scored as summarized in **Table 1**: Each attribute was assigned 1 or 2 point(s) in column 1 and 2 respectively. Total score was then calculated. A score of 6 or less was deemed as high SES while a score of 7 - 12 was judged as low SES.

Alongside the questionnaire, 2 mL of blood was drawn from each patient by venous puncture through a sterile procedure and collected into a vacutainer tube. Whole blood was centrifuged at 3000 rpm for 15 minutes to obtain a serum sample which was then stored in cryotubes at -20°C within 24 hours of sampling. Enzyme-linked immunosorbent assay (ELISA; HAVAB-EIA; Abbot Diagnostics, Illinois, USA) was used to determine the presence of HAV antibodies.

Data obtained were entered and analyzed using SPSS version 16.0 Chicago Illinois. Student t test was used for comparing qualitative variables. Logistic regression analysis was performed to determine the SES factors associated with anti-HAV antibodies positivity. *P* values <0.05 were considered statistically significant.

3. Results

Out of the 300 children, 256 were analyzed while forty four were excluded for not meeting the inclusion criteria. All the children were of African descent and boys were slightly more than girls (137 boys, 119 girls). The overall HAV antibody seroprevalence in this population was 44.5%. The age distribution is shown in **Table 2**.

There were 189 children from low SES and 107 from high SES with varied distribution as shown on **Figure 1**.

Table 1. Risk factor attributes for hepatitis A virus.

	1	2
Type of house	Permanent	Semi permanent or Shanty
Water supply	Running tap in the house	Running tap outside or communal well/river/from a vendor
Sanitation	Flush toilet in the house	Communal flush toilet or pit latrine outside or no defined facility
Crowded household	Low crowded house (1 - 4 people)	High crowded house (4 - 9 people)
Parents level of education	Both parents with secondary education and above	1 or 2 parents with primary education or none
Parents income	High $> \$15$ a day	Low $< \$3$ a day

1 = High SES, 2 = Low SES.

Table 2. Distribution of children according to age group.

Age group	Number	Percentage
2 - 4	80	31.3
5 - 9	109	42.6
10 - 14	67	26.2
Total	256	100

When age specific seroprevalence of HAV antibodies were analyzed against socio-economic status, it was found that generally children from a higher socioeconomic state had low antibody seroprevalence (Table 3).

On subjecting variables of SES to logistic regression analysis, it was shown that factors associated with presence of HAV antibodies were related to age, crowding, parents income, residential area, source of water supply and parent's level of education level in a descending order (Table 4).

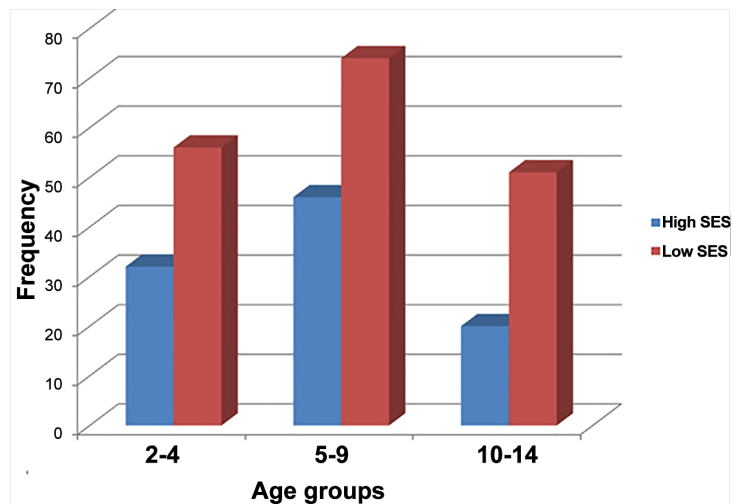


Figure 1. Distribution of children by age groups and socioeconomic states.

Table 3. Age specific antibody seroprevalence of HAV.

Age group	Socioeconomic status	% seroprevalence
2 - 4	High SES	3.8
	Low SES	37
5 - 9	High SES	14.6
	Low SES	61.8
10 - 14	High SES	38.9
	Low SES	77.6

Table 4. Factors associated with presence of HAV antibodies.

Factor	% seronegativity		P*	Relative risk	Lower limit	Upper limit
	High SES	Low SES				
Parents income	71.4	32.3	<0.05	2.2	1.7	2.8
Source of water	70.5	28.3	<0.05	2.5	2.8	3.4
Residential area	66.9	30.2	<0.05	2.2	1.6	3.0
Parents level of education	72.7	20.0	<0.05	3.6	2.4	5.6
Crowded household	70.4	36.7	<0.05	1.9	1.5	2.4
Age	73.2	34.6	<0.05	3.8	2.8	5.8

P*: degree of significance.

4. Discussion

The results of this study are in keeping with findings of previous studies [10] [11] [12] that HAV antibody seropositivity increased significantly with advancing age and was significantly different in every age group ($P < 0.05$). Our study indicates a significant shift in the pattern of HAV epidemiology in Kenya. In previous findings it was observed that most African countries such as Kenya, had very high rates of HAV infection and nearly all children by the age of 5 years had been infected [13]. The epidemiological shift may be attributed to improved socioeconomic status, improved public sanitation, use of chlorinated water and increased level of parental education. Hepatitis A virus seroprevalence rate is directly related to socioeconomic development of a particular society. For example, in developed countries such as North American states, Austria and Norway, seropositivity rates are low ranging from 2% and 20% in adolescence [14]. On the contrary, seropositivity rates in developing countries range between 50% and 100% until adult age and are related to poor socioeconomic development [15] [16] [17].

In deed when low and high socioeconomic status children are compared, the latter tend to have a pattern close to those of developed countries while the former have similar patterns to those of developing nations (Table 5).

Results from the current study shows that disease acquisition among the high SES population occurs in early adolescence and may proceed on to early adulthood rather than in early childhood. This may coincide with young adults' closer interaction at school, involvement in risky behaviours such as poor hand hygiene and interacting more and more with street populations [1] [2] [18]. The implication is that a low level of HAV immunity among young adult population puts them at a higher risk of outbreaks and severer symptomatic infections [13] [19].

Table 5. The HAV antibody seroprevalence age groups in several countries.

Country	Age group (years)	HAV seroprevalence
United Kingdom (Das <i>et al.</i> , 2000)	5 - 9	10.5
	10 - 14	13.9
	15 - 19	19.6
Italy (Fix <i>et al.</i> , 2002)	3 - 5	2.3
	17 - 19	16.3
India (Baudin <i>et al.</i> , 1971)	6 - 10	62.2
	11 - 15	68.5
	Over 16	80.8
Current study (Kenya) Low SES High SES	5 - 9	61.8
	10 - 14	77.6
	5 - 9	14.6
	10 - 14	38.9

This study reported a negative correlation between parental education level and HAV antibody seroprevalence. This has also been observed in other previous studies [17] [20]. It has been noted that parental education level has a direct effect on lifestyle led by the family through influencing sanitation, living in a less crowded area and thus being accessible to portable treated water [21]. On the contrary children from a low SES, whose parental level of education was low, may have been exposed to negative environmental factors that facilitated hepatitis A transmission and hence infection.

Notable is that HAV vaccines that have been available just before the beginning of the millennium providing consistent and long-lasting protection [22] have not been fully utilized in our setting. Countries such as the United States where vaccination programs have been executed in high endemic areas have reported very low outbreaks of HAV infections amongst young adults [9]. In Kenya, our national immunization program does not include HAV vaccine. We recommend that vaccination against HAV in preschool-aged children and more so children from higher SES settings should be considered to mitigate future morbidity and mortality arising from HAV infection.

5. Conclusion and Recommendation

These results show a considerable rate of HAV antibody seronegativity amongst the studied population especially those from richer backgrounds making them more susceptible to severe infection in future, with concomitant complications. We propose that revision of National Vaccination Program should be considered to include Hepatitis A vaccination.

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Limitation

This study limited to specific regions of Nairobi but represented populations of different socioeconomic states that were envisioned for in this study.

Conflict of Interest Statement

The authors have no conflict of interest concerning the work reported in this paper.

Author Contribution

Conceptualization and proposal development: A. W.

Data collection: A. W., M. J. R., H. M.

Data analysis and manuscript preparation: A. W., F. M., M. M. O.

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