Review

Epidemiology of hepatitis B virus infection in the Middle East

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SUMMARY In this article, the epidemiology of hepatitis B (HBV) infection in the Middle East is reviewed. The prevalence of HBV carrier status in the region is considered and the modes of transmission of infection discussed. The risk factors associated with HBV infection are examined and preventive measures against HBV infection in countries of the region are presented. The review is based on information from two sources — publications in the international literature on the epidemiology of HBV infection in Middle East countries, identified by searching MEDLINE and POPLINE, and Middle East country and regional reports on viral hepatitis. It is evident that HBV infection is a serious public health problem in the region and many questions specific to the region remain unanswered. Community-based surveys are recommended as they provide more accurate information that can be generalized than hospital-based surveys.

Introduction

Middle East countries show considerable variation in their economy, population characteristics, geography and level of health care. The Arabian Peninsula covers well over 3 million square kilometres. Countries on the peninsula are Saudi Arabia, Kuwait, Qatar, Bahrain, United Arab Emirates (UAE), Oman and Yemen.

Hepatitis B virus (HBV) infection is a major public health problem in the Middle East. The majority of the countries in the region have an intermediate or high endemicity of HBV infection.

In this article, the epidemiology of HBV infection in the Middle East will be reviewed, focusing on countries of the Arabian Peninsula and the bordering Middle East countries. First, the prevalence of HBV carrier status in the region will be reviewed. Then the modes of transmission of infection in these countries will be discussed. This will be followed by a description of the risk factors associated with HBV infection. Finally, preventive measures against HBV infection in countries of the region will be presented.

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Prevalence of HBV carrier status

Based on the prevalence of HBV chronic carriers (individuals positive for hepatitis B surface antigen, HBsAg) amongst adults in the general population, countries are classified as having low endemicity (< 2%), intermediate endemicity (2%–5%), or high

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endemicity (> 5%) of infection [*1*]. Age at infection is the most important factor determining whether an individual will become a chronic carrier. The risk of becoming a chronic carrier is inversely proportional to age at infection [*2*]. Infants infected at birth with HBV have a 70%–90% risk of becoming chronic carriers, whereas only 5% of adults infected with HBV become chronic carriers. Thus, in countries with intermediate and high endemicity, the infections leading to carriage predominantly occur perinatally or in early childhood.

Middle East countries represent the global epidemiology of HBV infection, with the prevalence of chronic carriers showing considerable variation between and within these countries. Countries of the region fall into all three groups of low, intermediate and high endemicity. However, the majority of countries in the region have an intermediate or high endemicity of chronic carriers [*1,3,4*].

Studies in the Middle East show the prevalence of HBsAg to range from 3% to 11% in Egypt, 4% to 5% in Iraq, 2.6% to 10% in Jordan, 2% to 6% in the Libyan Arab Jamahiriya, 2.3% to 10% in Oman, 5% to 6% in Palestine, 7.4% to 17% in Saudi Arabia, 16% to 20% in Sudan, 6.5% in Tunisia, 2% to 5% in UAE and 12.7% to 18.5% in the Republic of Yemen [*3,5–19*]. These surveys have been conducted on a variety of different population groups with the intention of giving a representative estimate of the prevalence of carriers in the general population (Table 1).

These groups included apparently healthy adults, schoolchildren, infants, pregnant women, blood donors and health care staff. It can be seen from the carrier rates listed above that the rates differ from one study to another, even when conducted in the same population and geographic area. This results from different study designs or study populations, where, for example, higher rates may be observed in community-based studies than in studies conducted amongst blood donors [*18*]. Blood donors may not be representative of the general population. In some settings, blood donors tend to be healthier than individuals in the general population and consequently are more willing and capable of donating blood. In Saudi Arabia, blood donors appeared to have a lower prevalence of HBsAg (13.9%) when compared to the general population (16.7%) ($P = 0.4$) [*4*]. On the other hand, in countries where donors are paid for their blood, these individuals may have higher rates of infection than the general population. Additionally, blood donors who are relatives of patients suffering from chronic liver disease (CLD) and requiring blood transfusions may themselves have higher rates of viral hepatitis and liver disease than the general population. In the Republic of Yemen, Scott et al. [*20*] found blood donors to have a significantly higher prevalence of HBsAg (20.6%) than non-donor apparently healthy individuals (12.1%) ($P = 0.02$). It is unclear whether these blood donors were paid or volunteer blood donors. Therefore, one cannot generalize findings based on studies conducted on blood donors.

Another possible explanation for the differences in the carrier rates is the use of different measurement techniques. There are many assays available that differ in their specificity and sensitivity. Most of the serological assays performed used commercial enzyme-linked immunosorbent assay (ELISA), radioimmunoassay (RIA) or reverse passive haemagglutination (RPHA). Tests using RPHA were usually confirmed by ELISA or RIA. In the Republic of Yemen, El-Guneid et al. [*6*] found a much higher hepatitis B e antigenaemia (HBeAg) (59.3%) amongst healthy individuals than

Table 1 **Studies on the prevalence of hepatitis B virus chronic carriers in Middle East countries**

Country	Region	Population	Type
Egypt	Kalyeoubeya (rural)	Pregnant women	Hospital based
Egypt	Menofia governorate (semi-rural)	Pregnant women	Hospital based
Iraq	–	Blood donors	Hospital based
Jordan	Amman (urban)	Volunteer blood donors	Hospital based
Jordan	Three villages and 1 urban hospital (rural + urban)	Asymptomatic individuals	Community based (rural) and hospital based (urban)
Kuwait	Kuwait maternity hospital (urban)	Pregnant women of various nationalities	Hospital based
Lebanon	Beirut (urban)	Pregnant women attending antenatal care	Hospital based
Saudi Arabia	Riyadh	Blood donors, outpatients	Hospital based
Saudi Arabia	Different provinces	Blood donors, schoolchildren, outpatients	Hospital based
Saudi Arabia	Different provinces	Children aged 1–10 years	Community based
Saudi Arabia	Jizan	Students, volunteer blood donors, pregnant women, neonates	Hospital based
Saudi Arabia	Jizan	Infants and children	Hospital based
Saudi Arabia	Riyadh	Blood donors, pregnant women, medical students	Hospital based
Saudi Arabia	Eastern province	Healthy ambulatory men	–
Saudi Arabia	–	Pregnant women attending antenatal care	Hospital based
Saudi Arabia	Riyadh	Pregnant women attending two hospitals for antenatal care	Hospital based
Yemen, Republic of	Sana'a, Taiz	Pregnant females in Taiz, healthy male blood donors	Hospital based
Yemen, Republic of	Sana'a, Hajjah, Taiz and Hudaydah	Pregnant women, Blood donors, hospital patients, schools	Hospital and school based
Yemen, Republic of	Sana'a, Hajjah, Taiz and Hudaydah	Pregnant women, blood donors, hospital patients, schools	Hospital and school based

ELISA = enzyme-linked immunosorbent assay.
CIEP = counterimmunoelectrophoresis.

Table 1 *(concluded)*

Country	Number studied	HBsAg prevalence %	Method	Year	Source
Egypt	150	8	ELISA	1992–1993	[30]
Egypt	360	11.1	ELISA	1983–1985	[31]
Iraq	505	3.6	OEP	1973	[33]
Jordan	2500	4.4	RIA and RPHA	1981	[9]
Jordan	1115	9.9	RIA	1985	[17]
Kuwait	1554	2.9	RPHA and ELISA	1986	[24]
Lebanon	558	2.9	ELISA	1993–1995	[25]
Saudi Arabia	–	4.6	ELISA	1990	[34]
Saudi Arabia	2702	16.7	RIA	1989	[4]
Saudi Arabia	4575	6.7	ELISA	1989–1990	[7]
Saudi Arabia	724	12.7	ELISA	1984	[8]
Saudi Arabia	325	11.1	ELISA	1984–1985	[12]
Saudi Arabia	5467	4.3	First RPHA, confirmed by RIA or ELISA	1986	[13]
Saudi Arabia	3588	8.8	RPHA	1982	[16]
Saudi Arabia	5000	2.8	RPHA	1979–1982	[26]
Saudi Arabia	3020	3.9	RPHA[a] ELISA[b]	1982–1984	[27]
Yemen, Republic of	537	18.5	ELISA	1993	[6]
Yemen, Republic of	879	12.1	ELISA	1988	[20]
Yemen, Republic of	348	13.5	ELISA	1988	[14]

RPHA = reverse passive haemagglutination.
RIA = radioimmunoassay.
[a]*At King Abdul Aziz Hospital.*
[b]*At King Khaled Hospital.*

Scott et al. (9.7%). They attributed this to the more sensitive microparticle enzyme immunoassay technique (IMx HBe, Abbot Laboratories) used for detection of HBeAg in their study.

Table 2 presents hepatitis B carrier rates and vaccination status in Middle East countries. A common finding is the high carrier rate of HBsAg and hepatitis B vaccination coverage in the majority of Middle East countries. The carrier rates from some of these countries have been declining. In Saudi Arabia, for example, carrier rates amongst children dropped from 6.7% in 1989 to 0.3% in 1997 ($P < 0.0001$) following the introduction of hepatitis B vaccination to the country's Expanded Programme on Immunization (EPI) [*21*].

In addition to the marked variation in carrier rates between Middle East countries, there is significant geographic variation in carrier rates within these countries. In Saudi Arabia, for example, the prevalence of chronic carrier females in the Jizan area (25%) is significantly higher than the prevalence in Najran (7.3%) ($P < 0.00003$) [*4*]. Jordan also shows significant differences in carrier rates between villages ranging from 5.7% in one village to 12.8% in another ($P < 0.02$) [*18*].

While some studies concluded that there was a significantly higher rate of infection and chronic carriers amongst males [*9,13*], others failed to find significant evidence for higher infection or carrier rates amongst males [*4,7,12*].

Mode of transmission

HBV can be transmitted at perinatal, childhood or adult ages. The main modes of transmission are mother-to-child, child-to-child, sexual and parenteral.

In the Middle East, the majority of infections occur through childhood and perinatal transmission. There is limited information on sexual transmission in Middle East societies. Parenteral transmission in health institutions should be limited due to routine screening of blood products. The number of intravenous drug users in the Middle East remains low compared to other regions, but there is little information on unsafe injection practices.

Studies on the magnitude of perinatal and childhood transmission in the Middle East have produced differing results. While some studies suggest that childhood transmission is the major mode of transmission of HBV infection with perinatal transmission being uncommon, others propose that perinatal transmission plays an important role in contributing to the pool of chronic carriers. Considering the heterogeneity of Middle East populations and the difference in the prevalence of chronic carriers and HBeAg positivity amongst women of childbearing age within them, intercountry differences in the mode of transmission probably exist.

Supporting the role of childhood transmission in the Middle East, Toukan et al. suggested that person-to-person, non-sexual, non-parenteral and intrafamilial contact was the major mode of transmission between asymptomatic HBV carriers and susceptible individuals [*22*]. A combined study in four Middle East countries (Table 3) found that only 21% (25/120) of children born to HBsAg-positive mothers became chronic carriers [*23*]. This was attributed to the low prevalence of HBeAg (13%) amongst HBsAg-positive mothers, although 94% (15/16) of HBeAg-positive mothers transmitted HBV to their infants.

A study in Kuwait found the prevalence of HBsAg among pregnant women to be

Table 2 **Hepatitis B virus (HBV) carrier rates and vaccination status in countries of the Middle East**[a]

Endemicity and country	HBsAg carrier state %	HBV vaccine in EPI	Selective HBV vaccination	Vaccination coverage %
Low endemicity				
Bahrain	0.9–1.25	Yes	Yes	89
Islamic Republic of Iran	1	Yes	–	81
Israel	1	Yes	Yes	92
Kuwait	1.5	Yes	Yes	94
Intermediate endemicity				
Cyprus	2–2.5	Yes	Yes	68
Iraq	4–5	Yes	–	59
Libyan Arab Jamahiriya	2–6	Yes	–	
United Arab Emirates	2–5	Yes	Yes	90
High endemicity				
Egypt	3–11	Yes	–	82
Jordan	3–10	Yes	No	90
Oman	2–10	Yes	Yes	99
Palestine	5–6	Yes	Yes	–
Sudan	16–20	No	No	–
Saudi Arabia	7–17	Yes	Yes	95
Tunisia	6.5	Yes	–	–
Republic of Yemen	12–18.5	Yes	No	42 (9)[b]
Unclear endemicity				
Lebanon	2.9	No	No	–
Syrian Arab Republic		Yes	Yes	76
Qatar	–	Yes	–	90

[a] *Source: Adapted from [5].*
[b] *9% coverage for the third dose of hepatitis B vaccine.*
EPI = Expanded Programme on Immunization.

2.9% (45/1554), 7.3% of whom were positive for HBeAg. Based on the low prevalence of HBeAg amongst pregnant women, they predicted a low transmission rate of infection to offspring [24]. In Lebanon, similar prevalence rates of HBsAg (2.9%) (16/558) and HBeAg (6.3%) was found amongst pregnant women and accordingly one would expect a low mother-to-child transmission as in Kuwait [25].

In a study in the Jizan area in Saudi Arabia, Arya et al. suggested that perinatal transmission was unlikely to play an important role in HBV hyperendemicity in Jizan due to the low HBeAg positivity of 9% (6/67) in carrier males and females alike associated with a low prevalence of HBsAg in females of childbearing age (4.9%) [8].

Another study conducted on mother-to-child transmission of HBV in Saudi Arabia by Basalamah et al. found 2.8% (140/5000) of pregnant women positive for HBsAg. A two-year follow-up of 50 HBsAg-positive women, 12% of whom (6/50) were positive

Table 3 **Mother-to-child transmission by HBeAg status in HBsAg-positive mothers**[a]

Status tested	Number tested	Number of positive babies	% of positive babies
HBsAg-positive mothers	120 (100%)	25	21
HBeAg-positive mothers	16 (13%)	15	94
HBeAg-negative mothers	104 (87%)	10	10

[a]*Source: [22].*

for HBeAg and their neonates showed that none of the children became HBsAg-positive [*26*]. A similar study by Ramia et al. conducted on 3020 women showed the overall prevalence of HBsAg to be 3.9% amongst pregnant women in Saudi, 11% of whom (13/119) were positive for HBeAg [*27*]. Another study by the same authors looking into transplacental transmission of HBV infection by HBsAg carrier mothers suggested a lack of evidence for perinatal transmission [*28*].

On the other hand, there are studies supporting the role of perinatal transmission of HBV infection in the Middle East. Due to a high rate of HBsAg (9.7%) amongst children aged 1 year in Saudi Arabia, Al-Faleh et al. suggested the possibility of significant HBV transmission during the perinatal period or soon after [*7*]. In the Republic of Yemen, approximately 17% (40/243) of pregnant women were HBsAg positive and 32% (9/28) of HbsAg-positive pregnant women were HBeAg-positive [*6*]. This high prevalence of HBeAg in pregnant Yemeni women indicates a potentially high rate of perinatal transmission of HBV. Another small study suggested the rate of mother-to-child transmission to be 50% (10/20) from HbsAg-positive mothers, based on cord blood positive for HBsAg [*29*].

Studies in Egypt also suggest that perinatal transmission is relatively high. El-Nawawy et al. detected HBsAg in 8% (12/150) of pregnant mothers and 17% (2/12) of their infants [*30*]. None of the HbsAg-positive mothers or their infants was HBeAg positive. In another study conducted in Egypt, 17% (6/35) of infants born to HbsAg-positive mothers were HbeAg-positive [*31*], and HBsAg was positive in 25%, 22% and 37% of cord, 3-month and 6-month blood specimens respectively. Out of 6 babies who became infected from HbeAg-positive mothers, 5 (83%) showed infection at 3 months and 1 did not show infection until 6 months. Table 4 shows hepatitis B e antigen and antibody among HBsAg-positive women in some of the studies conducted in the region.

Factors associated with HBV infection

The most common factors found to be associated with HBV infection and carrier status in the Middle East, other than the risk of perinatal transmission associated with HBsAg/HBeAg status of the mother, are family size, socioeconomic status, age, educational status and a history of previous blood transfusion, surgery or contact with a jaundiced person.

Evidence supporting the role of large family size in increasing the risk of HBV infection came from the observation of pronounced familial clustering of HBV infection in Jordan. A significant correlation was found between family size and the propor-

Table 4 **Hepatitis B e antigen and antibody in HBsAg-positive pregnant women in various Middle East countries**

Country	HBsAg-positive pregnant women	HBeAg-positive (%)	Anti-HBe-positive (%)	Transmission rate (%)	Source
Lebanon	2.9	6.3	–	–	[23]
Kuwait	2.9	7.3	65.8	–	[22]
Republic of Yemen	15.4	–	–	50	[27]
Republic of Yemen	16.6	32.1	–	–	[6]
Egypt	8	0	–	17	[28]
Saudi Arabia	2.8	12	88	–	[24]
Saudi Arabia	3.9	11	75	16	[25]

tion of HBsAg-positive family members [18,23]. Also in Jordan, there was a significantly greater HBsAg prevalence in lower (14.4%) than in upper (2.4%) socioeconomic classes [18]. Another study supporting this evidence showed the prevalence of HBsAg to be 11% and 4% respectively amongst low and high socioeconomic classes [23]. Earlier studies have also shown the prevalence of HBsAg to be 6.9% and 0.7% respectively in lower and upper socioeconomic classes [9]. Similar findings have been reported from the Syrian Arab Republic and Egypt, where the risk of infection was found to be greater in children of low compared to children of high socioeconomic status [3,31]. The association of a history of jaundice, previous blood transfusions and surgery with HBV infection and carrier status has been reported in Jordan, Egypt and the Republic of Yemen. In the Republic of Yemen, a multivariate analysis found age, a history of jaundice and a combined history of blood transfusion and surgery to be associated with HBV infection [20]. The odds ratio associated with increasing 10-year age intervals was 1.37 and 1.51 for carrier status and total markers respectively. The adjusted odds ratio for a combined history of surgery and blood transfusion was 2.76 (95% CI: 1.11–6.82). The adjusted odds ratio for a history of jaundice was 1.42 (95% CI: 1.01–2.01). Toukan et al. reported similar findings in Jordan [18]. In addition, they also found past or present HBV infection to be associated with a rural background, injections, tattooing, sexual exposure and surgical procedures. In Egypt, Ghaffar et al. examined risk factors for perinatal transmission. Apart from the proven importance of HBeAg/anti-HBe status in perinatal transmission, they found that maternal history of schistosomal infection was significantly associated with perinatal transmission [31]. A possible explanation for this association was that schistosomal infection resulted in impaired cell-mediated immunity and hence increased viraemia and infectivity. They also found higher rates of HBV transmission in rural areas as well as in mothers with low educational status. A negative correlation between prevalence of HBV infection and educational levels has also been observed in the Islamic Republic of Iran [3].

Prevention of HBV infection

The most common methods employed for the prevention of HBV infection in the Middle East are active immunization (universal and targeted), routine blood screening for HBsAg and ensuring of safe injection practices. Passive immunization using hepatitis B immunoglobulin (HBIG) is not common in the Middle East because the majority of chronic carriers result from childhood transmission, the cost is high and there is a large proportion of home deliveries in many Middle East countries. Because of cultural sensitivity, safe sex is not officially promoted in most countries of the region.

Active vaccination

Since the majority of HBV chronic carriers in the Middle East result from childhood and perinatal transmission, universal infant immunization is an important public health intervention for countries in the region.

The first Middle East countries to introduce hepatitis B vaccine into their EPI were Saudi Arabia and Qatar in 1989. These were followed by Oman in 1990, Bahrain, Iraq, Syrian Arabic Republic, UAE in 1991, Egypt in 1992, Palestine in 1993, Jordan and Tunisia in 1995, and the Republic of Yemen in 1998.

Vaccination coverage in these populations has been good overall. In particular, Jordan, Oman, Saudi Arabia, Kuwait, UAE, Qatar and Bahrain have achieved excellent coverage reaching 90%, 99%, 95%, 94% 90%, 90% and 89% for all recommended doses by 1 year of age respectively. In the Republic of Yemen, vaccine coverage is 42% for the first dose but drops to 9% for the third dose of hepatitis B vaccine [*32*].

Many Middle East countries, such as Bahrain, Kuwait, Oman, Palestine, Qatar, Saudi Arabia and UAE, have also introduced vaccination targeted at high-risk groups [*3*]. In Bahrain and Oman, for example, two high-risk groups are vaccinated; health care workers and susceptible contacts and household members of HBsAg carriers.

Qatar has introduced hepatitis B vaccine monitoring and surveillance activities [*3*]. All contacts of carriers are traced and vaccinated. As part of routine antenatal care, pregnant women are screened for HBsAg, and those positive are tested for HBeAg. All neonates in the country receive their first dose of hepatitis B vaccine in the delivery room. Babies born to HBsAg-positive mothers also receive HBIG [*3*].

Blood screening and safe injection practices

All countries of the Middle East routinely screen blood for HBsAg [*3*]. It is reported that the majority of Middle East countries use disposable needles and syringes and carry out adequate sterilization of surgical equipment and instruments [*3*]. However, it is estimated that unsafe injections may cause 8–16 million HBV infections each year worldwide, most of which occur in developing countries. Recent studies where injection practices were directly observed found that about 50% of all injections given in developing countries were done with syringes that were not sterilized. It is not known how much of a problem this may be in the Middle East.

Conclusion

Upon reviewing the literature on the epidemiology of HBV infection in the Middle East, it is evident that HBV infection is a major public health problem in many countries of the region. Toukan et al. estimated that HBV infection might account for up to

2% of all eventual deaths in a Middle East birth cohort [23]. In the Jizan province of Saudi Arabia, the high HBsAg carrier rate of 19.9% amongst males is consistent with the provinces high incidence of hepatocellular carcinoma [8]. In Jordan, there is a significantly higher prevalence of HBsAg in patients with CLD (54%) than in asymptomatic carriers (10%) (P = 0.001) [17]. Similarly in the Republic of Yemen, the prevalence of HBsAg amongst patients with CLD (24.1%) is significantly higher than asymptomatic carriers (18.5%) (P = 0.03) [6]. The high prevalence of HBsAg amongst patients with CLD indicates that HBV infection probably plays a significant role in the pathogenesis of CLD.

There is marked variation in carrier rates between and within Middle East countries. Chronic carrier rates range from 1.5% in Kuwait to 18.5% in the Republic of Yemen. In Saudi Arabia, carrier rates vary considerably from one region to another. Why such differences exist within the same country remains unexplained. In Jordan, intracountry differences have been attributed to socioeconomic status. In the Saudi Arabian population, which is considered a relatively homogeneous population, socioeconomic status does not explain the differences in prevalence of chronic carriers. Even when conducted on the same population, studies have produced different rates.

In many countries of the region age-specific prevalence of HBsAg carrier status has not been examined, which makes interpretation of the patterns of infection in these countries difficult. However, most of the studies in the region indicate that transmission in the region predominantly occurs during the early years of life, with adult transmission being relatively uncommon.

Transmission of HBV infection in the early years of life in the region appears to be a combination of perinatal and childhood transmission. The role of childhood and perinatal transmission probably differs from one country to another. Obviously, determining the role of either mode of transmission has important policy implications. If perinatal transmission is found to be a common mode of transmitting HBV infection, this means that vaccination against HBV at 6–8 weeks of age is too late to prevent mother-to-child infection. Under such circumstances, one must aim to vaccinate neonates at birth or within 24 hours of delivery at the latest. In some settings, such as the Republic of Yemen, where the majority of deliveries occur at home, introducing such a procedure has many implications. One of the major concerns is the difficulty of vaccinating home deliveries that occur in remote areas, bearing in mind that 75% of the Yemeni population lives in rural areas and is dispersed throughout approximately 65 000 rural hamlets.

Prevention programmes vary from one Middle East country to another. Some countries, such as Qatar, have excellent control programmes. Not only do they vaccinate all neonates in the delivery room, but they also screen and vaccinate eligible contacts of carriers. The effectiveness of these measures in reducing infection and carrier rates has not been examined. However, studies from Saudi Arabia show that the introduction of hepatitis B vaccination to EPI led to a significant reduction in HBV chronic carriers from 6.7% in 1989 to 0.3% in 1997.

The Republic of Yemen, the poorest country in the Arabian Peninsula, has the highest prevalence of chronic carriers. There is limited information on the pattern of transmission and age-specific prevalence of HBV in the population. The high prevalence of hepatitis B e antigenaemia amongst pregnant women found in one study and the high rate of mother-to-child

transmission suggested in another indicate that a high rate of perinatal transmission may exist.

The studies conducted in the Middle East have collectively found that HBV infection is a serious public health problem in the region. Many questions specific to the region remain unanswered. Effectiveness of hepatitis B vaccination against infection and carrier status, risk factors for infection and carrier status, the relative importance of HBV infection in the development of hepatocellular carcinoma in the region, the extent of perinatal transmission, and the pattern of HBV infection in different age groups are only examples of the many questions that deserve investigation. Community-based surveys will provide more accurate information that can be generalized than hospital-based surveys, which are not necessarily representative of the true situation amongst the general population.

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