

## Knowledge of hepatitis B and vaccination status of some expatriate ethnic groups of blue collar workers in Northern Saudi Arabia

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# KNOWLEDGE OF HEPATITIS B AND VACCINATION STATUS OF SOME EXPATRIATE ETHNIC GROUPS OF BLUE COLLAR WORKERS IN NORTHERN SAUDI ARABIA

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**هدف الدراسة :** للوقوف على مستوى المعرفة وحالة التطعيم بين بعض المجموعات العرقية من عمال اللون الأزرق المغتربين في شمال المملكة العربية السعودية

معلومات أساسية: الإصابة بالتهاب الكبد الوبائي (ب) من الأمراض الشائعة نسبياً في جميع أنحاء العالم، غير أن الطبقات الاجتماعية والاقتصادية المتدنية والمحرومة تعاني أكثر من تلك الإصابة المزمنة التي يمكن أن تؤدي إلى عواقب وخيمة بما فيها سرطان الكبد.

**طريقة الدراسة :** دراسة استقصائية عابرة لعينه تتكون من 665 شخصاً من المجموعات العرقية من عمال اللون الأزرق المغتربين في شمال المملكة العربية السعودية خلال العام 2005 وقد اختبرنا المستوى المعرفي وحالة التطعيم لديهم ومقارنتها مع بعض العوامل الاجتماعية والديموغرافية.

**نتائج الدراسة :** كان متوسط عمر المشاركين 45.61 سنة (+8.44) منهم 53% من غير العرب (غير الناطقين بالعربية) من المجموع أجاب 41.6% على 7 أو أكثر الجواب الصحيح من 12 سؤال تتعلق بالمعرفة عن طرق انتقال المرض ومضاعفاته. كما وجد أن 40% تقريباً من المجيبين لم يتم تطعيمهم بينما الباقون حصلوا على ثلاث جرعات كاملة من التطعيم، وكان المستوى المعرفي العالي (7 إجابات صحيحة أو أكثر) على علاقة وثيقة بالمستوى العالي للتعليم وحالة التطعيم والمجموعات العرقية والوظيفي والعمر والحالة الاجتماعية وفترة الإقامة في المملكة، بينما كان مستوى الدخل ومكان الإقامة غير مرتبط بمستوى المعرفة ( $p > 0.05$ ) أما حالة التطعيم فكانت مرتبطة بكل العوامل الاجتماعية والديموغرافية.

التعليق: بدأت برامج فحص التهاب الكبد للمغتربين في المملكة العربية السعودية قبل 10 سنوات. وأوضحت معدلات التحسن السابق والحالي نجاحاً ملموساً، ولكن يجب الإهتمام بتعزيز الصحة وحملات التطعيم وإيصال التطعيمات للطبقات المحرومة كخطوات مهمة لتعزيز ذلك النجاح.

**الكلمات المرجعية :** عمال اللون الأزرق ، التهاب الكبد الوبائي (ب)، المغتربين

**Objective:** To find out the level of knowledge and vaccination status of some expatriate ethnic groups of blue color workers.

**Background:** Hepatitis B (HBV) infection is relatively common throughout the world, but more prevalent in low socioeconomic and underprivileged classes. The chronic infection may lead to severe consequences including Hepatocellular carcinoma (HCC).

**Method:** A cross-sectional, community-based survey of some ethnic expatriate groups of blue color workers ( $n=665$ ) living in four main areas along the Northern Borders of Saudi Arabia was completed in 2005. We examined knowledge of HBV and vaccination status and compared them with some socio-demographic factors.

**Results:** The mean age of the participants was 45.61 years ( $\pm 8.44$ ), 53% of whom were Non-Arabs (Non Arabic speaking). Of the total, 41.6% gave seven or more correct answers out of 12 questions addressing knowledge about the transmission and sequelae of HBV. Almost 40% of the respondents had not been vaccinated while the remaining respondents had had three full doses of vaccination. A high level of knowledge ( $\geq 7$  correct answers) was significantly associated ( $p < 0.05$ ) with higher level of education, vaccination status, ethnic groups, occupation, age, marital status, and the time spent in Saudi Arabia. Income and type of accommodation were not associated ( $p > 0.05$ ) with level of knowledge. However, vaccination status was associated ( $p < 0.05$ ) with almost all socio-demographic factors.

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**Conclusion:** Hepatitis screening programs for expatriates in the Kingdom of Saudi Arabia started 10 years ago and are expected to have a great impact on the combat against HBV infections and their complications. However, beyond screening, health promotion, vaccination campaigns, and access to vaccine for the underprivileged classes are some necessary measures towards achieving success.

**Key Words:** Hepatitis B virus, vaccination status, expatriates, blue color workers

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## INTRODUCTION

The prevalence of hepatitis B (HBV) virus infection gives a great deal of concern in Saudi Arabia. The infection is particularly high among the underprivileged because of the common use of injections, and their countries of origin where the virus is highly endemic.<sup>1-3</sup>

The population of Saudi Arabia was estimated at 25,795,938 in July 2004, with a growth rate of about 2.4%. Out of this, 5,576,076 are non-nationals (21.6%). Nearly 100,000 foreigners enter the country each year, mostly to fill specific job openings. Immigrant workers come primarily from other Arab and Muslim countries, including many from South East Asia<sup>4</sup> and the Philippines.

Worldwide, the most important etiological factor associated with HCC is chronic infection with hepatitis B virus (HBV), which is responsible for about 80% of all cases of HCC.<sup>5</sup> The Asian expatriates in Saudi Arabia and their offspring remain at increased risk because hepatocellular carcinoma (HCC) is the most common malignancy in many Asian countries.<sup>6,7</sup> The prevalence of HBsAg in HCC patients is significantly higher. Besides, there is a high risk of HCC in the presence of HBsAg alone in Saudi Arabia.<sup>8</sup> HBV is highly endemic in Asian countries,<sup>9</sup> and evidence of past infection was found in up to 65% of immigrants from some regions<sup>10</sup> in a study in Canada.

Prevention of HCC relies on both serologic screening to identify chronic carriers of HBV as well as HBV vaccination of those lacking immunity.<sup>11,12</sup> In Saudi Arabia, there is an excellent program for screening expatriates. Although there is no data available for the prevalence of Hepatitis B virus among expatriates, studies show a reduction in the Saudi population.<sup>13-15</sup>

A number of studies<sup>16,17</sup> that explored patients' knowledge about HBV indicated that the status of vaccination is related to educational level and some other socio-demographic factors.<sup>18</sup> Although

the chances of underprivileged social classes developing HBV infection are higher,<sup>1,2</sup> no study has been conducted so far specifically exploring the knowledge of HBV infection among blue collar workers particularly in Saudi Arabia.

Hence, this paper presents the knowledge of blue collar expatriate workers on HBV infection. It also describes the association between the participants' socio-demographic characteristics, vaccination status and their level of knowledge.

## MATERIAL AND METHODS

### Study design & sample size

It was a community-based cross-sectional survey conducted in 2005. The Ethics Committee approval was received from the Central Hospital, Ministry of Health, Northern Saudi Arabia. During the study, there were 18636 (0.53% of total Non-Saudi males in the Kingdom) non-Saudi residents in Northern region, 51% being blue-collar workers.<sup>19</sup> A blue-collar worker is differentiated from a white-collar worker and service employees, in that the blue-collar worker earns an hourly wage for manual labor and not a monthly salary like a white-collar worker for the service industry.<sup>20</sup> Both skilled and unskilled blue collar workers were included.

Out of expatriates living in four main (Arar, Turaif, Rafah and Al-vagilla) accessible areas excluding all the desert areas, 690 adult male blue collar workers were identified through the snow ball (respondent-driven sampling)<sup>21,22</sup> technique for the survey. Only 25 persons refused to participate. Out of these, eight persons spoke too little English and Arabic to be able to give proper answers to the questions. However, the overall response rate was 95%. The level of significance was 0.05. The knowledge of HBV is expected to be around 35%,<sup>23</sup> with an effective interest of 10%. The estimated power of the study was calculated as 96.1%.

### Survey instrument

A 21-item questionnaire was prepared and used by the researchers to collect data. The instrument was tested on 10 individuals and then corrections made. The majority of the survey questions were taken or adopted from survey instruments used to evaluate childhood HBV immunization projects funded by the Centers for Disease Control and Prevention.<sup>24</sup> A series of 12 questions asking for respondents' knowledge about HBV infection were included. The questionnaire also included socio-demographic questions and it was developed in English as well as in Arabic language.

### Data collection

The study was publicized verbally in shops, restaurants and mosques. An introductory letter was given to some selected people, who showed interest in participating in the study and their advice was sought on how to approach other people. The interviews were conducted in their homes after obtaining a written consent, confirmation of their profession (only those classified as "blue collar" according to Morris et al<sup>20</sup> in their current job were included in the study) and confirming their addresses. Since most expatriate blue collar workers in Saudi Arabia live in dormitories which take one to four persons, it was possible to find more than 50 persons in one building. Consequently, it was relatively easy to find enough participants for the study. The researchers had decided on a standard interviewing method to minimize the inter-observer variations.

Furthermore, the interviewers had checked the immunization cards (where available) of the participants for confirmation of immunization status.

### Data analysis

The main outcome variables were the level of knowledge about HBV, and vaccination status. A summary score of knowledge was computed by summing correct responses to the 12 knowledge questions (the maximum possible score was therefore 12). This score was rated as "high" (7 or more correct answers) or "low" (6 or fewer correct answers). The different ethnic groups also were classified into two major categories: Non-Arabic speaking Pakistani, Indians, Bangladeshi, Filipino, and Chinese; and Arabic speaking with Egyptians, Syrians, Sudanese, Somali, Nigerian, and Yemeni. Occupation was further classified as follows:

laborers, street workers, watchmen, helpers etc, were grouped under "Non-skilled blue collar workers" and electricians, mechanics, plumbers, carpenters, machine operators etc, as "Skilled blue collar workers".

The proportion of life spent in Saudi Arabia which is a good measure of acculturation and was calculated from responses to questions about current age (confirmed through their identity card called Iqama) and age on date of first entry to the Kingdom.

Bivariate associations between the outcome variables and socio-demographic factors were examined first by using chi-square test and, where necessary, Fisher's exact test, followed by a logistic regression model where knowledge status was used as the dependent variable with a forward conditional stepwise approach.<sup>25</sup>

## RESULTS

### Study groups

We were able to contact 690 expatriates, 665 of whom were prepared to participate in the study; the response rate was 95%. The mean age of the participants was 45.61 years ( $\pm 8.44$ ), and 53% of them were Non-Arabic speaking while 47% were Arabic speaking. Almost 50% were middle-aged. With regard to their education, slightly more than half (56%) had completed a total 6 years of education. The skilled workers were 51% (Table 1).

### Hepatitis B knowledge & vaccination status

The majority of respondents (85%) had heard of HBV before, and 41.8% of the responders (n=278) had seven or more correct answers out of 12 questions addressing knowledge of transmission and sequelae of HBV. Of the total, 292 subjects (43.9%) had not been vaccinated while the remainder had had full three doses of vaccination (Table 1).

In bivariate comparisons using Chi square, high levels of knowledge on HBV was significantly associated with the level of education ( $p=0.0005$ ), occupation ( $p=0.006$ ), and immunization status ( $p=0.0005$ ). Age ( $p=0.040$ ), life spent in Saudi Arabia ( $p=0.035$ ), and ethnic group ( $p=0.040$ ) were also significantly associated with the level of knowledge (Table 2). Chi square for trend showed a significant linear association between the status of the knowledge of HBV and age (Chi square=4.41;  $p=0.036$ ), as well as level of education (Chi square=56.45;  $p<0.001$ ),

favoring the lower age groups and better education. On the other hand, vaccination status was significantly associated with all factors studied (Table 3).

### Logistic regression modeling

We entered nine socio-demographic acculturation predictors (age, education, marital status, income, proportion of life spent in Saudi Arabia, ethnic group, type of accommodation, occupational and knowledge) into a logistic regression model in order to identify factors which are independently associated with the status of immunization (complete vs. incomplete). All explanatory variables were categorical. Enter method was used in the analysis and -2 log likelihood of the model was 426.440. The model

**Table 1:** Characteristics of study subjects (n=665)

Variables	Frequency (%)
Age (years)	
<40	163 (24.5)
40-59	332 (50.0)
≥60	170 (25.6)
Education (years)	
<6	372 (55.9)
6-11	239 (35.9)
≥12	54 (8.1)
Ethnic groups	
Asians	353 (53.1)
Non-Asians	312 (46.9)
Occupation	
Skilled workers	339 (51.0)
Non-skilled workers	326 (49.0)
Annual income (in Saudi Riyals)	
<24,000	306 (46.0)
24,000-59,999	199 (29.9)
≥ 60,000	160 (24.1)
Accommodation	
Living alone	93 (14.0)
With family	113 (17.0)
With others	459 (69.0)
Religion	
Muslim	406 (61.1)
Christian	186 (28.0)
Budhist	73 (11.0)
Marital status	
Married	273 (41.1)
Single	339 (50.1)
Divorced	53 (8.0)
Time in Saudi Arabia (years)	
< 5	120 (18.04)
5-10	120 (18.0)
≥ 11	213 (32.0)
Immunization status	
Vaccinated	373 (56.0)
Not vaccinated	292 (43.9)
Level of knowledge	
High	278 (41.8)
Low	387 (58.2)

**Table 2:** Hepatitis B knowledge in relation to socio-demographic variables (n=665)

Variables	High knowledge N=278 (41.8%)	Low knowledge N=387 (58.2%)	p-value
Age (years)			0.040
<40	82 (29.5)	81 (20.9)	
40-59	130 (46.7)	202 (52.1)	
≥60	66 (23.7)	104 (26.8)	
Education (years)			0.0005
<6	125	240	
6-11	91	146	
≥12	62	1	
Ethnic groups			0.040
Asians	161	192	
Non-Asians	117	195	
Occupation			0.006
Skilled workers	120	206	
Non-skilled workers	158	181	
Annual income (in Saudi Riyals)			0.155
<24,000	140	166	
24,000-59,999	78	121	
≥ 60,000	60	100	
Accommodation			0.276
Living alone	45	48	
With family	50	63	
With others	183	276	
Religion			0.145
Muslim	30	43	
Christian	67	119	
Budhist	181	225	
Marital status			0.056
Married	130	209	
Single	129	144	
Divorced	19	34	
Time spent in Saudi Arabia (years)			0.035
< 5	59	61	
5-10	96	117	
≥ 11	123	209	
Immunization status			0.0005
Vaccinated	203	170	
Not vaccinated	75	217	

was able to predict the status of immunization with 71.1% sensitivity and 90.3% specificity. We found that knowledge was the only independent variable effecting status of immunization with an odds ratio of 12.9 (p<0.001).

### DISCUSSION

Hepatitis B virus (HBV) infection is a serious health problem worldwide. It is a significant burden on the health services especially in developing countries with limited resources. The most serious outcome of hepatitis B infection is chronic liver disease, which can range from chronic hepatitis resulting in cirrhosis to

**Table 3:** Immunization status for Hepatitis B in relation to socio-demographic (n=665)

Variables	Vaccinated (n=373)	Not vaccinated (n=292)	p-value
Age (years)			0.0005
<40	140	23	
40-59	233	99	
≥60	0	170	
Education (years)			0.0005
<6	258	107	
6-11	72	165	
≥12	43	20	
Ethnic groups			0.004
Asians	286	67	
Non-Asians	87	225	
Occupation			0.003
Skilled workers	277	62	
Non-skilled workers	96	230	
Annual income (in Saudi Riyals)			0.006
<24,000	250	56	
24,000-59,999	123	76	
≥ 60,000	0	160	
Accommodation			0.005
Living alone	81	12	
With family	89	24	
With others	203	256	
Religion			0.0002
Muslim	326	80	
Christian	47	139	
Budhist	0	73	
Marital status			0.0003
Married	227	193	
Single	146	46	
Divorced	0	53	
Time spent in Saudi Arabia (years)			0.004
< 5	105	15	
5-10	167	46	
≥ 11	101	231	

primary hepatocellular carcinoma with a case-fatality rate of about 1% in acute hepatitis cases.<sup>26</sup> Carrier rates of 5-15% have been reported from different regions.<sup>27,28</sup> Certain occupational groups are especially at risk. Since Saudi Arabia admits nearly 100,000 foreign workers<sup>29</sup> from different parts of the world (especially underdeveloped and developing countries) it is important to deal with the problem of local and international control of HBV infection. Evidence in KSA has shown that at least 4.1 % of the population is HBsAg positive.<sup>30</sup> Other studies have also reinforced the notion that the most dominant type of hepatitis infection is hepatitis B virus (HBV), followed by hepatitis C virus (HCV), and to a lesser extent hepatitis A virus (HAV).<sup>31,32</sup>

The most important preventive measures in HBV infection are screening and immunization.<sup>33</sup>

In the Kingdom of Saudi Arabia (KSA), there is an excellent program for screening expatriates. They can only have the residence permit after a certified health check. However, the immunization status of expatriates remains unclear. This study showed that slightly above 40% of the respondents had not been vaccinated while the remaining 60% had had all three doses of vaccination. This might indicate that the screening program itself is not enough motivation for vaccination. Other socio-demographic factors certainly have their role as demonstrated in our study. Additionally, some other barriers such as the cost of vaccination (loss of salary or direct costs to the individual) could be avoided if the charges paid by these hourly-paid workers are cancelled. This might also play an important role in the prevention and transmission of the disease.

Occupation might be an important factor in determining the level of knowledge. However, more importantly, it determines those at a higher risk of being exposed and spreading the disease. Detailed employment status was not required in this study. Hence, we can not comment on the individual risks to the different participants, though the level of immunization in our population can be regarded as good compared to other studies. Due to the recent efforts of the World Health Organization (WHO) to control HBV, many countries have implemented immunization programs for children resulting in higher immunization levels among younger age groups with high as 90% coverage rates.<sup>34</sup> Unfortunately, this is not the same for older people. The low level of knowledge in non-skilled workers puts them at a greater risk. It is therefore necessary that the work they actually do should be explored.

Ethnic background is clearly an important factor affecting many health indices. This might be due to the resources of the individual society as well as such other variables as cultural factors. For example, among the Hmong youth in California, sexual transmission of HBV is known only by 49 % of the population and HBV vaccination prevalence remains low (12%).<sup>35</sup> Another study demonstrated that only 51% of fourth grade primary school children living in Los Angeles of Asian Pacific origin had full vaccination against HBV.<sup>36</sup> The significant difference in HBV knowledge between participants of Non-Arabic vs. Arabic background in our study, showed a higher degree of knowledge among non-Arabs but this could not be

supported by the literature. A further classification of ethnic origins would clarify this question. Anyway, the possible differences among different backgrounds should stimulate public health planners and policy makers to develop different approaches for different groups of individuals according to their needs.

Among workers who had been in Saudi Arabia for less than five years, the uptake was 105/120 or 87.5%, while for those who had been in the country for 11 years or more, reported vaccination levels were 101/332 or 30.4%. This suggests that within the system, the availability of information and ease of access to vaccination are as important as the individual's knowledge about hepatitis B. It might be due to an improvement of the dissemination of information in last ten years, and particularly in case of Saudi Arabia, the screening program and legislation.

There are strong associations among some of the factors in our study. This might have a confounding effect in bi-variate analyses. In fact, life spent in KSA is as related to age as educational status is related to occupation, income, and accommodation. As a matter of fact, the logistic regression model demonstrates that the only independent variable predicting immunization status among those studied is the status of knowledge. Although factors such as the country's resources, preventive policies,<sup>37</sup> primary care organization,<sup>38</sup> and the knowledge and attitude of health professionals are all important in the struggle with HBV infection, our study suggests that we should concentrate on factors affecting the knowledge of the individual. All efforts should be made to increase the awareness and knowledge of the population on HBV infection.

In this study, we attempted to survey a representative sample of the expatriate population living along the northern borders of KSA. However, there were several limitations to our study. First, our sampling frame was based on verbal advertisement in different places where expatriates usually gathered which might have produced some selection bias (i.e. those who had participated might have higher level of knowledge as compared to those who did not). However, it might have had the advantage of even reaching illegal residents. Second, it was based on males only and therefore, can not be generalized to the whole population. We should mention here that the number of female expatriate workers in KSA is small compared with males since most of them

are maids or home help and therefore, difficult to reach. In addition, our survey did not include questions on family history or carrier status, which might have played an important role.

Despite the few limitations of our study, our model of predicted variables had 71.1% sensitivity and 90.3% specificity and it showed that expatriates had a reasonably good immunization status, with less good knowledge about HBV infection. Moreover, socio-demographic factors such as education, age, income, life spent in KSA, and marital status that have some direct or indirect impact on the level of knowledge might be taken into account while assessing the immunization status of those populations made up of a small number of expatriate or immigrants. Because of the association between these factors and the knowledge of HBV and the vaccination status, the success of any plans for immunization campaign would depend on whether all socio-demographic factors are considered.

Clearly, health promotion programs for expatriates on HBV need to be targeted and based on a thorough understanding of their knowledge, beliefs and cultural practices with regard to the infection. It should also focus on the improvement of their access to information and vaccine.

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## REFERENCES

1. Sahajian F, Voirin N, Vanhems P, Fabry J. Knowledge of hepatitis B and C among underprivileged people. *Rev Epidemiol Sante Publique* 2005;53(1):25-42.
2. Caruana SR, Kelly HA, De Silva SL, Chea L, Nuon S, Saykao P, Bak N, Biggs BA. Knowledge about hepatitis and previous exposure to hepatitis viruses in immigrants and refugees from the Mekong Region. *Aust N Z J Public Health* 2005;29(1):64-8.
3. Arya SC, Agarwal N, Ayoola AE. Hepatitis B viral infection in South west Saudi Arabia. *Saudi Med J* 2004;25(3):390.
4. Library of congress-Federal Research division, Country profile: Saudi Arabia, March 2005.
5. Chen CJ, Yu MW, Liaw YF. Epidemiological characteristics and risk factors of Hepatocellular carcinoma. *J Gastroenterol Hepatol* 1997; 12: S294-308.
6. London WT, McGlynn KA. Liver cancer. In: Scottenfeld D, Fraumeni JF (Eds.). *Cancer epidemiology and Prevention*. New York: Oxford University Press, 1996.
7. Di Busceglie AM, Rustgi VK, Hoofnagle JH, Dusheiko GM, Lotze MT, NIH conference: Hepatocellular carcinoma. *An Intern Med* 1988;108:390-401.
8. Ayoola EA, Gadour MO. Hepatocellular carcinoma in Saudi Arabia: role of hepatitis B and C infection. *J Gastroenterol Hepatol* 2004;19(6):665-9.

9. Gust ID. Epidemiology of hepatitis B infection in Western Pacific and South East Asia. *Gut* 1996;38(Suppl2): S18-S23.
10. Tong MJ, Hwang SJ. Hepatitis B virus infection in Asian Americans. *Gastroenterol Clin N Am* 1994;23:523-36.
11. Centers for Disease Control and Prevention. Screening for Hepatitis B virus infection among refugees arriving in the United States. *Morb Mortal Wkly Rep* 1991; 45: 784-7.
12. Rachiotis G, Goritsas C, Alikakou V, Ferti A, Roumeliotou A. Vaccination against hepatitis B virus in workers of a general hospital in Athens. *Med Lav* 2005;96(1):80-6.
13. Ayoola AE, Tobaigy MS, Gadour MO, Ahmad BS, Hamza MK, Ageel AM. The decline of hepatitis B viral infection in South-Western Saudi Arabia. *Saudi Med J* 2003; 24(9):991-5.
14. El Beltagy KE, Al Balawi IA, Almuneef M, Memish ZA. Prevalence of hepatitis B virus markers among blood donors in a tertiary hospital in Tabuk, northwestern Saudi Arabia. *Int J Infect Dis* 2008;12(5):495-9.
15. Al-Faleh FZ. Changing pattern of hepatitis viral infection in Saudi Arabia in the last two decades. *Ann Saudi Med* 2003;23(6):367-71.
16. Khuwaja AK, Qureshi R, Fatmi Z. Knowledge about hepatitis B and C among patients attending family medicine clinics in Karachi. *East Mediterr Health J* 2002;8(6):787-93.
17. Jackson JC, Rhodes LA, Inui TS, Buchwald D. Hepatitis B among the Khmer. Issues of translation and concepts of illness. *J Gen Intern Med* 1997;12:292-8.
18. Taylor VM, Jackson JC, Pineda M, Pham P, Fischer M, Yasui Y. Hepatitis B knowledge among Vietnamese immigrants: Implications for prevention of Hepatocellular carcinoma. *J Cancer Educ* 2000;15:51-5.
19. Demographic Survey Report 1421H-2001. Central Department of Statistics. [www.cdsi.gov.sa/asp/indexeng.asp](http://www.cdsi.gov.sa/asp/indexeng.asp)
20. Morris, R. and Carstairs, V. (1991), 'Which deprivation? A comparison of selected deprivation indices', *Journal of Public Health Medicine* 1991;13: 318-26.
21. Ompad DC, Galea S, Marshall G, Fuller CM, Weiss L, Beard JR, et al. Sampling and recruitment in multilevel studies among marginalized urban populations: the IMPACT studies. *J Urban Health*. 2008;85(2):268-80.
22. Palese A, Regattin L, Bertolano T, Brusaferrero S. Nurses staffing in surgical and orthopedical wards in a sample of Italian hospitals. Preliminary results of a descriptive study. *Assist Inferm Ric* 2006;25(4):206-13.
23. Sahajian F, Voirin N, Vanhems P, Fabry J. Knowledge of Hepatitis B and C Among Underprivileged People. *Rev Epidemiol Sante Publique* 2005;53:25-42.
24. Euler GL. Asian and Pacific Islander child hepatitis B vaccination catch-up: Why now is the best time? *Asian Am Pacific Isl Health* 1997; 5:40-5.
25. Rosner B. *Fundamentals of Biostatistics*. Boston: Duxbury, 1999.
26. Ghendon, Y. Perinatal Transmission of Hepatitis B Virus in High-Incidence Countries. *J Virol Methods* 1987;17:69-79.
27. Adebamowo, C. A.; Ajuwon, A. The Immunization Status and Level of Knowledge About Hepatitis B Virus Infection Among Nigerian Surgeons. *West Afr J Med* 1997;16:93-6.
28. Country profile: Saudi Arabia. Library of congress-Federal Research Division. 2006. 14-8
29. Al-Sarheed M. Occupational exposures and hepatitis B vaccination statuses in dental students in Central Saudi Arabia. *Saudi Med J* 2004;25(12):1943-6.
30. Memish Z, Qasim L, Abed E, AlBasheer A, Aldraihi A, Knawy B, Hajeer AH. Pattern of viral hepatitis infection in a selected population from Saudi Arabia. *Mil Med* 2003;168(7):565-8.
31. Lee CY, Naguel C, Gyurech D, Duvoisin N, Schilling J. Awareness of Vaccination Status and its Predictors Among Working People in Switzerland. *BMC Public Health* 2003;3:18.
32. de la HF, Perez L, Wheeler JG, de NM, Hall AJ. Vaccine Coverage With Hepatitis B and Other Vaccines in the Colombian Amazon: Do Health Worker Knowledge and Perception Influence Coverage? *Trop Med Int Health* 2005;10:322-9.
33. Kuo I, Sherman SG, Thomas DL, Strathdee SA. Hepatitis B Virus Infection and Vaccination Among Young Injection and Non-Injection Drug Users: Missed Opportunities to Prevent Infection. *Drug Alcohol Depend* 2004;73:69-78.
34. Vitale F, Di Benedetto MA, Casuccio A, Firenze A, Calandra G, Ballaro F, et al. The Influence of Professional Degree on the Knowledge of HIV, HBV and HCV Infections in Dentistry Practice. *Ann Ig* 2005;17:185-96.
35. Butler LM, Mills PK, Yang RC, Chen MS Jr. Hepatitis B Knowledge and Vaccination Levels in California Hmong Youth: Implications for Liver Cancer Prevention Strategies. *Asian Pac J Cancer Prev* 2005;6:401-3.
36. Pulido MJ, Alvarado EA, Berger W, Nelson A, Todoroff C. Vaccinating Asian Pacific Islander Children Against Hepatitis B: Ethnic-Specific Influences and Barriers. *Asian Am Pac Isl J Health* 2001;9:211-20.
37. Harwood SE. Federal Regulations for Implementing Infection Control Policies to Reduce Health-Care Workers' Risks. *Occup Med* 1989; 4 Suppl:115-6.
38. Budd J, Robertson R. Hepatitis C and General Practice: the Crucial Role of Primary Care in Stemming the Epidemic. *Br J Gen Pract* 2005;55:259-60.