

Hepatitis B in Moroccan health care workers

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Aim	To evaluate knowledge and perception of hepatitis B, including prevention, among Moroccan health care workers (HCWs) and to estimate seroprevalence of hepatitis B and vaccine coverage (VC).
Methods	Four hundred and twenty HCWs were randomly selected and stratified by site: 120 in Rabat, 140 in Taza and 160 in Témara–Skhirat. The study included an anonymous questionnaire about knowledge of hepatitis B and its prevention and a serological survey. Oral statements and vaccine registers were used to analyse the VC of the HCWs. Serological testing and VC were analysed according to the occupational exposure.
Results	Participation rates in the questionnaire and serological tests were 68% (285/420) and 66% (276/420), respectively. Fifteen (5%) HCWs had a history of hepatitis B. All HCWs considered that hepatitis B virus (HBV) infection may be acquired through blood exposure. Vaccination was acknowledged as a necessary means against HBV transmission by 276 (98%) HCWs. Forty-two per cent HCWs had no HBV serological markers. The prevalence of hepatitis B surface antigen was 1%. The mean prevalence of hepatitis B core antibody (anti-HBc) was 28% and was significantly higher ($P < 0.05$) among nursing auxiliaries (57%), nurses (30%), medical physicians (31%) and midwives (25%) than among laboratory technicians (13%). According to the vaccination registers (available in two sites), VC (≥ 3 doses) was 55%. VC was 75% among midwives, 61% among nurses, 53% among nursing auxiliaries and 38% among medical staff. Of the fully vaccinated HCWs without anti-HBc, 51% had serological evidence of protection.
Conclusion	HBV vaccines should be more readily available for Moroccan HCWs by reinforcing current vaccination programmes.
Key words	Cross-sectional study; HBV seroprevalence; HBV vaccine coverage; health care workers; hepatitis B; intermediate endemicity; knowledge; Morocco—Rabat.

Introduction

Health care workers (HCWs) represent one of the largest risk groups for hepatitis B virus (HBV) infection worldwide [1]. In countries with a low prevalence [hepatitis B surface antigen (HBsAg) prevalence $< 2\%$] of HBV (mainly in western Europe and North America), HBV vaccination programmes for HCWs were initiated in the early 1980s, with immunization being mandatory

in some western European countries [1]. In France, this strategy, associated with a reinforcement of universal precautions, quickly resulted in a decrease in occupationally acquired HBV rates in hospitals and in health-related settings [2].

Morocco is among the intermediate (HBsAg prevalence 2–7%) endemic countries. In the 1980s, the seroprevalence of HBV markers reached 50% in blood donors, hospitalized patients and HCWs [3–6]. Thus, in 1993, the Moroccan health authorities initiated a vaccination programme targeting HCWs. Vaccination is strongly advised but is not mandatory, and, to date, owing to recurrent vaccine shortages and lack of long-term funding in Morocco, a significant proportion of HCWs are not vaccinated. In 2000, the National Program of Immunization (NPI) estimated the number to be at least 20 000.

In a recent survey, we observed that Moroccan HCWs still had a poor perception of the risk of HBV infection with regard to occupational blood exposure, such as needlestick injuries [7]. In addition, non-specific preventive

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measures (hand cleaning, disposable medical equipment, educational campaigns and proper sterilization) are inadequate in some Moroccan health care facilities [8]. The differing views on the possible adverse effects of HBV vaccines, such as multiple sclerosis, which were aired in public debate in France, may also have negatively influenced the opinion of Moroccan HCWs, whose medical background is predominantly French, about the need for HBV vaccination [9–11].

Since the introduction of the vaccination programme initiated by the NPI, there have been no published studies on HBV markers among Moroccan HCWs. For this reason, and having previously studied the perception of occupational risk for blood exposure of HCWs in three Moroccan health care centres and their implementation of universal precautions [7,8], we carried out the present study to determine their immune status against HBV and their hepatitis B vaccination status. This study also aimed to determine their level of knowledge of HBV and HBV vaccination and their attitudes towards immunization.

Methods

The multicentric study was conducted to identify different occupational risks of acquiring HBV infection in HCWs at three different sites in Morocco: Rabat (capital, 1 million inhabitants), Témara–Skhirat on the Atlantic coast close to Rabat and Taza located in the north-east of the country 320 km from Rabat.

Participants in the Rabat population study were mainly recruited among laboratory technicians from the National Hygiene Institute, which is the main National Public Laboratory in Morocco and a member of the World Health Organization Reference Laboratory Network. Recruits for the Témara–Skhirat study were mainly health care providers working in dispensaries while those in Taza were mainly hospital health care providers (nurses, midwives, physicians, surgeons and anaesthetists).

In March 2000, a cross-sectional observational HBV marker survey was carried out among a randomly selected third of the population from each site: 120 in Rabat, 140 in Taza and 160 in Témara–Skhirat. Thus, of the total 1200 HCWs, we selected 420 subjects stratified by site. All subjects finally enrolled also completed a questionnaire on their knowledge of HBV and HBV vaccination.

The research protocol was approved by the Moroccan health authorities and by the Moroccan National Medical Association. All participants gave written informed consent to participate. Each personal interview was carried out in full respect of confidentiality. All HCWs were provided with the results of their serological tests and any further information they wished to have.

Face-to-face interviews were performed by two trained interviewers, one biologist and one occupational physi-

cian, who spoke both French and Moroccan. They used a structured questionnaire to record sociodemographic and occupational details, prior symptomatic hepatitis, HBV vaccination status, occupational and non-occupational risk factors and knowledge of HBV and HBV vaccination. Work-related risk factors included questions about occupation, years of education as a health professional, length of health care employment and instances of blood exposure. Non-occupational risk factors included questions about health care-associated risks (e.g. blood transfusion, dialysis and surgery) and individual lifestyle risks. Knowledge regarding HBV included questions about prevalence of the disease, routes of transmission, potential health consequences of transmission and the course and severity of the disease. Attitudes towards HBV immunization included questions concerning its usefulness, whether it should be performed before employment or on appointment, side effects and effectiveness, the desire to have serological tests before vaccination and the cost and reimbursement of HBV vaccination. The participants were questioned about their HBV vaccination status, which was checked against vaccine registers.

HBV vaccines used were successively Recombivax HB* (Korea Green Cross Corporation) and Engerix B 20* (Smith Kline Beecham Laboratories).

Venous blood samples were taken from every participant in accordance with universal precautions. Every blood sample was tested for the determination of HBsAg, hepatitis B surface antibody (anti-HBs) and hepatitis B core antibody (anti-HBc), using commercial enzyme-linked immunosorbent assay (ELISA) kits (Abbott Laboratories) in a single laboratory. All these kits had been registered at the Department of Evaluation of Medical Procedures at the French Health Security Agency for Health Products (Paris).

We used a subset of 810 Moroccan voluntary blood donors recruited in March 2000 as a control population. Routine screening of blood donors for HBsAg was first introduced in Moroccan Blood Transfusion Centres in February 1982 and has been performed by ELISA tests since 1 July 1985. In addition to the data on HBsAg prevalence in this population of donors, the blood transfusion centre of Rabat at our request determined anti-HBc (Monolisa, Bio-Rad Laboratories). Available variables from this data set were age, gender, HBsAg and anti-HBc. Since the control population of blood donors was statistically younger (mean age: 41.7 versus 30.9 years) and had a different sex ratio F:M (0.61 versus 0.3), a multivariate analysis was conducted to compare prevalence of anti-HBc in the two populations.

Epi-info 2000 (Centres for Disease Control and Prevention/World Health Organization) was used to enter and validate data and for statistical calculations. χ^2 test, Fisher's exact test and Student's *t*-test were used as appropriate. A *P*-value <0.05 was defined as statistically significant. A multivariate analysis was performed using adjusted odds ratio (OR) and 95% confidence intervals.

Results

The questionnaire response rate was 68% (285/420). It was statistically higher ($P < 0.001$) in Taza (113/140 = 81%) than in Témara-Skhirat (101/160 = 63%) and Rabat (71/120 = 59%). One hundred and thirty-five subjects did not take part in the survey: 49 in Rabat were not sufficiently well informed and did not wish to participate, while the other 86 were HCWs on holiday, sick-leave, on a training course or simply declined to participate on the days the survey was conducted.

The participants had a mean (\pm SD) age of 41.4 ± 7 years and there was female preponderance (174/285 = 61%). Mean (\pm SD) employment duration in the occupation was 17 years (± 7 years). The overall population included 133 (47%) nurses, 57 (20%) laboratory technicians, 45 (16%) doctors (36 medical physicians, 5 anaesthetists and 4 surgeons), 21 (7%) nursing auxiliaries and 12 (4%) midwives. The remaining participants were theatre assistants (6), cleaners (4), medical secretaries (4), sterilization workers (2) and ambulance man (1).

Of the HCWs, 15 (5%) had a history of HBV infection confirmed by serology, 40 (14%) a history of jaundice and 10 (4%) a history of presumed viral hepatitis. A total of 223 (48%) HCWs reported a past history of invasive surgical procedures, in particular circumcision, performed in the past by barbers but now in hospitals or private clinics. Seventeen subjects (6%) had received a blood transfusion. Hepatitis B seroprevalence of those who gave a history of invasive surgical procedures or receiving a blood transfusion did not significantly differ from those who had no medical history.

Two hundred and fifty-five subjects (96%) thought hepatitis B could be serious; of these, 220 (95%) seemed to be aware of complications related to chronic hepatitis B, 151 (68%) that acute hepatitis B could be fatal and 95 (37%) considered that hepatitis spontaneously healed. There was overall awareness of acquisition of HBV infection through blood transfusion (100% of 271 responses) or vertical transmission (97% of 271 responses). Eighty-five per cent of HCWs (out of 250 responses) were aware that HBV was also a sexually transmitted disease and 259

subjects (93%) mentioned the use of a condom as an effective means of prevention. Two hundred and forty-three subjects (87%) thought that washing one's hands could prevent HBV transmission. Prevention by the use of disposable gloves was approved of by 271 HCWs (96%).

Vaccination was acknowledged as a necessary means against HBV transmission by 276 (98%) persons; 253 (96%) considered it to be effective while 39 (16%) thought HBV vaccine was not free from adverse side effects. Vaccination against HBV was regarded as essential in the workplace by 277 (98%) as was serological screening before vaccination. Two hundred and thirty (81%) agreed that vaccination should be made mandatory for anyone applying for the same position they held. Two hundred and eighty-five HCWs would have preferred being vaccinated before taking up their positions at paramedical and medical schools. Of those HCWs who were vaccinated, 218 (77%) had been vaccinated during vaccination campaigns. One hundred and fifty-three (55%) subjects were willing to pay for vaccination (without having any firm idea of the price), but 277 (98%) of 282 respondents considered that the cost should be borne by the employer.

Of the HCWs vaccinated, 81% (231/285) claimed to have received at least one dose and 36% (102/285) three doses. However, there was a significant ($P < 0.01$) difference between vaccine coverage (VC) based on a declarative assessment and VC as recorded in vaccine registers. In declarative assessments, there was under-reporting by those who had received no or three doses and overestimation by those who had received one or two.

According to the vaccination registers available from Taza and Témara-Skhirat, the VC rate with three doses was 55% (Table 1). The VC rate of at least three doses was 75% (9/12) among midwives, 58% (77/132) among nurses, 50% (4/8) among laboratory technicians, 53% (9/17) among nursing auxiliaries and 39% (11/28) among physicians, 40% (2/5) anaesthetists and 25% (1/4) surgeons.

A total of 273 blood samples were taken and analysed. Two physicians, one biologist and one male nurse refused

Table 1. VC of HCWs ($n = 214$) against HBV according to DA and VRs in two sites (Taza and Témara-Skhirat), Morocco

	VC					
	Taza		Témara-Skhirat		Taza and Témara-Skhirat	
	DA, $n = 113$ (%)	VR, $n = 104$ (%)	DA, $n = 101$ (%)	VR, $n = 93$ (%)	DA, $n = 214$ (%)	VR, $n = 197$ (%)
0 dose	8 (7)	7 (7)	19 (19)	25 (27)	27 (13)	32 (16)
1 dose	15 (13)	7 (7)	17 (17)	10 (11)	32 (15)	17 (9)
2 doses	37 (33)	24 (23)	30 (30)	16 (17)	67 (31)	40 (20)
≥ 3 doses	53 (47)	66 (63)	35 (34)	42 (45)	88 (41)	108 (55)

to be tested, three feared injections and the fourth mistrusted scientists. Two other HCWs claimed they did not wish to be used as guinea pigs. In addition to the above 273 blood samples, the results of three female physicians (whose blood results were available from previous testing) were added to our results. Two were undergoing laboratory investigations: one was a chronic HBsAg carrier and the other had been infected with hepatitis C virus and knew that she was immune to HBV by vaccination. The third physician had contracted and recovered from acute hepatitis B. Hence, the serological results of 276 HCWs were analysed and are shown in Table 2.

HBsAg prevalence was 1% (3/276). Of the three persons involved, two were nurses in Taza who had a history of invasive surgical procedures but were unaware that they had HBV infection. One of the two, a 38-year-old male nurse, had been working for 5 years (three of which were in dispensaries) with no knowledge about exposure to blood accidents and had received only one dose of vaccine. The other, a 54-year-old female nurse, the mother of four children, had been working for 34 years including 27 years in medical analysis hospital laboratories. The third HBsAg carrier was an unvaccinated female physician, who worked in Témara-Skhirat and knew she had HBV infection.

HBsAg prevalence among blood donors was higher than among our study population (2 versus 1%). The prevalence of anti-HBc was 28% (78/276) and increased with age: 16% <35 years, 29% between 35 and 49 years and 41% >49 years. The prevalence of anti-HBc was significantly ($P < 0.05$) higher among health care providers (Taza and Témara-Skhirat) than among laboratory technicians (Rabat) and significantly higher ($P < 0.05$) among nursing auxiliaries (57%), nurses (30%), medical physicians (31%) and midwives (25%) than among laboratory technicians (13%) (Table 2). The prevalence of anti-HBc after adjustment for age and sex was not significantly different between our population of HCWs (28%) and our data set of blood donors (26%).

Table 3 shows the seroprevalence of biological markers and doses of vaccine recorded in registers for 197 partic-

ipants from Taza and Témara-Skhirat. Insufficient information was available for participants from Rabat. The table shows that 66/197 (34%) of all participants had evidence of HBV infection and that the proportion of naive HCWs with anti-HBs ≥ 10 IU/l following full vaccination (≥ 3 doses) was 51% (39/76).

The analysis of vaccine registers showed an increase in the proportion of protected HCWs with the number of HBV vaccine doses received (26–36%).

HCWs who had a poor immune response (anti-HBs < 10 IU/l) did not significantly differ in terms of age and sex from those who had a good immune response (anti-HBs ≥ 10 IU/l). Non-medical HCWs with a secondary school education were better protected (anti-HBs ≥ 10 IU/l) [χ^2 , $P < 0.05$; OR = 1.8 (1.1–2.9)], due to a higher VC, than medical staff.

Discussion

This study showed that Moroccan HCWs are well informed about hepatitis B. Over a quarter of our population study had evidence of HBV infection (28% with anti-HBc), and VC against HBV with three doses, assessed by registers, was poor (55%) among HCWs and better among nurses and midwives than among medical staff.

Of the fully vaccinated HCWs without anti-HBc, one-third (36%) had serological evidence of protection (anti-HBs ≥ 10 mIU/ml), as measured 6 years after initial vaccination.

Strengths of the study included the fact that it was multicentric, which allowed us to include all occupational categories of HCWs. Furthermore, the population was selected at random from 1200 subjects. The participation rate was of particular interest since the study was performed in a developing country where inhabitants are not used to taking part in epidemiological and research studies [12]. All participants received their own results of the serological testing together with a medical interpretation.

One limitation of our study is the size of our population sample due to limited funding and the cost of biological

Table 2. Seroprevalence of hepatitis B markers in HCWs ($n = 276$) according to occupation

	No marker, n (%)	HbsAg, n (%)	Anti-HBc positive, n (%)	Anti-HBs ≥ 10 IU/l, n (%)	Total ^a
Nurses	44 (33)	2 (1)	40 (30)	82 (61)	133
Laboratory technicians	34 (63)	0	7 (13)	19 (35)	54
Physicians	17 (47)	1 (3)	11 (31)	15 (42)	36
Nursing auxiliaries	7 (33)	0	12 (57)	14 (67)	21
Midwives	4 (33)	0	3 (25)	7 (58)	12
Anaesthetists	2 (40)	0	1 (20)	2 (40)	5
Surgeons	0	0	1 (25)	4 (100)	4
Other staff ^b	9 (82)	0	2 (18)	2 (18)	11
Total	117 (42)	3 (1)	77 (28)	145 (52)	276

^aSome HCWs may have two HBV markers.

^bOther staff were cleaners (4), medical secretaries (4), sterilization workers (2) and ambulance man (1).

Table 3. Seroprevalence of biological markers (anti-HBc and anti-HBs) in HCWs ($n = 197$) according to vaccine doses recorded in the registers from Taza and Témara-Skhirat

Serological markers	Number of vaccine doses reported			
	0 dose 32 (16) <i>n</i> (%)	1 or 2 doses 57 (29) <i>n</i> (%)	≥ 3 doses 108 (55) <i>n</i> (%)	Total 197
Naive and no Ab response (anti-HBc and anti-HBs negative)	14 (44)	19 (33)	37 (34)	70 (36)
Immunized with Ab response (anti-HBc negative, anti-HBs positive)	7 (22)	15 (26)	39 (36)	61 (31)
Previous infection with no Ab response (anti-HBc positive, anti-HBs negative)	4 (12)	5 (9)	4 (4)	13 (6)
Previous infection with Ab response (anti-HBc and anti-HBs positive)	7 (22)	18 (31)	28 (26)	53 (27)

Ab, antibody.

testing. Therefore, we had low numbers of certain categories of HCWs (particularly surgeons and anaesthetists), despite the decision to include three sites in order to have a representative description of Moroccan HCWs. In addition, serological testing prior to vaccination of the HCWs had not been performed and we were unable to analyse the vaccine registers of laboratory technicians from Rabat.

The lower prevalence of HBsAg (1%) among HCWs when compared to Moroccan blood donors (2%) from Rabat might be explained by their awareness of the routes of HBV transmission, by efforts made to implement universal precautions by HCWs and by preliminary benefits due to the initiation of national programmes of immunization [13–15].

VC estimated from registers is likely to be more realistic. Analysis of vaccine registers provides reliable data but may overlook vaccinations performed previously in other institutions and underestimate VC. Our study based on vaccine registers concerning HCWs who received three doses showed a 54% VC rate, which is close to the 64% rate found by A. Aouni and colleagues in a Moroccan multicentre study conducted in medical analysis laboratories in Casablanca, Marrakech and Kénitra (21st International Mediterranean Symposium of Health at Work, Marrakech, 26–28 October 2001).

There are several reasons for poor VC at the time of our study in Morocco (55%). Firstly, there is no systematic vaccination before employment or on appointment. Sec-

ondly, vaccination is mainly provided by one-off vaccination campaigns (77%). In addition, there are vaccine shortages and difficulties in supplies depending on the region. Finally, VC may have been influenced by concerns expressed by 16% of staff regarding the questionable causal association between HBV vaccine and multiple sclerosis [9–11].

Poor vaccine protection in our sample population raises several issues. In fully vaccinated HCWs, the age at primo-vaccination was 38 years. This might be too late for optimal protection since older HCWs are more likely to be poor responders [16,17]. However, the rate of vaccine protection (51%) might be underestimated because of the post-vaccine fall in anti-HBs [18–20]. We cannot exclude the possibility that refrigeration of some vaccine batches was suboptimal and that there were variations in shelf life of vaccines according to batches. The mode of administration of the vaccine was not assessed.

Our cross-sectional study showed that HCWs with anti-HBc who received three doses of HBV vaccine were more likely to have a humoral response (anti-HBs ≥ 10 IU/l) than those with undetectable anti-HBc. However, antibody response in fully vaccinated HCWs cannot be assessed properly by our study since its design does not provide any serological data before vaccination.

The readiness of Moroccan health authorities to protect HCWs together with the impressive success of preventive vaccination in developed countries and the organization of health care services in the workplace in Morocco should result in greater VC and protection of HCWs since the price of HBV vaccine is no longer an obstacle in Morocco [21,22]. This approach is consistent with Morocco's adherence to the Expanded Vaccination Program promoted by the World Health Organization.

Key points

- To our knowledge, this study is the first published since the implementation of HBV vaccination programmes for HCWs in Morocco, a region of intermediate HBV endemicity.
- Moroccan HCWs appear to be well informed about hepatitis B, but over a quarter of our study population had evidence of HBV infection.
- VC against hepatitis B with three doses, assessed by registers, was poor among HCWs and better in nurses and midwives than in medical staff.

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Conflicts of interest

None declared.

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