vention group, and it is possible that this group was inherently more likely to accept the influenza vaccine. However, we found low vaccination rates among internal medicine (43%) and family practice (46%) residents before the vaccination program was extended. Interestingly, dermatology residents had the highest vaccination rate (88%) among the residency training programs, and vaccination rates in housekeeping (55%) and in maintenance and engineering (65%) exceeded those for most groups of nurses and residents at the University of Iowa Hospital and Clinics. Unfortunately, no information on what different supervisors did with the vaccination data is available. Finally, our project specifically targeted residents, and, in the future, other hospital staff should be included.

Feeding back information to physicians has been shown to positively affect physician behavior.[5-7] However, we did not inform the residents directly of the vaccination rates; instead, we informed their supervisors. Because we did not feed information back to the residents directly, part of our treatment effect may have been the result of a Hawthorne effect. The Hawthorne effect refers to the observation that individual and group behaviors are often altered when individuals or groups know that they are being studied. Investigators have previously suggested that the Hawthorne effect be used to change the behavior of healthcare workers in the desired direction.[8-10] Informing healthcare workers that their vaccination status is being observed may help to increase vaccination rates. In the future, we hope to assess the effect of communicating this information both at the group level and at the individual level.

Our targeted intervention increased influenza vaccination rates. The critical components of this intervention included informing departments that their vaccination rates were being monitored and providing supervisors with the vaccination rates of their residents. Healthcare epidemiologists could use this inexpensive approach to increase influenza vaccination rates among healthcare workers.

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Prevalence of Needlestick Injuries Among Medical Students at a University in Iran

TO THE EDITOR—The incidence of human immunodeficiency virus (HIV) infection in Iran is increasing at an alarming rate, especially among intravenous drug abusers. In different areas of Iran, the incidence of hepatitis B virus (HBV) infection ranges from 1.75% to 5%, and the incidence of hepatitis C virus (HCV) infection ranges from 0.2% to 1.5%.[1,2] Among the most serious occupational hazards for medical students are injuries from sharp instruments and devices (sharps) and needlestick injuries (NSIs) and the associated risk of exposure to bloodborne viruses, including HBV, HCV, and HIV.[3,4]

The rate of acquisition of a bloodborne virus depends on the prevalence of the virus among the patient population and the susceptibility of the health care worker.[5] Recent estimates of rates of acquisition among susceptible health care workers were 6% to 30% for HBV, 5% to 10% for HCV, and 0.3% for HIV.[6] Administration of preexposure vaccination or prophylaxis is more than 90% effective in the prevention of HBV infection, less effective in the prevention of HIV infection,[7] and not effective in the prevention of HCV infection.

This survey of NSIs was the first conducted among medical students in Iran, to establish the frequency and circumstances of NSIs and to test the students' knowledge of the reporting system. The medical course at Shiraz University of Medical Sciences is 7 years long, during which clinical training lasts for 3 years and is divided into 3 components—studentship (fifth year), externship (sixth year), and, finally, internship (seventh year). During all 3 years, infection control is taught through lectures within courses. The survey tool was a questionnaire that was pretested on a random sample of participants, to ensure practicability, validity, and interpretation of responses. The reliability of the questionnaire was assessed using the Kuder Richardson test, for reliability, and Cronbach's α internal consistency coefficient.

More than half (57.2%) of all 600 medical students were in clinical training, with the majority of students (301 [87.7%] of 343) reporting that they had received information about standard precautions. Since entering their clinical year, 238 (69.4%) of 343 students had experienced a total of 644 NSIs, yielding an NSI-to-student ratio of 1.9 : 1 over the course of, on average, 12 months (maximum, 17 months). Twenty-one percent of students had experienced 2 NSIs, 19.7% had experienced 3 NSIs, and 24.4% had experienced more than 3 NSIs, yielding an NSI-to-student ratio of 2.7 : 1. Most NSIs occurred in a patient's room during a simple procedure, such as venous sampling or intravenous injection ($P < .001$).

Almost all medical students (97.4%) reported routinely wearing gloves when suturing wounds, whereas glove use was poor in all other contexts. Few students (74 [21.6%] of 343) reported that they always used sharps containers to dispose of needles, with few (42 [12.2%]) rarely or never practicing recapping. Most students (89.8%) had been vaccinated against HBV (95% confidence interval, 86.1%-92.8%). Post-injury prophylaxis was given to 13 students: 3 required zidovudine, and 10 required γ-globulin.

Most students (63.3%) reported levels of concern about the risk of contracting a bloodborne virus ranging from "extremely concerned" to "very concerned," yet only 29.4% of students had allowed their concern to influence their decision for a residency specialty placement. Details are shown in the Table.

Our findings in Iran are similar to those of a Taiwanese study, in which 61.9% of nursing students had experienced at least one NSI, with 70.1% occurring in a patient's room.[4] In countries with well-established standard precaution policies, NSIs still occur among medical students but are less frequent and account for only one third of NSIs worldwide; 72.1% of NSIs in those countries occur in a busy clinical area (i.e., the operating room).[3] Many reasons have been postulated for the occurrence of NSIs, including lack of experience in performing procedures, insufficient training, work load, and fatigue.[8,9] Although 87.7% of our students had received standard precaution information, our findings indicate that this level of training is dangerously inadequate. Providing information is not enough; understanding and implementation of safety guidelines are the keys to the prevention of NSIs.[10] Underreporting was endemic in our sample, with 85.3% of injuries not followed up by evaluation. This high level of underreporting supports our argument that students are not prepared during their standard precaution information sessions.

TABLE. Characteristics of Sharps Injuries and Glove Use Reported by Medical Students.

Characteristic reported	No. (%) of Injuries
Where injury occurred	
Patient room	327 (50.7)
Emergency room	317 (33.6)
Operating theater	69 (10.7)
Unstated	36 (5)
Procedure during which injury occurred	
Venous sampling or intravenous injection	235 (39.3)
Wound suturing	190 (29.5)
Arterial puncture	139 (21.6)
Recapping of needle	51 (7.9)
Lumbar puncture	11 (1.7)
Always wearing gloves	
During wound suturing	334 (97.4)
During arterial puncture	85 (24.8)
Wearing double gloves	
When working in operating room	43 (16.5)
When working in emergency room	5 (1.5)
When performing intravenous injection	2 (0.6)
Reason for not routinely wearing double gloves	
Inadequate facilities supply	186 (54.2)
Decreased ability to manipulate tissues and instruments	154 (44.9)
Decreased hand sensation, tingling, numbness	2525 (7.3)
No need because it adds no protection	54 (15.7)
Reason for not reporting injury	
Did not realize all injuries had to be reported	98 (43.3)
Did not know to whom injury should be reported	79 (38.9)
Reporting would not influence the outcome	58 (28.6)

Wearing gloves reduces the exposure of health care workers to bloodborne viruses when they are injured,[11] but half the students did not routinely use gloves. Double gloving is practiced in Iran, when latex gloves are routinely provided, and is practiced elsewhere.[5,11] However, implementation of this protective practice was also poor among our students. Although sharps containers, which are common in countries with well-developed standard precaution practices,[7] are available in Iran, they were rarely used by students, who practiced recapping 87.7% of the time. Providing sharps containers as a matter of policy is not sufficient, and our findings suggest that students need hospitals to provide a safer training environment with a policy of mandatory use of sharps containers, a better level of standard precaution information, and better clinical procedure instructions.

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Effectiveness of Hepatitis B Vaccination

TO THE EDITOR—The theoretical basis for the effectiveness of hepatitis B (HB) vaccination for the prevention of HB virus (HBV) infection has long been accepted; however, to our knowledge, no cases have been reported in which the effectiveness could be conclusively shown in a single human. Recently, a 50-sample pooled nucleic acid amplification test conducted at the Kanagawa Red Cross Blood Center identified an HBV-positive donor (a 43-year-old male public official) who was suspected to be in the HBV window period. His serum HBV DNA level was found to be 6,300 copies/mL by single-sample nucleic acid amplification test; the infection was with a genotype B strain. The donor was positive for anti–HB surface antigen antibody (anti-HBs), but the titer was relatively low (35 mIU/mL) (EIA cutoff value, 5 mIU/mL). Findings for anti–HB core antibody (anti-HBc), HB surface antigen, HB e antigen, and anti–HB e antigen antibody were all negative. The donor kindly provided a second blood sample, and, curiously, the HBV DNA had disappeared—16 days after the first blood donation, the anti-HBs titer had rapidly increased to 574 mIU/mL, and a test for anti-HBc IgM yielded positive results. A confirmation test conducted 30 days after the first donation showed the same results—the donor was negative for HBV DNA and was positive for both anti-HBs (titer, 383 mIU/mL) and anti-HBc IgM. The donor's alanine aminotransferase level was less than 20 IU/L throughout the month he was followed. Testing of plasma from a preserved donation made 372 days earlier showed that, at that time, he was negative for all HBV markers, even anti-HBs (titer, 0.1 mIU/mL). The seroconversion to anti-HBc IgM was deemed to be conclusive evidence of first-time HBV infection. The infection route was not apparent, because he reported no sexual activity or needlestick injury. The donor had received HB vaccination 20 years earlier (at 23 years old), when he worked at a rehabilitation hospital. We concluded that, because of the HB vaccination, the transmitted HBV was cleared rapidly by a secondary immune response.

This case supports the view that HB vaccination is effective against HBV transmission in immunocompetent individuals and also shows that memory cells produced in response to vaccination can last for more than 20 years,[1] even if the anti-HBs titer is very low. To our knowledge, this is the first successful documentation of the effectiveness of HB vaccination in a single human. We were fortunate to identify, from 20 million blood donors in Japan, an individual in the HBV window period who had previously been vaccinated and for whom blood had been stored from a previous donation. Although this very short transient viremia was probably a standard immune reaction to HB vaccination at the DNA level, it brings up another problem for blood centers. Even though a donor has been vaccinated, a short period of viremia may occur after exposure to HBV, which would result in a high risk of HBV transmission by transfusion. Furthermore, it is important that the question of whether such donors should be allowed to reenter donor programs after viral clearance be discussed.

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