

# Public Awareness Campaign and Knowledge Assessment of Iranian (Bio) Medical Students Regarding Hepatitis B and C Infections

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## Abstract

**Background:** New treatment and vaccination strategies provide the opportunity for eliminating viral hepatitis. Lack of adequate knowledge seems to be a barrier against hepatitis elimination due to the emergence of newly infected cases.

**Objectives:** The aim of this study was to evaluate the knowledge of Iranian (bio) medical students regarding hepatitis B virus (HBV) and hepatitis C virus (HCV) infections and to determine the effect of hepatitis public awareness campaign (PAC), held by the students, on the knowledge level.

**Methods:** This prospective study was conducted during PAC by Iran hepatitis network for world hepatitis Day in 2016. The PAC had 2 major parts: 1) training of the registered (bio) medical students in a workshop; and 2) sending the trained students to Tehran metro stations to promote public hepatitis awareness on July 26 - 28, 2016. Hepatitis knowledge of the students was evaluated by a validated questionnaire before the workshop, after the workshop, and after the end of PAC.

**Results:** A total of 91 undergraduate students participated in the workshop, PAC, and the survey. The mean total knowledge scores of the students before and after the workshop were  $56.2 \pm 18.0$  and  $75.8 \pm 17.9$ , respectively. Moreover, the scores further increased to  $96.6 \pm 6.1$  after the end of the campaign ( $P < 0.05$ ).

**Conclusions:** The results demonstrated that knowledge regarding HBV and HCV infections is not sufficient in the study population. Therefore, we suggest using social activities and awareness campaigns to increase awareness among (bio) medical students.

**Keywords:** Knowledge, Hepatitis C, Hepatitis B, (Bio) Medical Students, Health Promotion, Campaign, Iran

## 1. Background

Viral hepatitis is one of the important health problems around the world. Prevalence of hepatitis B virus (HBV) infection is mild in Iran, as reported in less than 2% of the general population (1). The infantile vaccination program established in 1993, along with the vaccination of high-risk groups, has shown positive impacts on decreasing the prevalence of HBV infection in the past decade (2).

Iran has low endemicity for hepatitis C virus (HCV) infection, with a prevalence of less than 0.5% (3). The world health organization (WHO) has set the goal to eliminate HCV by 2030 (4). Although new treatment strategies have provided the opportunity for HCV elimination, effective treatments are not yet adequate (5). Also, insufficient knowledge regarding viral hepatitis seems to be a barrier against disease elimination due to the emergence of newly infected cases (5, 6).

It is well known that healthcare workers are exposed

to an increased risk of blood-borne diseases (7, 8). In fact, the majority have experienced at least 1 occupational injury in the clinical setting (8, 9). The average risk of disease transmission after needlestick exposure to infected blood has been estimated at approximately 0.3% for HIV, 1.8% for HCV, and 6% - 30% for HBV among healthcare workers (8). Overall, risk of transmission is at the highest level in (bio) medical students during their professional health training (10).

Previous studies have shown that the knowledge of Iranian physicians, medical specialists, and (bio) medical students regarding HBV, HCV, and other blood-borne diseases is not adequate (11-13). Furthermore, iatrogenic transmission remains an important route of transmission for HBV and HCV infections (14, 15).

Improvement of the general population's knowledge about viral hepatitis is an important step towards disease elimination. Therefore, public awareness campaigns (PACs) may be helpful in this area (5, 6), even in special pop-

ulations, such as (bio) medical students and healthcare workers (13). Therefore, in the present study, we aimed to evaluate the knowledge level of Iranian (bio) medical students regarding HBV and HCV infections and to determine the effect of a hepatitis PAC, held by the students, on the level of knowledge.

## 2. Methods

A PAC was planned by Iran hepatitis network (IHN) for world hepatitis Day in 2016 (6). This prospective study was performed during this campaign.

### 2.1. Study Population

We made announcements in social networks for registration in the PAC. A total of 151 (bio) medical students registered primarily in our website to join the PAC. Only students, who participated in both workshop and campaign program, were included in the survey (91 out of 151 students).

### 2.2. Campaign Program

The campaign had 2 major parts. The first part was a hepatitis workshop, which was held by IHN on July 24, 2016. In total, 91 students participated voluntarily in the workshop and were allowed to enter the program. Two pamphlets in simple Persian language for HBV, HCV, and PAC materials were prepared. The pamphlets comprised of the epidemiology of HBV and HCV infections in Iran, viral hepatitis elimination programs by WHO and IHN (by 2030), general transmission routes and the most important transmission routes in Iran, harm reduction strategies, false beliefs of the general population about HBV and HCV, diagnostic tests, and treatment strategies focusing on new therapies. Also, some free references were introduced for additional information ([meldcenter.com/book-and-brochur/](http://meldcenter.com/book-and-brochur/)).

In the second part, the trained students were sent to Tehran metro stations to promote public hepatitis awareness during July 26 - 28, 2016. There were 3 shifts every day (10:00 - 13:00, 13:00 - 16:00, and 16:00 - 19:00) in 4 metro stations simultaneously. The students set their station and time of presence voluntarily. During the PAC, more than 400 face-to-face consultations were done by the students (6).

### 2.3. Instrument Validation

A questionnaire, including 15 items, was designed by a gastroenterologist, and each item of the questionnaire was scored for necessity, relevance, clarity, and simplicity by 8 other specialists. Then, the content validity ratio (CVR), as

well as relevance-, clarity-, and simplicity-content validity indices (R-CVI, C-CVI, and S-CVI), was calculated. All 15 questions were included in the questionnaire, as CVR, R-CVI, C-CVI, and S-CVI were above 0.75 for all of them.

### 2.4. Survey

All the participating students completed the questionnaire before (pretest,  $T_1$ ) and after (posttest,  $T_2$ ) the workshop. Also, posttest was repeated right after finishing the campaign (final test,  $T_3$ ). Then, the results of  $T_1$ ,  $T_2$ , and  $T_3$  were compared.

### 2.5. Ethical Considerations

The present study was approved by the ethics committee of Baqiyatallah University of Medical Sciences. All the students participated in PAC and completed the questionnaires voluntarily.

### 2.6. Statistical Analysis

Data were analyzed using SPSS version 21 (IBM Inc., Chicago, IL, USA). The number of correct answers for each question was presented as number and percentage. McNemar's test was used for the comparison of correct answers to each question between  $T_1$ ,  $T_2$ , and  $T_3$ . The total knowledge score was calculated for each participant. Each correct answer was scored 1, while an incorrect answer was scored 0. The total score was calculated as the total score of individual questions and was presented as mean  $\pm$  standard deviation (SD) on a scale of 100. The total knowledge score was compared between  $T_1$ ,  $T_2$ , and  $T_3$  by paired sample t test.

## 3. Results

In total, 91 (bio) medical students (24 males and 67 females) with the mean age of  $21.83 \pm 2.24$  years (range, 18 - 27 years) enrolled in our program. The participants were undergraduate students of medicine (64.8%), midwifery (6.6%), dentistry (6.6%), nursing (5.5%), pharmacy (4.4%), medical virology (4.4%), anesthesia (3.3%), microbiology (2.2%), and physiotherapy (2.2%). They were students of 7 universities of medical sciences in Tehran province (86.8%) and some other provinces (13.2%). The mean duration of students' presence in the stations was  $5.17 \pm 2.98$  hours (minimum, 3 hours; maximum, 18 hours during 3 days).

Overall, 54% of the students were unaware of their HBV vaccination status. Only 23.1% of the participants were familiar with the most prevalent HBV transmission route in Iran before the workshop. The proportion of participants with correct answers increased at  $T_2$  in comparison to  $T_1$ .

The least significant increase in the number of students with correct answers was observed in Q<sub>3</sub> and Q<sub>11</sub> (increased from 85.7% - 86.8% to 87.9% - 89%), while the most significant increase was observed for Q<sub>15</sub> (increased from 46.15% to 83.5%; Table 1).

The increase in the proportion of correct answers was not significant for Q<sub>3</sub> or Q<sub>11</sub> ( $P > 0.05$ ), while it was significant for all other individual questions ( $P < 0.05$ ; Table 1 Figure 1). The mean total knowledge scores of the students before and after the workshop were  $56.2 \pm 18.0$  and  $75.8 \pm 17.9$ , respectively ( $P = 0.001$ ).

The number of participants with correct answers increased at T<sub>3</sub> in comparison with T<sub>2</sub>. The smallest increase in the number of participants with correct answers was observed in Q<sub>2</sub> and Q<sub>5</sub> (increased from 90.1% - 92.3% to 97.8% - 100%), while the largest increase was observed in Q<sub>15</sub> (increased from 46.15% to 93.4%; Table 1). The increase in the proportion of correct answers was significant for all individual questions ( $P < 0.05$ ; Table 1 Figure 1). The mean total knowledge score of the students increased to  $96.6 \pm 6.1$  after the end of the campaign ( $P = 0.003$ ; Table 1). Regarding 8 questions, PAC could increase the number of participants with correct answers more than the workshop (Q<sub>1</sub>, Q<sub>3</sub>, Q<sub>6</sub> - Q<sub>9</sub>, Q<sub>11</sub>, and Q<sub>13</sub>; Figure 1).

#### 4. Discussion

In the present study, we aimed to evaluate the level of hepatitis knowledge in a nonrandom sample of (bio) medical students and to determine the effect of PAC on the level of knowledge. The baseline assessment of the students showed that their knowledge was better in some areas, compared to others. About 86-87% of the students were familiar with blood transmission routes and effective vaccination for HBV, while 13% - 14% did not have adequate knowledge. Only 23.1% of the students were aware of the most prevalent transmission route for HCV in Iran, and 29.7% were familiar with accurate treatment for HCV. The present results also demonstrated an increase in the number of participants with correct answers after holding the PAC.

It is well known that healthcare workers are exposed to an increased risk of blood-borne infections (16-18); this risk is at the highest level during their health professional training (10). HBV infection among healthcare workers has been estimated to be 2 to 4 times higher than the general population (10). Chronic HCV infection is also transmitted by blood-to-blood contact either through drug use or more commonly through healthcare procedures.

A great deal of the global burden of HCV has been attributed to medical professions. Today, we have the opportunity to find and treat infected patients and control dis-

ease transmission (14, 15). WHO has proposed a plan for the elimination of viral hepatitis by 2030 (4, 19), and public awareness seems to be an important step in these programs to avoid person-to-person transmission and help find the unknown cases (5, 6). This awareness is more important in high-risk groups, such as (bio) medical students, compared to other groups; therefore, effective measures should be taken for this important issue in Iran.

The T<sub>1</sub> results demonstrated that the general knowledge of Iranian undergraduate (bio) medical students regarding HBV and HCV infections was inadequate. This finding was in congruence with previous studies regarding hepatitis knowledge of Iranian (bio) medical students (11, 13). In addition, most of the students had passed at least 1 course about blood-borne diseases and harm reduction. Moreover, comparison of T<sub>1</sub> and T<sub>2</sub> results showed that theoretical, educational programs, such as hepatitis workshops, could increase the proportion of participants with correct answers; however, this increase was insufficient.

In a study on the medical interns of Tehran University of Medical Sciences, 25.6% and 32.1% of the participants had 1 and 2 - 4 accidental exposures to blood, respectively. Only 17.6% of the participants always wore gloves during the procedure, and only 5.5% never recapped the needle; in total, 87.5% of the subjects were vaccinated against HBV (20). In this regard, in a study in Cameroon, 55.9% of medical students had accidental exposure to blood, and 54% were not vaccinated against HBV (21). Also, 89% of healthcare workers were unvaccinated for HBV in Tanzania, which could be attributed to unawareness, inadequate knowledge, or impractical knowledge (22).

Among 961 (bio) medical students in Vientiane, only 21% were fully immunized for HBV, and 9.1% received only 1 or 2 doses of vaccine. The main reason for non-vaccination was that they did not know where to get vaccinated. More than 72% of the surveyed students were unable to correctly answer any of the 5 questions about HBV (agent of hepatitis B, mode of HBV transmission, risk factors for hepatitis, main symptoms, and complications); also, 37% were aware of being at risk of HBV infection (7).

In the present study, the number of participants with correct answers increased to 19.6% after the workshop and further increased to 20.8% through PAC. Comparison of T<sub>2</sub> and T<sub>3</sub> results for individual questions also indicated that correct answers can dramatically increase (up to 100%) by holding a social program, such as PAC, after the theoretical educational program. The students were motivated to read more about HBV and HCV infections during the campaign to answer people's questions regarding hepatitis. Also, they were encouraged to read more resources after finishing the campaign.

HBV vaccination is included in Iran's national immu-

**Table 1.** The Proportion of Participants with Correct Answers for Each Question Before and After the Workshop and After the Campaign<sup>a</sup>

Questions	T <sub>1</sub> <sup>b</sup>	T <sub>2</sub> <sup>c</sup>	T <sub>3</sub> <sup>d</sup>	P <sub>1</sub> /P <sub>2</sub> /P <sub>3</sub> <sup>e</sup>
<b>Q<sub>1</sub>. What is the most prevalent transmission route of HBV in Iran?</b> (1: Unsafe injection / 2 <sup>f</sup> : Mother to infant / 3: Unsafe Barbershops / 4: Unsafe cupping)	21 (23.1)	30 (33)	71 (78)	0.004/< 0.001/< 0.001
<b>Q<sub>2</sub>. What is the most prevalent transmission route of HCV in Iran?</b> (1 <sup>f</sup> : Unsafe injection / 2: Mother to infant / 3: Unsafe Barbershops / 4: Unsafe cupping)	54 (59.3)	82 (90.1)	89 (97.8)	< 0.001/0.016/< 0.001
<b>Q<sub>3</sub>. Which one has an effective vaccine?</b> (1 <sup>f</sup> : HBV / 2: HCV / 3: Both / 4: None)	79 (86.8)	81 (89)	91 (100)	0.500/0.002/< 0.001
<b>Q<sub>4</sub>. Can a hepatitis B patient marry without transmitting it to his/her spouse?</b> (1 <sup>f</sup> : Yes / 2: No)	55 (60.4)	82 (90.1)	91 (100)	< 0.001/0.004/< 0.001
<b>Q<sub>5</sub>. Can women with hepatitis B become pregnant and give birth to a healthy baby?</b> (1 <sup>f</sup> : Yes / 2: No)	63 (69.2)	84 (92.3)	91 (100)	< 0.001/0.014/< 0.001
<b>Q<sub>6</sub>. Chronic HBV...</b> (1: Can be cured / 2 <sup>f</sup> : Can be controlled / 3: Both 1 and 2)	52 (57.1)	59 (64.8)	89 (97.8)	0.016/< 0.001/< 0.001
<b>Q<sub>7</sub>. Do chronic HBV carriers need treatment?</b> (1: Yes / 2 <sup>f</sup> : No)	38 (41.8)	54 (59.3)	80 (87.9)	< 0.001/< 0.00/< 0.001
<b>Q<sub>8</sub>. HBV and HCV lead to...</b> (1: Cirrhosis / 2: Liver cancer / 3 <sup>f</sup> : Both 1 and 2 / 4: None)	60 (65.9)	67 (73.6)	90 (98.9)	0.017/< 0.001/< 0.001
<b>Q<sub>9</sub>. Which one is the diagnostic test for HBV?</b> (1: ALT / 2 <sup>f</sup> : HBs-Ag / 3: HBs-Ab / 4: HBe-Ag)	45 (49.45)	65 (71.4)	91 (100)	< 0.001/< 0.001/< 0.001
<b>Q<sub>10</sub>. Which one is the diagnostic test for HCV?</b> (1: ALT / 2: HBe-Ab / 3 <sup>f</sup> : HCV-Ab / 4: HCV-Ag)	44 (48.35)	76 (83.5)	89 (97.8)	< 0.001/< 0.001/< 0.001
<b>Q<sub>11</sub>. Which one can transmit HBV and HCV?</b> (1: Unsafe tattooing / 2: Unsafe cupping / 3: Unsafe injection / 4 <sup>f</sup> : All)	78 (85.7)	80 (87.9)	91 (100)	0.250/0.002/< 0.001
<b>Q<sub>12</sub>. Which drug is used for the treatment of HBV?</b> (1: PEG-interferon / 2: Tenofovir / 3: Adefovir / 4 <sup>f</sup> : All)	45 (49.45)	75 (82.4)	90 (98.9)	< 0.001/< 0.001/< 0.001
<b>Q<sub>13</sub>. Which drug is used for the treatment of HCV?</b> (1: Tenofovir / 2: Lamivudine / 3 <sup>f</sup> : Sofosbuvir / 4: All)	27 (29.7)	42 (46.15)	85 (93.4)	< 0.001/< 0.001/< 0.001
<b>Q<sub>14</sub>. Can kissing and hugging transmit HBV and HCV?</b> (1: Yes / 2 <sup>f</sup> : No)	64 (70.3)	82 (90.1)	91 (100)	< 0.001/0.004/< 0.001
<b>Q<sub>15</sub>. The minimum serum HBs-Ab titer for protection against HBV is...</b> (1: 5 / 2 <sup>f</sup> : 10 / 3: 100 / 4: 1000)	42 (46.15)	76 (83.5)	90 (98.9)	< 0.001/< 0.001/< 0.001
<b>Total knowledge percentage (0 - 100)</b>	56.2 ± 18.0	75.8 ± 17.9	96.6 ± 6.1	0.001/0.003/< 0.001

<sup>a</sup>Data are described as number (%) and mean ± standard deviation. HCV, hepatitis C virus; HBV, hepatitis B virus; ALT, alanine aminotransferase; HBs-Ag, hepatitis B surface antigen; HBe-Ab, hepatitis B core antibody; HBs-Ab, hepatitis B surface antibody; HCV-Ab, HCV antibody.

<sup>b</sup>Before workshop (pretest, T<sub>1</sub>).

<sup>c</sup>After workshop (posttest, T<sub>2</sub>).

<sup>d</sup>After the campaign (final test, T<sub>3</sub>).

<sup>e</sup>P value for comparison between T<sub>1</sub> and T<sub>2</sub> (P<sub>1</sub>), P value for comparison between T<sub>1</sub> and T<sub>3</sub> (P<sub>2</sub>), and P value for comparison between T<sub>2</sub> and T<sub>3</sub> (P<sub>3</sub>).

<sup>f</sup>Correct answer.

nization program for neonates and is strictly enforced. Nevertheless, it is only recommended for healthcare workers and is not strictly enforced for (bio) medical students (20, 23). The present survey showed that 54% of the stu-

dents were unaware of their HBV vaccination status. They also did not have enough knowledge about their hepatitis B surface antibody (HBsAb) titer for protection against HBV. All (bio) medical students, who were enrolled in our

program, were HBV-vaccinated, according to the national vaccination program for HBV vaccination of neonates and adolescents (23). Based on the findings, (bio) medical students and other high-risk groups should ensure protection against HBV through routine HBsAb examination (24).

#### 4.1. Limitations

The present study could not compare the effects of PAC and workshop separately. Nevertheless, it was clear that PAC provides some extra knowledge for the students and increases their level of knowledge. Assessment of knowledge immediately after the campaign might be biased, as it did not evaluate knowledge retention. Also, the study sample was not selected randomly, which might have affected the baseline evaluation of knowledge; therefore, we suggest a national survey on this subject.

#### 4.2. Conclusion

The present results demonstrated that knowledge regarding HBV and HCV infections is inadequate among Iranian undergraduate (bio) medical students. The inadequacy of knowledge can lead to iatrogenic transmission or infection and postpone the elimination of viral hepatitis due to the emergence of new cases. Also, the proportion of correct answers increased up to 100% through holding a social program, such as PAC, after the theoretical educational program. Therefore, we suggest using social activities and campaigns to increase awareness among (bio) medical students. In addition, further national studies are required to confirm the reported findings.

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#### Footnotes

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**Conflicts of Interests:** Seyed Moayed Alavian is the chairman of IHN. Hamidreza Karimi-Sari, Maryam Tajik, and

Mohammad-Ehsan Bayatpoor are the executive managers of Tehran Hepatitis Awareness Campaign, and Heidar Sharafi is the research director of IHN.

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#### References

1. Salehi-Vaziri M, Sadeghi F, Almasi Hashiani A, Gholami Fesharaki M, Alavian SM. Hepatitis B Virus Infection in the General Population of Iran: An Updated Systematic Review and Meta-Analysis. *Hepat Mon.* 2016;**16**(4):ee35577. doi: [10.5812/hepatmon.35577](https://doi.org/10.5812/hepatmon.35577). [PubMed: [27257428](https://pubmed.ncbi.nlm.nih.gov/27257428/)].
2. Alavian SM. Hepatitis B virus infection in Iran; Changing the epidemiology. *Arch Clin Infect Dis.* 2010;**5**(1):51-61.
3. Hajarizadeh B, Razavi-Shearer D, Merat S, Alavian SM, Malekzadeh R, Razavi H. Liver Disease Burden of Hepatitis C Virus Infection in Iran and the Potential Impact of Various Treatment Strategies on the Disease Burden. *Hepat Mon.* 2016;**16**(7):ee37234. doi: [10.5812/hepatmon.37234](https://doi.org/10.5812/hepatmon.37234). [PubMed: [27642346](https://pubmed.ncbi.nlm.nih.gov/27642346/)].
4. Hellard M, Sacks-Davis R, Doyle J. Hepatitis C elimination by 2030 through treatment and prevention: think global, act in local networks. *J Epidemiol Community Health.* 2016 doi: [10.1136/jech-2015-205454](https://doi.org/10.1136/jech-2015-205454). [PubMed: [27343304](https://pubmed.ncbi.nlm.nih.gov/27343304/)].
5. Hesamizadeh K, Sharafi H, Rezaee-Zavareh MS, Behnava B, Alavian SM. Next Steps Toward Eradication of Hepatitis C in the Era of Direct Acting Antivirals. *Hepat Mon.* 2016;**16**(4):ee37089. doi: [10.5812/hepatmon.37089](https://doi.org/10.5812/hepatmon.37089). [PubMed: [27275164](https://pubmed.ncbi.nlm.nih.gov/27275164/)].
6. Karimi-Sari H, Tajik M, Bayatpoor ME, Alavian SM. Increasing the Awareness of the General Population: An Important Step in Elimination Programs of Viral Hepatitis. *Am J Gastroenterol.* 2017;**112**(2):393-5. doi: [10.1038/ajg.2016.534](https://doi.org/10.1038/ajg.2016.534). [PubMed: [28154404](https://pubmed.ncbi.nlm.nih.gov/28154404/)].
7. Pathoumthong K, Khampanisong P, Quet F, Latthaphasavang V, Souvong V, Buisson Y. Vaccination status, knowledge and awareness towards hepatitis B among students of health professions in Vientiane, Lao PDR. *Vaccine.* 2014;**32**(39):4993-9. doi: [10.1016/j.vaccine.2014.07.022](https://doi.org/10.1016/j.vaccine.2014.07.022). [PubMed: [25066734](https://pubmed.ncbi.nlm.nih.gov/25066734/)].
8. Beltrami EM, Williams IT, Shapiro CN, Chamberland ME. Risk and management of blood-borne infections in health care workers. *Clin Microbiol Rev.* 2000;**13**(3):385-407. doi: [10.1128/CMR.13.3.385-407.2000](https://doi.org/10.1128/CMR.13.3.385-407.2000). [PubMed: [10885983](https://pubmed.ncbi.nlm.nih.gov/10885983/)].
9. Mashoto KO, Mubyazi GM, Mohamed H, Malebo HM. Self-reported occupational exposure to HIV and factors influencing its management practice: a study of healthcare workers in Tumbi and Dodoma Hospitals, Tanzania. *BMC Health Serv Res.* 2013;**13**:276. doi: [10.1186/1472-6963-13-276](https://doi.org/10.1186/1472-6963-13-276). [PubMed: [23866940](https://pubmed.ncbi.nlm.nih.gov/23866940/)].
10. Pruss-Ustun A, Rapiti E, Hutin Y. Estimation of the global burden of disease attributable to contaminated sharps injuries among health-care workers. *Am J Ind Med.* 2005;**48**(6):482-90. doi: [10.1002/ajim.20230](https://doi.org/10.1002/ajim.20230). [PubMed: [16299710](https://pubmed.ncbi.nlm.nih.gov/16299710/)].
11. Alavian SM, Mahboobi N, Mahboobi N, Savadrudbari MM, Azar PS, Daneshvar S. Iranian dental students' knowledge of hepatitis B virus infection and its control practices. *J Dent Educ.* 2011;**75**(12):1627-34. [PubMed: [22184603](https://pubmed.ncbi.nlm.nih.gov/22184603/)].
12. Daniali SS, Bakhtiari MH, Nasirzadeh M, Aligol M, Doaei S. Knowledge, risk perception, and behavioral intention about hepatitis C, among university students. *J Educ Health Promot.* 2015;**4**:93. doi: [10.4103/2277-9531.171807](https://doi.org/10.4103/2277-9531.171807). [PubMed: [27462635](https://pubmed.ncbi.nlm.nih.gov/27462635/)].
13. Karimi-Sari H, Bayatpoor ME, Alavian SM. Awareness Campaign in (bio)Medical Students in Iran: a model for increasing the knowledge regarding hepatitis B and C. *Clin Microbiol Infect.* 2016 doi: [10.1016/j.cmi.2016.11.022](https://doi.org/10.1016/j.cmi.2016.11.022). [PubMed: [27956270](https://pubmed.ncbi.nlm.nih.gov/27956270/)].

14. Foster GR. Chronic hepatitis C: less of a problem than first thought?. *Lancet Gastroenterol Hepatol.* 2017;**2**(3):146-7. doi: [10.1016/S2468-1253\(16\)30209-6](https://doi.org/10.1016/S2468-1253(16)30209-6). [PubMed: [28404121](https://pubmed.ncbi.nlm.nih.gov/28404121/)].
15. Lanini S, Easterbrook PJ, Zumla A, Ippolito G. Hepatitis C: global epidemiology and strategies for control. *Clin Microbiol Infect.* 2016;**22**(10):833-8. doi: [10.1016/j.cmi.2016.07.035](https://doi.org/10.1016/j.cmi.2016.07.035). [PubMed: [27521803](https://pubmed.ncbi.nlm.nih.gov/27521803/)].
16. Askarian M, Malekmakan L. The prevalence of needle stick injuries in medical, dental, nursing and midwifery students at the university teaching hospitals of Shiraz, Iran. *Indian J Med Sci.* 2006;**60**(6):227-32. doi: [10.4103/0019-5359.25904](https://doi.org/10.4103/0019-5359.25904). [PubMed: [16790948](https://pubmed.ncbi.nlm.nih.gov/16790948/)].
17. Makary MA, Al-Attar A, Holzmüller CG, Sexton JB, Syin D, Gilson MM, et al. Needlestick injuries among surgeons in training. *N Engl J Med.* 2007;**356**(26):2693-9. doi: [10.1056/NEJMoa070378](https://doi.org/10.1056/NEJMoa070378). [PubMed: [17596603](https://pubmed.ncbi.nlm.nih.gov/17596603/)].
18. Muralidhar S, Singh PK, Jain RK, Malhotra M, Bala M. Needle stick injuries among health care workers in a tertiary care hospital of India. *Indian J Med Res.* 2010;**131**:405-10. [PubMed: [20418554](https://pubmed.ncbi.nlm.nih.gov/20418554/)].
19. Lancet T. Towards elimination of viral hepatitis by 2030. *Lancet.* 2016;**388**(10042):308. doi: [10.1016/S0140-6736\(16\)31144-8](https://doi.org/10.1016/S0140-6736(16)31144-8). [PubMed: [27477148](https://pubmed.ncbi.nlm.nih.gov/27477148/)].
20. Shariati B, Shahidzadeh-Mahani A, Oveysi T, Akhlaghi H. Accidental exposure to blood in medical interns of Tehran University of Medical Sciences. *J Occup Health.* 2007;**49**(4):317-21. doi: [10.1539/joh.49.317](https://doi.org/10.1539/joh.49.317). [PubMed: [17690526](https://pubmed.ncbi.nlm.nih.gov/17690526/)].
21. Noubiap JJ, Nansseu JR, Kengne KK, Tchokfe Ndoula S, Agyingi LA. Occupational exposure to blood, hepatitis B vaccine knowledge and uptake among medical students in Cameroon. *BMC Med Educ.* 2013;**13**:148. doi: [10.1186/1472-6920-13-148](https://doi.org/10.1186/1472-6920-13-148). [PubMed: [24200149](https://pubmed.ncbi.nlm.nih.gov/24200149/)].
22. Debes JD, Kayandabila J, Pogemiller H. Knowledge of Hepatitis B Transmission Risks Among Health Workers in Tanzania. *Am J Trop Med Hyg.* 2016;**94**(5):1100-2. doi: [10.4269/ajtmh.15-0797](https://doi.org/10.4269/ajtmh.15-0797). [PubMed: [26928835](https://pubmed.ncbi.nlm.nih.gov/26928835/)].
23. Alavian SM, Zamiri N, Gooya MM, Tehrani A, Heydari ST, Lankarani KB. Hepatitis B vaccination of adolescents: a report on the national program in Iran. *J Public Health Policy.* 2010;**31**(4):478-93. doi: [10.1057/jphp.2010.35](https://doi.org/10.1057/jphp.2010.35). [PubMed: [2119653](https://pubmed.ncbi.nlm.nih.gov/2119653/)].
24. Schillie S, Murphy TV, Sawyer M, Ly K, Hughes E, Jiles R, et al. CDC guidance for evaluating health-care personnel for hepatitis B virus protection and for administering postexposure management. *MMWR Recomm Rep.* 2013;**62**(RR-10):1-19. [PubMed: [24352112](https://pubmed.ncbi.nlm.nih.gov/24352112/)].