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Hepatitis B and hepatitis C in Pakistan: prevalence and risk factors

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Summary

Background—Pakistan carries one of the world's highest burdens of chronic hepatitis and mortality due to liver failure and hepatocellular carcinomas. However, national level estimates of the prevalence of and risk factors for hepatitis B and hepatitis C are currently not available.

Methods—We reviewed the medical and public health literature over a 13-year period ([Au?1] 1994–September 2007) to estimate the prevalence of active hepatitis B and chronic hepatitis C in Pakistan, analyzing data separately for the general and high-risk populations and for each of the four provinces. We included 84 publications with 139 studies (42 studies had two or more sub-studies).

Results—Methodological differences in studies made it inappropriate to conduct a formal meta-analysis to determine accurate national prevalence estimates, but we estimated the likely range of prevalence in different population sub-groups. A weighted average of hepatitis B antigen prevalence in pediatric populations was 2.4% (range 1.7–5.5%) and for hepatitis C antibody was 2.1% (range 0.4–5.4%). A weighted average of hepatitis B antigen prevalence among healthy adults (blood donors and non-donors) was 2.4% (range 1.4–11.0%) and for hepatitis C antibody was 3.0% (range 0.3–31.9% [Au?2]). Rates in the high-risk subgroups were far higher.

Conclusions—Data suggest a moderate to high prevalence of hepatitis B and hepatitis C in different areas of Pakistan. The published literature on the modes of transmission of hepatitis B and hepatitis C in Pakistan implicate contaminated needle use in medical care and drug abuse and unsafe blood and blood product transfusion as the major causal factors.

Keywords

Hepatitis; Hepatitis B virus; Hepatitis C virus; Pakistan; Injection

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Introduction

Hepatitis B virus (HBV) and hepatitis C virus (HCV) are among the principal causes of severe liver disease, including hepatocellular carcinoma and cirrhosis-related end-stage liver disease. The World Health Organization (WHO) estimates that there are 350 million people with chronic HBV infection and 170 million people with chronic HCV infection worldwide.[1,2] Hepatitis B is estimated to result in 563 000 deaths and hepatitis C in 366 000 deaths annually.[3] Given its large population (165 million) and intermediate to high rates of infection,[1,2] Pakistan is among the worst afflicted nations.

Pakistan has one of the world's highest fertility rates, exceeding four children per woman.[4] Its approximately 800 000 sq km are slightly less than twice the size of the state of California in the USA and Pakistan is larger than either Turkey or Chile.[4,5] Pakistan is divided into four provinces, Punjab, Sindh, Northwest Frontier Province (NWFP), and Balochistan, as well as federally administered areas including the capital (Islamabad), Federally Administered Tribal Areas (FATAs), and the western third of Jammu and Kashmir.[6,7] Considering Pakistan's size and large, growing population, there is a surprising dearth of information about hepatitis prevalence, although more is known about its risk factors. We reviewed the medical and public health literature over a 13-year period for details on the prevalence of HBV and HCV in Pakistan, analyzing data separately for general and high-risk populations and for each of the four provinces. We further reviewed the published literature concerning the risk factors, including the major modes of transmission of HBV and HCV in Pakistan.

Methods

We initially identified the studies of interest from 1994 to 2007 (up to September 30, 2007) by search of the PubMed database of the National Library of Medicine, National Institutes of Health (USA), using two search strategies: [hepatitis AND Pakistan] and [(HBV OR HCV OR Blood Borne) AND Pakistan]. We also searched in Pakmedinet.com, a search engine that includes the non-indexed journals of Pakistan, by using the keywords [hepatitis or HBV or HCV]. We identified additional articles through searches of specific authors working in this field and through the cited references of relevant articles.

Abstracts of 903 articles were reviewed by one author (SAA) and 182 articles were identified based on the likelihood that primary data on the prevalence of chronic HBV or HCV in Pakistan were to be found within. Articles commenting on risk factors for transmission of hepatitis in Pakistan were also identified. Out of 182 articles, 23 could not be retrieved for complete review due to the obscure or unclear nature of the reference, though we included eight of these studies based on the relevant information available in the abstracts. We found 57 articles reporting primary data on the prevalence of chronic HBV and 63 articles reporting primary data on the prevalence of chronic HCV in Pakistan.

Detection of hepatitis B surface antigen (HBsAg) was considered the marker of chronic HBV and detection of hepatitis C virus antibody (HCVAb) was considered the marker of chronic HCV. Data from these articles regarding study time period, region (city and province), study population (general or high-risk), lab techniques used for HBsAg or HCVAb detection, total sample size, and percentages and numbers of HBV and HCV positive cases were extracted. Prevalence data from individual studies were further segregated into age groups or regions of the country if described in the study. Studies that included primarily but not exclusively adult data were still grouped with adults. Some studies had methodological features that could be criticized; they were included only if they provided the HBsAg or HCVAb data on a defined population using reliable laboratory methods. Based on the sample size of individual studies, simple Wilson binomial confidence intervals were calculated for each study,[8] along with a

naïve weighted average prevalence (weighted by each study's sample size) in the general and high-risk populations. Due to methodological differences between studies and the very large sample sizes of a few studies, no formal statistical testing for differences between studies was carried out.

Results

HBV in general populations

Eight pediatric[9–16] and 35 adult[10,13,15,17–48] studies addressed the seroprevalence of chronic HBV infection in the general population of Pakistan using HBsAg in asymptomatic persons. The weighted average of all the studies in general pediatric populations was 2.4% (range 1.7–5.5%; Figure 1). Studies in adults were either conducted in blood bank donors[17–37] or in a non-blood donor general population.[10,13,15,38–48] Overall HBsAg seroprevalence was higher in the non-blood donor population (3.8% weighted average, range 1.4–11.0%) than the blood donor population (2.3% weighted average, range 1.4–8.4%; Figure 1). The overall HBsAg seroprevalence in healthy adults based on combined data from blood donors and non-donors was 2.4% (range 1.4–11.0%).

Few studies have been published from Balochistan,[15,39,43] NWFP,[21,27,30,33,37,43,45] and rural parts of Sindh.[18,48] Three small studies in Balochistan[15,39,43] showed a higher prevalence of HBsAg (9.3% weighted average, range 3.9–11.0%) compared to other provinces (Figure 1). Wide variations in different areas within each province were again noted but no clear trends in prevalence rates were identified over time.

HCV in general populations

We found eight pediatric[9,10,14,16,38,49–51] and 35 adult[10,17,18,22–25,27–30,32–38,40–42,44–47,49,50,52–59] studies assessing HCVAb seroprevalence in general populations. The weighted average HCVAb seroprevalence in pediatric studies was 2.1% (range 0.4–5.4%). In the adults, studies of HCV seroprevalence in non-blood donors[10,38,40–42,44–47,49,50,59] showed higher rates (5.4% weighted average, range 2.1–31.9%) than in blood donors[17,18,22–25,27–30,32–37,52–58] (2.8% weighted average, range 0.5–20.7%; Figure 2). The overall HCV seroprevalence in healthy adults, based on combined data from blood donors and non-donors was 3.0% (range 0.5–31.9% [Au?2]).

Punjab[10,17,23–25,28,29,34,35,38,40–42,44–47,49,50,53,54,57,58] reports suggested a higher prevalence of HCV (4.3% weighted average, range 0.4–31.9%) compared to Sindh,[18,22,32,45,52,56] Balochistan,[55] and NWFP[27,30,33,37,45,59] (Figure 2). Ten[10,38,40–42,44,46,47,49,50] of 12 studies[10,38,40–42,44–47,49,50,59] in non-blood donors were performed in Punjab. Wide variations in different areas within Punjab were noted (range 0.4–31.9%) and no clear trends were identified over time.

Prevalence of HBV and HCV in high-risk populations

Few studies have addressed the prevalence of HBsAg and HCVAb in the high-risk populations of Pakistan[60–93] (Figure 3). Only one study in female sex workers[67] and one study in male sex workers (hijras, some of whom are eunuchs)[68] were found to address the HBV seroprevalence in this population (Figure 3). No HCV study in sex workers was identified. Studies in the household contacts of HCV infected patients[60–66] showed a relatively high prevalence of HCV (19.0% weighted average, range 4.3–38.0%; Figure 3). In multi-transfused population of patients with thalassemia or hemophilia, three studies[71,72,75] showed a moderately high prevalence of HBsAg (7.8% weighted average, range 5.0–8.4%), while seven studies[69–75] showed a very high prevalence of HCVAb (47.2% weighted average, range 25–60%; Figure 3). Similarly, a high prevalence of HBsAg[83,84] (14.6% weighted average, range

12.4–16.6%) and HCVAb[85,86] (38% weighted average, range 23.7–68%) was described in the studies of patients undergoing chronic dialysis. Studies in healthcare workers showed relatively higher rates of HBV[76–82] (6% weighted average, range 0–10.3%) and HCV[79,81,82] (5.5% weighted average, range 4.0–5.9%, Figure 3) than in the general population (Figures 1 and 2). Studies in pregnant women showed similar rates of HBV[87–89] (2.9% weighted average, range 1.8–12.6%; Figure 3), but higher rates of HCV[89–93] (5.3% weighted average, range 3.2–16.5%; Figure 3), compared to the general population (Figures 1 and 2).

Risk factors for HBV and HCV infection in Pakistan

Needles in healthcare settings—Injections in healthcare settings have been well described in the literature as a major mode of transmission of HBV and HCV in developing countries.[94,95] A few well-controlled studies have demonstrated a relationship between therapeutic injections and the high prevalence of HBV and HCV.[14,38,60,96–99] Khan et al. interviewed 203 adult patients as they left local clinics in a peri-urban community just outside of Karachi (Sindh), the major port city located in southern Pakistan.[96] Of the patients, 81% received an injection on the day of interview. Of the 135 patients who provided a serum sample, 44% were HCVAb positive and 19% had antibodies against HBV (HBsAg was not measured). If oral and injectable medications were deemed equally effective, 44% of the patients declared that they would still prefer injectables. Unsterile, used needles were being used in 94% of the injections observed by the study team and none of the 18 practitioners knew that HCV could be transmitted by injections. In a case–control study in Hafizabad (Punjab), Luby et al. found that HCV infected patients were significantly more likely to have received five or more injections in the past 10 years compared to non-infected controls (odds ratio 5.4, confidence interval 1.2–28).[38] In a study of household members of patients with HCV in Hafizabad (Punjab), Pasha et al. showed that the household members who had more than four injections per year were 11.9 times more likely to be infected than others ($p = 0.02$).[60] Similarly, Usman et al. found that in patients with acute HBV, the attributable risk for therapeutic injections was 53%.[97] Other studies by Jafri et al., Bari et al., Shazi and Abbas, and others have also shown similar results from diverse regions of Pakistan.[14,98,99]

Luby et al. in a follow-up study in Hafizabad showed that it is possible to improve the practice of unsterile and unnecessary injections by relatively simple community-based interventions.[100] After low-cost community-based efforts to increase awareness, there was a reported decrease in the use of injections overall and an increase in the use of new needles for injections. The assumption that this will lead to decreased transmission of HBV and HCV makes logical sense, but has not been demonstrated.

Receipt of blood and blood products—Very high prevalence rates of HBV and HCV in multi-transfused populations are due to blood transfusions, but limited data are available about the practices of blood banks in Pakistan. Luby et al. studied 24 randomly selected blood banks in Karachi in 1995; while 95% had reagents and equipment to test for HBV, only 55% could screen for HIV and 23% for HCV.[101] Fifty percent of blood banks regularly utilized paid blood donors and only 25% actively recruited voluntary blood donors. More recent data about the practices are not available. In 2001, Ahmed reported a higher prevalence of HBV in professional blood donors as compared to voluntary blood donors (9% vs. 0.8%, $p < 0.001$).[102]

Injection drug users (IDUs)—According to the year 2000 National Assessment Study of Drug Use in Pakistan supported by the United Nations Office of Drug Control and Crime Prevention (UNODC), there are 500 000 heroin addicts in Pakistan, of whom 75 000 (15%) are regular IDUs and 150 000 (30%) are occasional IDUs.[103] Data on the disease burden in this large high-risk population are limited. Kuo et al., in a study conducted in 2003, showed

HCV prevalence of 93% and 75% among IDUs of Lahore (Punjab) and Quetta (Balochistan), respectively,[104] while Achakzai et al., in a smaller study in 2004, showed HBV, HCV, and HIV prevalences of 6%, 60%, and 24%, respectively, in the IDUs of Quetta.[105] A year 2005 pilot survey of IDUs in Karachi (Sindh) showed an HIV prevalence of 26%, confirming the long-anticipated expansion of the HIV epidemic in Pakistan.[106] HBV and HCV seroprevalence rates were not studied in this survey. A follow-up national survey in 2005 showed HIV prevalence of 23% and 0.5% and HCV prevalence of 88% and 91% in IDUs of Karachi (Sindh) and Lahore (Punjab), respectively.[107]

Occupational risks—Certain professions like healthcare workers, sex workers, and barbers may be at increased risk of getting HBV and HCV. The best studied amongst them in Pakistan are healthcare workers, showing a relatively higher prevalence (weighted average 6% and 5.5% for HBV and HCV, respectively) than in general population (Figures 1 and 2). The lack of universal immunization against HBV has been highlighted, especially in these high-risk populations, but coverage of HBV immunization has improved in the general population since 2003.[108] According to the WHO–UNICEF estimates of 2005, 73% of the target population (infants <1 year) of Pakistan have been vaccinated for HBV.[108] While trends are encouraging, coverage is still significantly lower than in industrialized countries. Its benefits on HBV incidence may not be apparent for many years, though eventually one would expect substantial benefit from the innovation of HBV vaccination among Pakistani infants.

Shaving by barbers—It has been suspected that barbers may be contributing to the spread of HBV and HCV by using contaminated razors for shaving. Janjua and Nizamy, in a cross-sectional study of barbers in Rawalpindi/Islamabad in 1999, showed that only 13% knew that hepatitis could be transmitted by contaminated razors.[109] During the actual observation, razors were reused for 46% of shaves. It is possible that contaminated razors may be contributing in the transmission of HBV and HCV, but their relative importance is not clear.

Household contacts/spousal transmission—While some studies have shown a relatively higher prevalence in the household members of patients with HBV and HCV, other studies in the spouses of index cases have shown rates similar to controls.[60–64] Pasha et al. showed the prevalence of HCV in household members of HCV patients to be 2.5 times that of the general population, but no routes of transmission within the household were associated.[60] The international literature suggests that the sexual transmission of HCV is very low.[110, 111] It is likely that the high prevalence reported in household contacts in Pakistan may be due to the fact that they are exposed to the same community risk factors as the index patient, rather than intra-household transmission per se. In contrast, HBV intra-familial transmission is well documented outside of Pakistan, and HBV is far more infectious as compared to HCV or HIV.[112–114]

Discussion

We observed highly variable seroprevalence estimates for both HBV and HCV from different studies in similar populations, even within the same province. Unlike highly contagious diseases like measles that have a more predictable seroprevalence, blood-borne illnesses like hepatitis and HIV are transmitted sporadically or in micro-epidemics. These micro-epidemics may account for the wide variations in prevalence seen within a nation, a province, or even a community. Identification of the causes of these micro-epidemics provides an opportunity to limit the transmission of these diseases.[115–117] However, methodological differences in sampling strategies may also contribute to differences in seroprevalence within similar regions or populations. For example, one study of the general population did a staged cluster random sampling of the entire city's study population,[14] while another study of putative 'random

samples' in a different city recruited persons with the aid of newspaper advertisements[50] that may have distorted the risk profile of respondents compared to the former study.

As seen in this review, studies of HBV and HCV prevalence are often conducted in blood donor populations because of convenience and access to a large sample size. However, these studies may not truly represent the general population. Prevalence in blood donors may be an underestimate of the population prevalence if potential donors with a high-risk profile, like history of jaundice, injection drug use, multiple sexual partners, etc. are screened out by questionnaires. Conversely, prevalence in blood donors may be an overestimate of the general population if professional blood donors were included, who are often injection drug users selling blood for money. Nonetheless, it is clear that both HBV and HCV infections are very common in Pakistan such that serious incidence rates of end-stage liver disease, both cirrhosis and hepatocellular carcinoma, will plague this nation for many years to come.

The published literature regarding risk factors for HBV and HCV transmission in Pakistan is informative. WHO estimates that in Southeast Asia, an average person receives four injections per year, most of which are unnecessary and up to 75% are unsafe or reused.[118] Unnecessary injections are given commonly in Pakistan out of the prevalent view in the population that injected medicines are more effective than oral medications.[119,120] Intramuscular injections are frequently used for fever, fatigue, and general ailments, while intravenous drips are used for the treatment of weakness, fever, and 'severe' diseases.[96,120,121] Some people use IV drips to cool down during the summer (HQ, personal observation). These injections are given by physicians at clinics, by informal, untrained providers, by health workers who do home visits, and by pharmacists both trained and informal.[122,123] The healthcare providers may even encourage the injection-seeking behavior because patients are more willing to pay an additional physician's fee for injections but will not pay this added fee for oral medications.[123] Syringes are reused and sterility of injections is often not maintained due to financial limitations and lack of risk awareness among the healthcare providers and the population in general.[122] These injections appear to be the single most significant factor in the spread of HBV and HCV in the general population of Pakistan.

There are about 1.5 million units of blood products transfused each year in Pakistan.[124] Data on the safety of this transfusion process are scanty – perhaps due to the lack of a system of reporting infectious or non-infectious adverse events.[125] The transfusion network is poorly organized and likely contributes significantly in the transmission of serious infectious diseases. In fact, the leading hepatologist and public health scientist of Pakistan and editor of the country's premier medical journal for 30 years died in 2004 of cerebral malaria that she acquired through a blood transfusion given during bilateral knee replacement surgery. Her case dramatized the need for regulation and control of the transfusion practices in Pakistan. Under the umbrella of National Blood Policy, comprehensive measures are needed in both public and private sectors of all four provinces. These measures should include a situational analysis and a realistic assessment of the blood requirement in the area, followed by recruitment and maintenance of voluntary, non-remunerated blood donors and standardization and regulation of appropriate blood screening procedures.

IDUs are numerous in Pakistani society and though they have a disproportionately high burden of health problems, they have been inadequately studied. Limited data suggest the likelihood that the prevalences of hepatitis and HIV are very high in this community. Urgent efforts need to be made to better study this population and to apply globally effective programs like needle exchange and condom distribution together with appropriate counseling and therapy for their drug addiction. Unless serious infections are controlled in IDUs, they will continue to be the source of HBV, HCV, and now HIV to the general population in Pakistan.

While universal immunization against HBV has still not been achieved, significant advances have been made. HBV vaccine has been included in the EPI (Expanded Program for Immunization) since 2002. All healthcare providers in the public sector are eligible for free HBV vaccination. Full coverage with HBV vaccination in the general population would be ideal, but at least healthcare workers and other high-risk professionals should be immunized universally.

The Herculean task of reeducating healthcare providers, informal sector providers, high-risk persons, and the general population is worthy of investment, particularly now that HIV has risen markedly among IDUs, resulting in a concentrated, rather than a nascent epidemic.[106, 107] Urgent comprehensive efforts at the structural, healthcare provider, and individual level are needed to control the spread of these blood-borne infections (Table 1).

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References

1. Previsani, N.; Lavanchy, D. WHO/CDS/CSR/LYO/2002.2:Hepatitis B. Geneva: World Health Organization; 2002. Hepatitis B.
2. Hepatitis C. Geneva: World Health Organization; 2000 [(accessed August 2008 [Au?3]]. World Health Organization fact sheets. Available at: http://www.who.int/mediacentre/factsheets/fs164/en/
3. Perz JF, Armstrong GL, Farrington LA, Hutin YJ, Bell BP. The contributions of hepatitis B virus and hepatitis C virus infections to cirrhosis and primary liver cancer worldwide. J Hepatol 2006;45:529–38. [PubMed: 16879891]
4. The world factbook. Pakistan. USA: Central Intelligence Agency. 2007 [accessed August 2008]. Available at: https://www.cia.gov/library/publications/the-world-factbook/geos/pk.html [Au?4]
5. California state facts. United States Geological Survey. 2006 [accessed August 2008]. Available at: http://www.usgs.gov
6. Country profile: Pakistan. Library of Congress Federal Research Division. 2005 [accessed August 2008]. Available at: http://lcweb2.loc.gov/frd/cs/profiles/Pakistan.pdf
7. The Constitutional basis for the Federation of Pakistan. The Constitution of the Islamic Republic of Pakistan. 2007. Available at: http://www.nrb.gov.pk/constitutional_and_legal/constitution/part1.notes.html=1accessed [Au?5]
8. Agresti A, Coull B. Approximate is better than ‘exact’ for interval estimation of binomial proportions. Am Stat 1998;52:119–26.
9. Agboatwalla M, Isomura S, Miyake K, Yamashita T, Morishita T, Akram DS. Hepatitis A, B and C seroprevalence in Pakistan. Indian J Pediatr 1994;61:545–9. [PubMed: 7538098]
10. Khan HI. A study of seroprevalence of hepatitis B and C in mothers and children in Lahore. Pak Pediatr J 1996;20:163–6.
11. Abbas KA, Tanwani AK. Prevalence of hepatitis B surface antigenaemia in healthy children. J Pak Med Assoc 1997;47:93–4. [PubMed: 9131862]
12. Khan MA, Ali AS, Ul Hassan Z, Mir F, Ul Haque S. Seroprevalence of hepatitis B in children. Pak Pediatr J 1998;22:75–7.
13. Qasmi SA, Aqeel S, Ahmed M, Alam SI, Ahmad A. Detection of hepatitis B viruses in normal individuals of Karachi. J Coll Physicians Surg Pak 2000;10:467–9.
14. Jafri W, Jafri N, Yakoob J, Islam M, Tirmizi SF, Jafar T, et al. Hepatitis B and C: prevalence and risk factors associated with seropositivity among children in Karachi, Pakistan. BMC Infect Dis 2006;6:101. [PubMed: 16792819]

15. Quddus A, Luby SP, Jamal Z, Jafar T. Prevalence of hepatitis B among Afghan refugees living in Balochistan, Pakistan. Int J Infect Dis 2006;10:242–7. [PubMed: 16448838]
16. Aziz S, Muzzafar R, Hafiz S, Abbas Z, Zafar MN, Naqvi SA, et al. *Helicobacter pylori*, hepatitis viruses A, C, E antibodies and HBsAg — prevalence and associated risk factors in pediatric communities of Karachi. J Coll Physicians Surg Pak 2007;17:195–8. [PubMed: 17462174]
17. Bhatti FA, Shaheen N, Uz Zaman Tariq W, Amin M, Saleem M. Epidemiology of hepatitis C virus in blood donors in Northern Pakistan. Pak Armed Forces Med J 1996;46:91–2.
18. Kakepoto GN, Bhally HS, Khaliq G, Kayani N, Burney IA, Siddiqui T, et al. Epidemiology of blood-borne viruses: a study of healthy blood donors in Southern Pakistan. Southeast Asian J Trop Med Public Health 1996;27:703–6. [PubMed: 9253870]
19. Bukhari SM, Khatoon N, Iqbal A, Naeem S, Shafqat S, Lone A, et al. Prevalence of hepatitis B antigenaemia in Mayo Hospital Lahore. Biomedica 1999;15:88–91.
20. Majed A, Qayyum A. Presence of hepatitis B virus in healthy donors at blood unit of Punjab Institute of Cardiology Lahore. Pak J Med Res 2000;39:111–2.
21. Ahmed F, Shah SH, Tariq M, Khan JA. Prevalence of hepatitis B carrier and HIV in healthy blood donors at Ayub Teaching Hospital. Pak J Med Res 2000;39:91–2.
22. Abdul MS, Aamir K, Mehmood K. Seroprevalence of HBV, HCV and HIV infections among college going first time voluntary blood donors. J Pak Med Assoc 2000;50:269–70. [PubMed: 10992712]
23. Ryas M, Hussain T, Bhatti FA, Ahmed F, Uz Zaman Tariq W, Khattak MF. Epidemiology of hepatitis C virus infection in blood donors in Northern Pakistan. J Rawalpindi Med Coll 2001;5:56–9.
24. Khattak MF, Salamat N, Bhatti FA, Qureshi TZ. Seroprevalence of hepatitis B, C and HIV in blood donors in northern Pakistan. J Pak Med Assoc 2002;52:398–402. [PubMed: 12532573]
25. Mumtaz S, Ur Rehman M, Muzaffar M, Ul Hassan M, Iqbal W. Frequency of seropositive blood donors for hepatitis B, C and HIV viruses in railway hospital Rawalpindi. Pak J Med Res 2002;41:51–3.
26. Rahman MU, Akhtar GN, Lodhi Y. Transfusion transmitted HIV and HBV infections in Punjab, Pakistan. Pak J Med Sci 2002;18:18–25.
27. Ahmad J, Taj AS, Rahim A, Shah A, Rehman M. Frequency of hepatitis B and hepatitis C in healthy blood donors of NWFP: a single center experience. J Postgrad Med Inst 2004;18:343–52.
28. Asif N, Khokar N, Ilahi F. Seroprevalence of HBV, HCV and HIV infection among voluntary non-renumerated and replacement donors in Northern Pakistan. Pak J Med Sci 2004;20:24–8.
29. Mahmood MA, Khawar S, Anjum AH, Ahmed SM, Rafiq S, Nazir I, et al. Prevalence of hepatitis B, C and HIV infection in blood donors of Multan region. Ann King Edward Med Coll 2004;10:459–61.
30. Zaidi A, Tariq WZ, Haider KA, Ali L, Sattar A, Faqeer F, et al. Seroprevalence of hepatitis B, C and HIV in healthy blood donors in Northwest of Pakistan. Pak J Pathol 2004;15:11–6.
31. Akhtar S, Younus M, Adil S, Hassan F, Jafri SH. Epidemiologic study of chronic hepatitis B virus infection in male volunteer blood donors in Karachi, Pakistan. BMC Gastroenterol 2005;5:26. [PubMed: 16086833]
32. Abdul MS, Nanan D, Sabir S, Altaf A, Kadir M. Hepatitis B and C infection in first-time blood donors in Karachi — a possible subgroup for sentinel surveillance. East Mediterr Health J 2006;12:735–41. [PubMed: 17333817]
33. Aziz MS. Prevalence of anti hepatitis C antibodies and hepatitis B surface antigen in healthy blood donors in Baltistan. Pak Armed Forces Med J 2006;56:189–91.
34. Ijaz AU, Shafiq F, Toosi NA, Malik MN, Qadeer R. Hepatitis B and hepatitis C in blood donors: analysis of 2-years data. Ann King Edward Med Coll 2007;13:59–61.
35. Sultan F, Mehmood T, Mahmood MT. Infectious pathogens in volunteer and replacement blood donors in Pakistan: a ten-year experience. Int J Infect Dis 2007;11:407–12. [PubMed: 17331775]
36. Chaudhary IA, Samiullah, Khan SS, Masood R, Sardar MA, Mallhi AA. Seroprevalence of hepatitis B and C among the healthy blood donors at Fauji Foundation Hospital, Rawalpindi Pak. J Med Sci 2007;23:64–7.
37. Alam M, Naeem MA. Frequency of hepatitis B surface antigen and anti-hepatitis C antibodies in apparently healthy blood donors in Northern areas. Pakistan J Pathol 2007;18:11–4.

38. Luby SP, Qamruddin K, Shah AA, Omair A, Pahsa O, Khan AJ, et al. The relationship between therapeutic injections and high prevalence of hepatitis C infection in Hafizabad, Pakistan. Epidemiol Infect 1997;119:349–56. [PubMed: 9440439]
39. Marri SM, Ahmed J. Prevalence of hepatitis B antigenaemia in general population of Quetta, Balochistan. Biomedica 1997;13:51–2.
40. Tanwani A, Ahmad N. Prevalence of hepatitis B surface antigen and anti-hepatitis C virus in laboratory based data at Islamabad. Pak J Surg 2000;19–20:25–9.
41. Khokhar N, Gill ML, Malik GJ. General seroprevalence of hepatitis C and hepatitis B virus infections in population. J Coll Physicians Surg Pak 2004;14:534–6. [PubMed: 15353136]
42. Waseem R, Kashif MA, Khan M, Qureshi AW. Seroprevalence of HBsAg and anti-HCV in Ghurki Teaching Hospital, Lahore. Ann King Edward Med Coll 2005;11:232–4.
43. Abbas Z, Shazi L, Jafri W. Prevalence of hepatitis B in individuals screened during a countrywide campaign in Pakistan. J Coll Physicians Surg Pak 2006;16:497–8. [PubMed: 16827971]
44. Mirza IA, Mirza SH, Irfan S, Siddiqi R, Tariq WZ, Janjua AN. Seroprevalence of hepatitis B and C in young adults seeking recruitment in the armed forces. Pak Armed Forces Med J 2006;56:192–7.
45. Sherif TB, Tariq WZ. Seroprevalence of hepatitis B and C in healthy adult male recruits. Pakistan J Pathol 2006;17:147–50.
46. Alam M, Tariq WZ, Akram S, Qureshi TZ. Frequency of hepatitis B and C in central Punjab. Pakistan J Pathol 2006;17:140–1.
47. Mirza IA, Kazmi SM, Janjua AN. Frequency of hepatitis B surface antigen and anti-HCV in young adults — experience in southern Punjab. J Coll Physicians Surg Pak 2007;17:114–5. [PubMed: 17288863]
48. Abdulla EM, Abdulla FE. Seropositive HBsAg frequency in Karachi and interior Sindh, Pakistan. Pak J Med Sci 2007;23:157–60.
49. Parker SP, Khan HI, Cubitt WD. Detection of antibodies to hepatitis C virus in dried blood spot samples from mothers and their offspring in Lahore, Pakistan. J Clin Microbiol 1999;37:2061–3. [PubMed: 10325381]
50. Aslam M, Aslam J. Seroprevalence of the antibody to hepatitis C in select groups in the Punjab region of Pakistan. J Clin Gastroenterol 2001;33:407–11. [PubMed: 11606859]
51. Hyder SN, Hussain W, Aslam M, Maqbool S. Seroprevalence of anti-HCV in asymptomatic children. Pak J Pathol 2001;12:89–93.
52. Mujeeb SA, Shahab S, Hyder AA. Geographical display of health information: study of hepatitis C infection in Karachi, Pakistan. Public Health 2000;114:413–5. [PubMed: 11035468]
53. Ahmad S, Gull J, Bano KA, Aftab M, Khokhar MS. Prevalence of anti-hepatitis C antibodies in healthy blood donors at Services Hospital Lahore. Pak Postgrad Med J 2002;13:18–20.
54. Rahman MU, Akhtar GN, Lodhi Y. Seroprevalence of hepatitis C antibodies in blood donors. Pak J Med Sci 2002;18:193–6.
55. Ali N, Nadeem M, Qamar A, Qureshi AH, Ejaz A. Frequency of hepatitis C virus antibodies in blood donors in Combined Military Hospital, Quetta. Pak J Med Sci 2003;19:41–4.
56. Akhtar S, Younus M, Adil S, Jafri SH, Hassan F. Hepatitis C virus infection in asymptomatic male volunteer blood donors in Karachi, Pakistan. J Viral Hepat 2004;11:527–35. [PubMed: 15500553]
57. Chaudry NT, Jameel W, Ihsan I, Nasreen S. Hepatitis C. Prof Med J 2005;12:364–7.
58. Ahmad N, Asgher M, Shafique M, Qureshi JA. Evidence of high prevalence of hepatitis C virus in Faisalabad, Pakistan. Saudi Med J 2007;28:390–5. [PubMed: 17334466]
59. Muhammad N, Jan MA. Frequency of hepatitis C in Buner, NWFP. J Coll Physicians Surg Pak 2005;15:11–4. [PubMed: 15670516]
60. Pasha O, Luby SP, Khan AJ, Shah SA, McCormick JB, Fisher-Hoch SP. Household members of hepatitis C virus-infected people in Hafizabad, Pakistan: infection by injections from health care providers. Epidemiol Infect 1999;123:515–8. [PubMed: 10694166]
61. Akhtar S, Moatter T, Azam SI, Rahbar MH, Adil S. Prevalence and risk factors for intrafamilial transmission of hepatitis C virus in Karachi, Pakistan. J Viral Hepat 2002;9:309–14. [PubMed: 12081609]

62. Akhtar S, Moatter T. Intra-household clustering of hepatitis C virus infection in Karachi, Pakistan. Trans R Soc Trop Med Hyg 2004;98:535–9. [PubMed: 15251402]
63. Irfan A, Arfeen S. Hepatitis C virus infection in spouses. Pak J Med Res 2004:43.[Au?6]
64. Kumar N, Sattar R, Ara J. Frequency of hepatitis C virus in the spouses of HCV positive patients and risk factors of the two groups. J Surg Pak 2004;9:36–9.
65. Khokhar N, Gill ML, Alam AY. Interspousal transmission of hepatitis C virus. J Coll Physicians Surg Pak 2005;15:587–9.
66. Qureshi H, Arif A, Ahmed W, Alam SE. HCV exposure in spouses of the index cases. J Pak Med Assoc 2007;57:175–7. [PubMed: 17489523]
67. Anwar MS, Jaffery G, Rasheed SA. Serological screening of female prostitutes for anti-HIV and hepatitis B surface antigen. Pak J Health 1998;35:69–73.
68. Baqi S, Shah SA, Baig MA, Mujeeb SA, Memon A. Seroprevalence of HIV, HBV and syphilis and associated risk behaviours in male transvestites (Hijras) in Karachi, Pakistan. J Pak Med Assoc 2006;56(1 Suppl 1):S17–21. [PubMed: 16689477]
69. Bhatti FA, Amin M, Saleem M. Prevalence of antibody to hepatitis C virus in Pakistani thalassaemics by particle agglutination test utilizing C 200 and C 22-3 viral antigen coated particles. J Pak Med Assoc 1995;45:269–71. [PubMed: 8714623]
70. Abdul MS, Shiekh MA, Khanani R, Jamal Q. Prevalence of hepatitis C virus infection among beta-thalassaemia major patients. Trop Doct 1997;27:105. [PubMed: 9133797]
71. Hussain M, Khan MA, Mohammad J, Jan A. Frequency of hepatitis B and C in hemophiliac children. Pak Pediatr J 2003;27:157–60.
72. Mohammad J, Hussain M, Khan MA. Frequency of hepatitis B and hepatitis C infection in thalassemic children. Pak Pediatr J 2003;27:161–4.
73. Younus M, Hassan K, Ikram N, Naseem L, Zaheer HA, Khan MF. Hepatitis C seropositivity in repeatedly transfused thalassemia major patients. Int J Pathol 2004;2:20–3.
74. Burki MF, Hassan M, Hussain H, Nisar Y, Krishan J. Prevalence of anti-hepatitis C antibodies in multiply transfused beta thalassemia major patients. Ann Pak Inst Med Sci 2005;1:150–3.
75. Shah MA, Khan MT, Ulla Z, Ashfaq Y. Prevalence of hepatitis B and hepatitis C virus infection in multi-transfused thalassemia major patients in North West Frontier Province. Pak J Med Sci 2005;21:281–3.
76. Abdul MS, Zuberi SJ, Lodi TZ, Mehmood K. Prevalence of HBV infection in health care personnel. J Pak Med Assoc 1994;44:265.
77. Khan GM, Malik MN, Rana K, Fayyaz A. Profile of hepatitis B surface antigen positivity in health care personnel. Mother Child 1996;34:135–8.
78. Fazli Z, Asghar H, Baig NU, Fahmi A, Dil AS, Zaidi SS, et al. Prevalence of hepatitis B virus in dental clinics in Rawalpindi/Islamabad. J Pak Med Assoc 1998;48:259. [PubMed: 10067049]
79. Mujeeb SA, Khatri Y, Khanani R. Frequency of parenteral exposure and seroprevalence of HBV, HCV, and HIV among operation room personnel. J Hosp Infect 1998;38:133–7. [PubMed: 9522291]
80. Tariq WZ, Ghani E, Karamat KA. Hepatitis B in health care personnel. Pak Armed Forces Med J 2000;50:56–7.
81. Aziz S, Memon A, Tily HI, Rasheed K, Jehangir K, Quraishy MS. Prevalence of HIV, hepatitis B and C amongst health workers of Civil Hospital Karachi. J Pak Med Assoc 2002;52:92–4. [PubMed: 12071075]
82. Nadeem M, Yousaf MA, Mansoor S, Mansoor S, Khan FA, Zakaria M, et al. Seroprevalence of HBsAg and HCV antibodies in hospital workers compared to aged matched healthy blood donors. Pak J Pathol 2004;15:17–20.
83. Mujeeb SA, Shaikh MA, Kehar SI. Prevalence of HB infection in haemodialysis patients. J Pak Med Assoc 1994;44:226.
84. Khokhar N, Alam AY, Naz F. Hepatitis B surface antigenemia in patients on hemodialysis. Rawalpindi Med J 2004;29:18–21.
85. Gul A, Iqbal F. Prevalence of hepatitis C in patients on maintenance haemodialysis. J Coll Physicians Surg Pak 2003;13:15–8. [PubMed: 12685968]

86. Khokhar N, Alam AY, Naz F, Mahmud SN. Risk factors for hepatitis C virus infection in patients on long-term hemodialysis. J Coll Physicians Surg Pak 2005;15:326–8. [PubMed: 15924834]
87. Mehnaz A, Hashmi H, Syed S, Kulsoom. Hepatitis B markers in mothers and its transmission in newborn. J Coll Physicians Surg Pak 2002;12:240–2.
88. GuleRana, Akmal N, Akhtar N. Prevalence of hepatitis B in pregnant females. Ann King Edward Med Coll 2006;12:313.
89. Yousfani S, Mumtaz F, Memon A, Memon MA, Sikandar R. Antenatal screening for hepatitis B and C virus carrier state at a University Hospital. J Liaqat Univ Med Health Sci 2006;5:24–7.
90. Zafar MA, Mohsin A, Husain I, Shah AA. Prevalence of hepatitis C among pregnant women. J Surg Pak 2001;6:32–3.
91. Rizvi TJ, Fatima H. Frequency of hepatitis C in obstetric cases. J Coll Physicians Surg Pak 2003;13:688–90. [PubMed: 15569552]
92. Khokhar N, Raja KS, Javaid S. Seroprevalence of hepatitis C virus infection and its risk factors in pregnant women. J Pak Med Assoc 2004;54:135. [PubMed: 15129873]
93. Jaffery T, Tariq N, Ayub R, Alam AY. Frequency of hepatitis C in pregnancy and pregnancy outcome. J Coll Physicians Surg Pak 2005;15:716–9. [PubMed: 16300710]
94. Simonsen L, Kane A, Lloyd J, Zaffran M, Kane M. Unsafe injections in the developing world and transmission of bloodborne pathogens: a review. Bull World Health Organ 1999;77:789–800. [PubMed: 10593026]
95. Hauri AM, Armstrong GL, Hutin YJ. The global burden of disease attributable to contaminated injections given in health care settings. Int J STD AIDS 2004;15:7–16. [PubMed: 14769164]
96. Khan AJ, Luby SP, Fikree F, Karim A, Obaid S, Dellawala S, et al. Unsafe injections and the transmission of hepatitis B and C in a periurban community in Pakistan. Bull World Health Organ 2000;78:956–63. [PubMed: 10994278]
97. Usman HR, Akhtar S, Rahbar MH, Hamid S, Moattar T, Luby SP. Injections in health care settings: a risk factor for acute hepatitis B virus infection in Karachi, Pakistan. Epidemiol Infect 2003;130:293–300. [PubMed: 12729198]
98. Bari A, Akhtar S, Rahbar MH, Luby SP. Risk factors for hepatitis C virus infection in male adults in Rawalpindi-Islamabad, Pakistan. Trop Med Int Health 2001;6:732–8. [PubMed: 11555441]
99. Shazi L, Abbas Z. Comparison of risk factors for hepatitis B and C in patients visiting a gastroenterology clinic. J Coll Physicians Surg Pak 2006;16:104–7. [PubMed: 16499801]
100. Luby S, Hoodbhoy F, Jan A, Shah A, Hutin Y. Long-term improvement in unsafe injection practices following community intervention. Int J Infect Dis 2005;9:52–9. [PubMed: 15603995]
101. Luby S, Khanani R, Zia M, Vellani Z, Ali M, Qureshi AH, et al. Evaluation of blood bank practices in Karachi, Pakistan, and the government's response. J Pak Med Assoc 2006;56(1 Suppl 1):S25–30. [PubMed: 16689480]
102. Ahmed M. Hepatitis B surface antigen study in professional and volunteer blood donors. Ann Abbasi Shaheed Hospital Karachi. Med Dental Coll 2001;6:304–6.
103. Drug abuse in Pakistan — results from year 2000 national assessment. Pakistan: United Nations Office for Drug Control and Crime Prevention and The Narcotics Control Division, Anti-Narcotics Force, Government of Pakistan; 2000.
104. Kuo I, Ul-Hasan S, Galai N, Thomas DL, Zafar T, Ahmed MA, et al. High HCV seroprevalence and HIV drug use risk behaviors among injection drug users in Pakistan. Harm Reduct J 2006;3:26. [PubMed: 16914042]
105. Achakzai M, Kassi M, Kasi PM. Seroprevalences and co-infections of HIV, hepatitis C virus and hepatitis B virus in injecting drug users in Quetta, Pakistan. Trop Doct 2007;37:43–5. [PubMed: 17326891]
106. Pilot survey of vulnerable populations of IDUs, FSWs, MSWs, and Hijras in Karachi. Pakistan: The Consultant Group, Infection Control Society P, Pakistan AIDS Prevention Society, Interactive Research and Development; 2005.
107. National study of reproductive tract and sexually transmitted infections — survey of high risk groups in Lahore and Karachi. Pakistan: National AIDS Control Program, Ministry of Health, Government of Pakistan/Family Health International/Department for International Development; 2005.

108. Immunization profile — Pakistan. Geneva: World Health Organization; 2006 [accessed August 2008]. Available at: http://www.who.int/vaccines/globalsummary/immunization/countryprofileresult.cfm?C='pak'
109. Janjua NZ, Nizamy MA. Knowledge and practices of barbers about hepatitis B and C transmission in Rawalpindi and Islamabad. J Pak Med Assoc 2004;54:116–9. [PubMed: 15129868]
110. Vandelli C, Renzo F, Romano L, Tisminetzky S, De Palma M, Stroffolini T, et al. Lack of evidence of sexual transmission of hepatitis C among monogamous couples: results of a 10-year prospective follow-up study. Am J Gastroenterol 2004;99:855–9. [PubMed: 15128350]
111. Alary M, Joly JR, Vincelette J, Lavoie R, Turmel B, Remis RS. Lack of evidence of sexual transmission of hepatitis C virus in a prospective cohort study of men who have sex with men. Am J Public Health 2005;95:502–5. [PubMed: 15727984]
112. Lobato C, Tavares-Neto J, Rios-Leite M, Trepo C, Vitvitski L, Parvaz P, et al. Intrafamilial prevalence of hepatitis B virus in Western Brazilian Amazon region: epidemiologic and biomolecular study. J Gastroenterol Hepatol 2006;21:863–8. [PubMed: 16704537]
113. Abdool Karim SS, Thejpal R, Coovadia HM. Household clustering and intra-household transmission patterns of hepatitis B virus infection in South Africa. Int J Epidemiol 1991;20:495–503. [PubMed: 1917255]
114. Zervou EK, Gatselis NK, Xanthi E, Ziciadis K, Georgiadou SP, Dalekos GN. Intrafamilial spread of hepatitis B virus infection in Greece. Eur J Gastroenterol Hepatol 2005;17:911–5. [PubMed: 16093867]
115. Transmission of hepatitis B and C viruses in outpatient settings — New York, Oklahoma, and Nebraska, 2000–2002. MMWR Morb Mortal Wkly Rep 2003;52:901–6. [PubMed: 14508437]
116. Transmission of hepatitis B virus among persons undergoing blood glucose monitoring in long-term-care facilities — Mississippi, North Carolina, and Los Angeles County, California, 2003–2004. MMWR Morb Mortal Wkly Rep 2005;54:220–3. [PubMed: 15758894]
117. Transmission of hepatitis B virus in correctional facilities — Georgia, January 1999–June 2002. MMWR Morb Mortal Wkly Rep 2004;53:678–81. [PubMed: 15295311]
118. Hutin YJ, Hauri AM, Armstrong GL. Use of injections in healthcare settings worldwide, 2000: literature review and regional estimates. BMJ 2003;327:1075. [PubMed: 14604927]
119. Janjua NZ, Hutin YJ, Akhtar S, Ahmad K. Population beliefs about the efficacy of injections in Pakistan's Sindh province. Public Health 2006;120:824–33. [PubMed: 16876212]
120. Altaf A, Fatmi Z, Ajmal A, Hussain T, Qahir H, Agboatwalla M. Determinants of therapeutic injection overuse among communities in Sindh, Pakistan. J Ayub Med Coll Abbottabad 2004;16:35–8. [PubMed: 15631369]
121. Raglow GJ, Luby SP, Nabi N. Therapeutic injections in Pakistan: from the patients' perspective. Trop Med Int Health 2001;6:69–75. [PubMed: 11263465]
122. Janjua NZ. Injection practices and sharp waste disposal by general practitioners of Murree, Pakistan. J Pak Med Assoc 2003;53:107–11. [PubMed: 12779025]
123. Janjua NZ, Akhtar S, Hutin YJ. Injection use in two districts of Pakistan: implications for disease prevention. Int J Qual Health Care 2005;17:401–8. [PubMed: 15883127]
124. Kazi, BM. Standards and guidelines for blood transfusion services. Islamabad, Pakistan: World Health Organization/National Institute of Health, Federal Health Ministry, Government of Pakistan; 1999.
125. Rahman M, Jawaid SA. Need for national blood policy to ensure safe blood transfusion. Pak J Med Sci 2004;20:81–4.

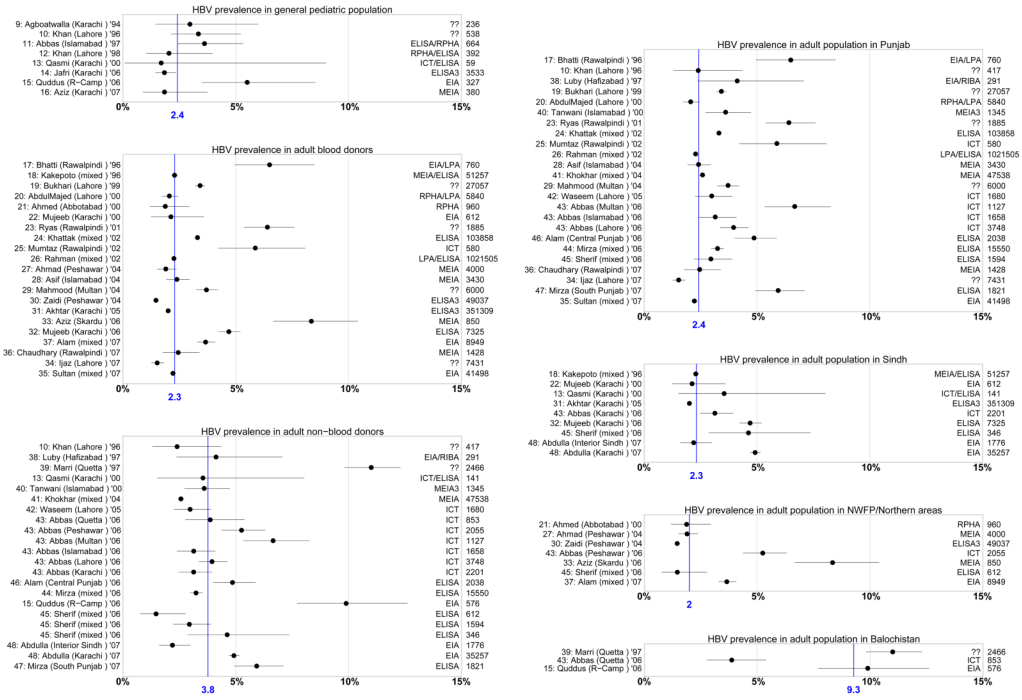

FIGURE 1. Summary of studies reporting HBV prevalence in the general population of Pakistan

Each study is represented horizontally. From L-R: reference number, first author, city in which study conducted, year in which study published; Dot and bar represent the point prevalence of HBV with calculated 95% confidence interval; lab technique used to detect HBsAg; and sample size of the study. The vertical line represents the calculated weighted average prevalence of HBV based on all the studies in the particular group.

ELISA (#) =Enzyme linked immunosorbent assay (# represents generation of test); RPHA=Reverse particle hemagglutination assay; ICT=Immuno-chromatographic test; LPA=Latex particle agglutination; MEIA (#)=Micro enzyme immunoassay (# represents generation of test); RIBA=Recombinant immunoblot assay; ??=unknown

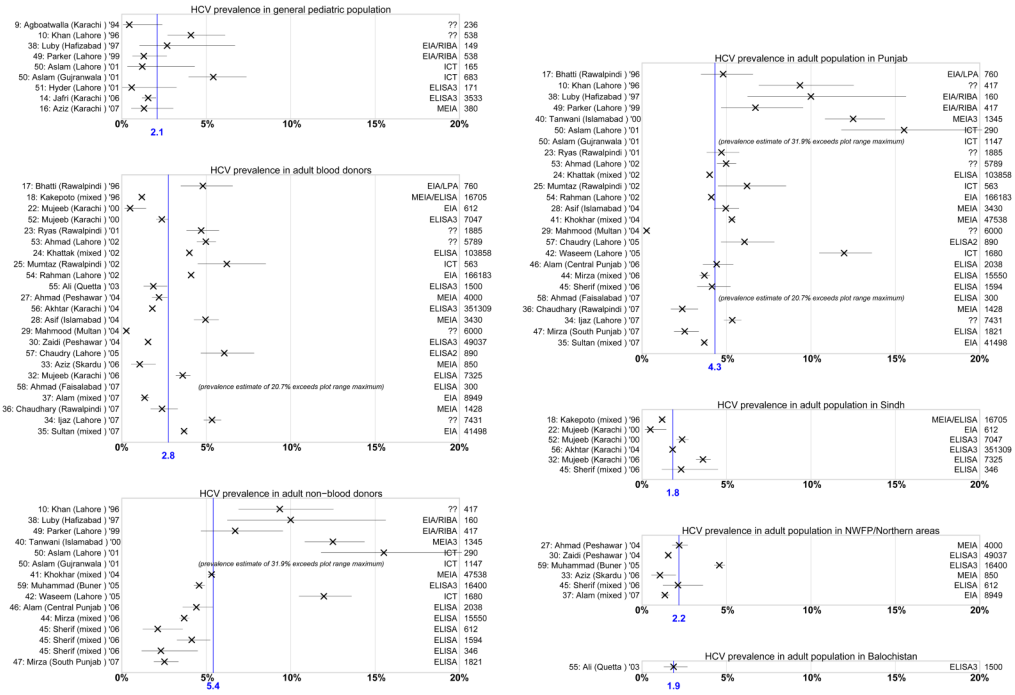

FIGURE 2. Summary of studies reporting HCV prevalence in the general population of Pakistan

Each study is represented horizontally. From L-R: reference number, first author, city in which study conducted, year in which study published; Cross and bar represent the point prevalence of HCV with calculated 95% confidence interval; lab technique used to detect HCVAb; and sample size of the study. The vertical line represents the calculated weighted average prevalence of HCV based on all the studies in the particular group.

ELISA (#) =Enzyme linked immunosorbent assay (# represents generation of test); RPHA=Reverse particle hemagglutination assay; ICT=Immuno-chromatographic test; LPA=Latex particle agglutination; MEIA (#)=Micro enzyme immunoassay (# represents generation of test); RIBA=Recombinant immunoblot assay; ??=unknown

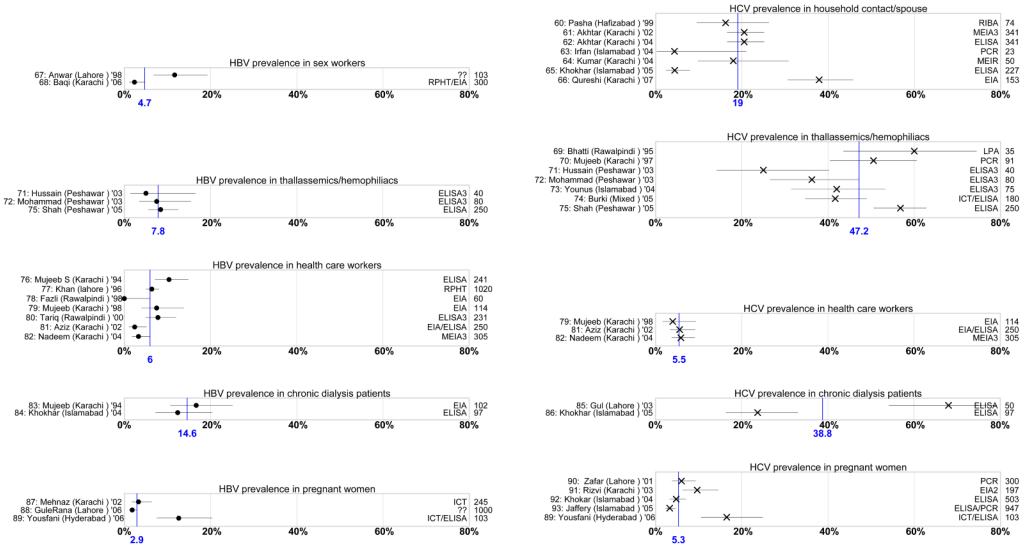

FIGURE 3. Summary of studies reporting HBV and HCV prevalence in the high risk population of Pakistan

Each study is represented horizontally. From L-R: reference number, first author, city in which study conducted, year in which study published; Dot and bar represent the point prevalence of HBV with calculated 95% confidence interval while cross and bar represent point prevalence of HCV with calculated 95% confidence interval; lab technique used to detect HBsAg or HCVAb; and sample size of the study. The vertical line represents the calculated weighted average prevalence of HBV or HCV based on all the studies in the particular group. ELISA (#) =Enzyme linked immunosorbent assay (# represents generation of test); RPHA=Reverse particle hemagglutination assay; ICT=Immuno-chromatographic test; LPA=Latex particle agglutination; MEIA (#)=Micro enzyme immunoassay (# represents generation of test); RIBA=Recombinant immunoblot assay

Table 1

Suggested interventions for reducing the transmission of blood-borne infections in Pakistan in addition to HBV vaccination

Risk factor	Structural level interventions	Health provider level interventions	Individual level interventions
Injections in healthcare settings	• Media campaign to educate public about risks of unnecessary injections • Availability of low-cost, single use syringes • Ensure availability of low-cost oral medicines	Education regarding: • Risks of unnecessary injections • Risks of reuse of needles • Availability of oral medication alternatives to injectables	Counseling for: • Insistence on oral medications whenever possible • Insistence on only new syringes and needles for injections
Injection drug use	• Creation of positive opportunities for youth • Recognition of the problem in the community • Needle exchange programs/single use syringes only • Limit availability of drugs • Drug treatment programs with opiate agonist availability	Training regarding: • Recognition of signs of drug abuse and the need to screen for HBV, HCV, and HIV • Counseling, treatment, and rehabilitation of drug addicts • Stigma reduction and willingness to care for addicts	• Education of the addict regarding the risks of infections caused by sharing needles • Counseling of the addict's family to support the patient
Receipt of blood and blood products	• Enforcement of legislation regarding mandatory screening of blood at all blood banks • Media campaign to encourage volunteer blood donations • Ban on paid blood donations	Education regarding: • Importance of comprehensive screening of all blood products • Dangers associated with paid blood donations • Limited indications for transfusion to avoid overuse	Family education regarding: • Risks of paid blood donations • Insistence on well-screened blood only • Avoidance of unnecessary use of blood or blood products
Occupational risk to healthcare workers	• Availability of safer injection technologies for blood drawing • Proper disposal of contaminated waste	Education regarding: • Safety precautions • Management of high-risk situations	Education regarding: • Safety precautions • Hand washing
Prevention of mother to child transmission	• Universal prenatal screening policies for HBV and HIV • Ready availability of test kits, drugs, vaccines, and immune globulin	Education regarding: • Need for universal screening • Management of HIV with antiretroviral medications and replacement or exclusive breast feeding	• Mass education regarding benefits of HBV and HIV screening • Counseling for reduction in social harm

Risk factor	Structural level interventions	Health provider level interventions	Individual level interventions
		• Management of HBV with vaccine and HepB immune globulin in neonates	
Sexual transmission	• 100% condom policy in sex industry • 'ABC' advocacy and education • Expanded STD services	Education regarding: • Management of STDs • 'ABC' • Stigma reduction and willingness to care for at-risk population	• Education of sex workers regarding condom use • Counseling of discordant couples in condom use

HBV, hepatitis B virus; HCV, hepatitis C virus; STD, sexually transmitted disease; ABC, 'Abstinence' for youth, 'Be faithful' for sexually active, and 'Condom availability and education' specially for high-risk persons and venues.