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# potential for human immunodeficiency virus parenteral transmission in the Middle East and North Africa: An analysis using hepatitis C virus as a proxy biomarker

Mohamoud YA *et al*. Potential for HIV parenteral transmission in MENA

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**Abstract**

The Middle East and North Africa (MENA) region has endured several major events of parenteral transmission. Recent work has established the utility of using hepatitis C virus (HCV) as a proxy biomarker for assessing the epidemic potential for human immunodeficiency virus (HIV) parenteral transmission. In this review, we use data on the prevalence of HCV infection antibody (seroprevalence) among general population and high risk population groups to assess the potential for HIV parenteral transmission in MENA. Relatively low prevalence of HCV infection in the general population groups was reported in most MENA countries indicating that parenteral HIV transmission at endemic levels does not appear to be a cause for concern. Nonetheless, there could be opportunities for localized HIV outbreaks and transmission of other blood-borne infections in some settings such as healthcare facilities. Though there have been steady improvements in safety measures related to parenteral modes of transmission in the region, these improvements have not been uniform across all countries. More precautions, including infection control training programs, surveillance systems for nosocomial infections and wider coverage and evaluation of hepatitis B virus immunization programs need to be implemented to avoid the unnecessary spread of HIV, HCV, and other blood-borne pathogens along the parenteral modes of transmission.

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**Key words:** Hepatitis C virus; human immunodeficiency virus; parenteral transmission; Middle East and North Africa; proxy biomarker

**Core tip:** The Middle East and North Africa (MENA) region has witnessed several major events of infection parenteral transmission. Recent studies of hepatitis C virus (HCV) epidemiology established the utility of using HCV as a proxy biomarker for assessing the potential for human immunodeficiency virus (HIV) parenteral transmission. Building on these novel ideas, we used HCV antibody prevalence data to assess the potential for substantial and/or sustainable HIV parenteral transmission in MENA. We found that HCV prevalence levels are consistent with limited potential for parenteral HIV transmission, but that there could be still opportunities for localized and isolated HIV outbreaks, particularly in formal and informal healthcare settings.

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**Introduction**

The Middle East and North Africa (MENA) region has endured several major events of parenteral transmission of infectious diseases. These include the world’s largest iatrogenic transmission of a blood-borne pathogen; the hepatitis C virus (HCV) epidemic in Egypt during the era of parenteral antischistosomal therapy (PAT)[[1](#_ENREF_1)], and two human immunodeficiency virus (HIV) outbreaks in renal dialysis centers also in Egypt[[2](#_ENREF_2),[3](#_ENREF_3)]. The region has also witnessed the largest documented nosocomial outbreak in HIV and acquired immune deficiency syndrome (AIDS) history which occurred in a children’s hospital in Libya and involved 402 children, 19 mothers (through breast feeding), and two nurses[[4-6](#_ENREF_4)].

Parenteral transmission of blood-borne pathogens has been documented to occur, particularly in resource-limited settings including different MENA countries[[7](#_ENREF_7),[8](#_ENREF_8)]. A few countries in this region such as Afghanistan, Pakistan, Somalia and Yemen, still lack the resources necessary to screen all blood donations and to sterilize medical equipment[[9-15](#_ENREF_9)]. Public health systems in these countries are over-stretched leading to some lapses in safety measures[[16](#_ENREF_16)]. Standard precautions are not routinely implemented in public and even less so in private practices such as among dentists[[17](#_ENREF_17),[18](#_ENREF_18)], and in hemodialysis centers[[19](#_ENREF_19)].

MENA also suffers from a high prevalence of unnecessary medical injections, unnecessary transfusions, reuse of needles and syringes, and scarifications[[6](#_ENREF_6),[10](#_ENREF_10),[11](#_ENREF_11),[16](#_ENREF_16),[20-24](#_ENREF_20)]. At 4.3 per year, this region has the highest rate of injections per person per year of all regions[[25](#_ENREF_25)]. Injections are the preferred mode of therapy even when alternative modes are equally effective and available[[26](#_ENREF_26),[27](#_ENREF_27)]. Blood transfusions are performed sometimes even without being medically indicated[[28](#_ENREF_28)]. A considerable fraction of the population reports such procedures, between 6.7% to 14.2% of diverse population groups in Sudan reported having blood transfusion at least once in their lifetime[[29-39](#_ENREF_29)].

HCV, first identified in 1989, is a blood-borne viral infection[[40](#_ENREF_40),[41](#_ENREF_41)]. It is primarily transmitted through direct percutaneous exposures to blood such as blood transfusions, sharing of needles, and accidental percutaneous occupational exposures[[42](#_ENREF_42)]. HCV is a major cause of chronic liver disease and hepatocellular carcinoma[[43](#_ENREF_43)], and is the most prevalent transfusion-transmitted infection[[44](#_ENREF_44)]. It is estimated that 130-170 million people worldwide are infected with HCV[[45](#_ENREF_45),[46](#_ENREF_46)].

Both HIV and HCV are transmitted easily through infected needles[[47](#_ENREF_47)]. Evidence from needle-stick injury studies suggest that the injection-related transmission probability for HCV is up to 10 times greater than that for HIV[[47](#_ENREF_47),[48](#_ENREF_48)]. Building on this, recent work has established the utility of using HCV antibody prevalence (seroprevalence) as a powerful proxy biomarker for the potential spread of HIV through the parenteral modes of transmission[[49-54](#_ENREF_49)]. Study findings show, for example, that among a population of people who inject drugs (PWID) if HCV prevalence was less than 30%, then HIV prevalence is likely to be negligible[[52-54](#_ENREF_52)]. However, if HCV prevalence is greater than 30%, then HIV prevalence would increase progressively with increasing HCV prevalence[[52-54](#_ENREF_52)]. Accordingly, based on the epidemiological overlap between these two infections, HCV prevalence can inform the potential for HIV parenteral transmission in a population, and predict the size of a potential HIV epidemic. HCV in this regards is a better proxy of parenteral transmissions than hepatitis B virus (HBV) which has other non-parenteral major modes of transmission[[55](#_ENREF_55)].

Given the history of major events of parenteral transmission of blood-borne pathogens in MENA, and the emerging HIV epidemics among high risk groups[[56-58](#_ENREF_56)], questions have risen as to whether there is ongoing parenteral HIV transmission in MENA beyond PWID, and whether such transmission explains a fraction of HIV acquisitions where there are no apparent identifiable risk behaviors[[59](#_ENREF_59)]. To address these questions, given limitations on HIV data, we conducted a review of HCV prevalence among general population and high risk population groups in MENA to assess the potential for HIV parenteral transmission in the region.

This review draws on findings from the MENA HIV/AIDS Synthesis Project, the largest HIV study in MENA to date[[58](#_ENREF_58),[59](#_ENREF_59)]. The project consists of a compilation, synthesis, and analysis of available data on HIV, sexually transmitted infections (STIs), and sexual risk behavior across different population groups and the various countries in MENA[[59](#_ENREF_59)]. In this review we summarize one aspect of the HIV/AIDS Synthesis project, which is the effort examining the potential for major HIV parenteral transmission in this region.

**HCV prevalence and HIV transmission potential in general population groups in MENA**

Table 1 summarizes the outcome of our review of HCV prevalence among general population groups. On the whole, low to intermediate levels of HCV prevalence are found among general population groups in most MENA countries. HCV prevalence among blood donors in Afghanistan ranges between 0.3% and 1.9% and between 0.1% and 2.1% in Iran. The prevalence among pregnant women is less than 1% in most MENA countries. These levels are not dissimilar to those found in the Americas, Asia, and Europe[[60](#_ENREF_60)]. These rather low levels imply that there is a low risk for HIV parenteral transmission among general population groups in the region.

Despite the rather low HCV prevalence levels observed in most countries, MENA as a whole appears to have the highest HCV prevalence worldwide[[61](#_ENREF_61)]. This is largely due to the contribution of the high prevalence found in heavily affected countries specifically Egypt[[62](#_ENREF_62),[63](#_ENREF_63)] and Pakistan[[64-67](#_ENREF_64)]. The Demographic and Health Survey conducted in Egypt in 2008 estimated a prevalence of 14.7% among individuals 15-59 years[[62](#_ENREF_62)]. This high level is believed to be a consequence, at least in part, of the world’s largest documented iatrogenic transmission of blood-borne pathogens during the era of PAT mass campaigns in Egypt[[1](#_ENREF_1),[68](#_ENREF_68)]. From the 1950s to the early 1980s, the Egyptian Ministry of Health led large-scale campaigns to control schistosomiasis[[68](#_ENREF_68)]. Millions of people were treated with intravenous injections of tartar emetic, before an oral drug replaced this standard of care across the country in the 1980s[[1](#_ENREF_1)]. Reuse of glass syringes and lax sterilization practices during PAT campaigns appear to have caused widespread infection with HCV, such that Egypt today has the world’s highest HCV prevalence[[42](#_ENREF_42),[46](#_ENREF_46),[61](#_ENREF_61),[63](#_ENREF_63)].

Pakistan appears to also suffer from a high HCV prevalence. A recent meta-analysis pooling 132 studies found HCV prevalence of 3% among blood donors and 4.7% among the general population in Pakistan[[64](#_ENREF_64)]. Although the reasons behind the high HCV levels in this country remain not well understood, several studies investigated the risk factors associated with HCV infection. Nosocomial exposures including reuse of needles, medical procedures and blood transfusions were reported to be strongly associated with HCV infection in this country[[69](#_ENREF_69)]. Additionally, community exposures through razor sharing and circumcision by barbers were also identified as risk factors[[69](#_ENREF_69)]. The high HCV levels and parenteral exposures identified in both Egypt and Pakistan may suggest a potential for some marginal parenteral HIV transmission in these countries.

Parenteral HCV transmission among general population groups in the region appears to be ongoing though largely at low levels. This is highlighted, for example, in studies conducted among children. HCV prevalence among children in Saudi Arabia ranged from 0.1% to 1.8%[[70-72](#_ENREF_70)] and as high as 1.5% in Somalia[[73](#_ENREF_73),[74](#_ENREF_74)] and 2.1% in Pakistan[[75](#_ENREF_75),[76](#_ENREF_76)]. Studies in Egypt suggest that in addition to vertical transmission, children could have been exposed to HCV horizontally, possibly through household exposures[[77-81](#_ENREF_77)]. Medical exposures to HCV at a very young age have been also indicated[[82-85](#_ENREF_82)]. HCV prevalence levels, however, are too low to be indicative of sustainable HIV parenteral transmission, as they are much smaller than the about 30% HCV prevalence threshold indicative of considerable potential for HIV parenteral transmission[[52](#_ENREF_52)].

**HCV prevalence and HIV transmission potential in high risk groups in MENA**

There are specific populations at higher risk for HCV and HIV parenteral transmission in MENA. Table 2 summarizes the outcome of our review of HCV prevalence among different populations at higher risk of HCV infection. High HCV prevalence is found among hospitalized and clinical populations, which have experienced various facility-based medical procedures such as hemodialysis patients and multi-transfused patients. A recent study in Algeria found HCV prevalence of 30% among hemophiliacs[[86](#_ENREF_86)]. Incidence studies conducted in Tunisia and Morocco estimate fairly high incidence rates for HCV infection among dialysis patients (2.76 and 9.41 per 100 person-years, respectively)[[87](#_ENREF_87),[88](#_ENREF_88)]. Multiple studies in the region have found strong correlations between HCV infection and different medical procedures, perinatal care, and dental treatment[[89-97](#_ENREF_89)]. Accordingly, exposures in medical care settings could constitute potential avenues for HIV parenteral transmission.

HIV prevalence has been measured and documented among a number of these high risk populations in several MENA countries. Table 3 lists these HIV prevalence measures. High HIV prevalence of 38.5% was reported among children with thalassemia in Qatar. Similarly, HIV prevalence of 4.8% was reported among blood or blood products recipients in Egypt. These studies with high HIV prevalence, however, tend to be old studies, published in the early 1990s, reflecting infections that occurred mainly before improvements in safety precautions and before implementation of stringent blood screening protocols. Meanwhile, the nil prevalence reported in more recent studies conducted in Iran, Jordan, Lebanon and Morocco reflects cross sectional surveys after safety precautions and stringent blood screening have been implemented widely in this region.

Individuals in certain professions could be at higher risk of being infected, or transmitting blood-borne infections, due to exposures to bodily fluids. Occupational injuries among healthcare workers (HCWs) are common in the region. In Morocco, occupational injuries were found to be at high frequency, though they were found to be rarely declared[[22](#_ENREF_22),[98](#_ENREF_98)]. Forty-nine percent of HCWs in Egypt[[19](#_ENREF_19)], 58.9% in Morocco[[98](#_ENREF_98)], and 45% in Pakistan[[16](#_ENREF_16)], reported a needle stick injury in the previous year[[16](#_ENREF_16)]. Another such professional category are barbers, who seem to have a five-fold higher HCV prevalence than the general population (5% in Morocco[[99](#_ENREF_99)] and 2.8% in Turkey[[100](#_ENREF_100)]). Acquiring HCV infection at barber shops has been reported in Pakistan[[65](#_ENREF_65),[76](#_ENREF_76),[101](#_ENREF_101)]. Studies among traditional barbers in Morocco and Pakistan have shown that the risk of blood-borne infections was not known to barbers nor to their customers and that hygiene conditions were deficient[[99](#_ENREF_99),[102](#_ENREF_102)]. This poses a concern with a tradition in MENA of barbers practicing medicine[[99](#_ENREF_99)].

Prisoners constitute another group at higher risk of HCV infection and transmission in the region. HCV prevalence of 31.4% was reported among prisoners in Egypt[[103](#_ENREF_103)], while the prevalence ranged from 30%[[104](#_ENREF_104)] to as high as 78%[[105](#_ENREF_105)] among prisoners in Iran. This high prevalence suggests that injecting drug use and sharing of injecting and non-injecting utensils is common in prisons.

Some parenteral transmission of HCV in medical settings appears to be ongoing in MENA. This is evidenced by the high HCV prevalence levels reported among thalassemic children and children on hemodialysis. A recent study conducted in 2010, among 692 Egyptian diabetic children with an average age of 10.4 years, reported a prevalence of 2.5%[[85](#_ENREF_85)]. Similarly, another study in Saudi Arabia reported a prevalence of 11% among children with cancer undergoing chemotherapy[[70](#_ENREF_70)].

**Discussion**

Given the rather low prevalence of HCV in general population groups in most MENA countries, parenteral HIV transmission at endemic levels does not appear to be a cause for concern. The only possible exceptions are Egypt and Pakistan where higher levels of HCV parenteral transmission appear to be ongoing. However, HCV prevalence in these two countries is still well below the threshold level of 30%, and thus is not sufficient for sustainable parenteral HIV transmission.

Nonetheless, isolated HIV outbreaks in these two countries and in other countries in the region, particularly in healthcare facilities, could still occur as they have occurred in the past. The largest ever HIV/AIDS nosocomial outbreak occurred in a children’s hospital in Libya[[4-6](#_ENREF_4)]. The first ever documented HIV outbreak in renal dialysis centers occurred in Egypt[[2](#_ENREF_2)], which later witnessed a second HIV outbreak in another renal dialysis center[[3](#_ENREF_3)]. More recently, a high HIV prevalence of 35.8% was found in a survey of the general population in Gujarat, Pakistan, and apparently it may reflect an HIV parenteral-transmission outbreak related to medical care procedures[[106](#_ENREF_106)].

While HCV genotype 4 is the most prevalent in Egypt[[107](#_ENREF_107)], HCV genotype distribution varies between countries and within countries in the rest of the MENA region[[107](#_ENREF_107)]. Different HCV genotypes may have different transmission probabilities or natural history. This suggests that our ability to use HCV prevalence as a proxy for potential HIV parenteral transmission may be dependent on which genotype is prevalent in MENA countries. However, as demonstrated by Vickerman *et al*[52-54], potential differences in the transmission probability or natural history of the different genotypes do not appear to affect the utility of HCV prevalence as a proxy biomarker of HIV parenteral transmission[[49-54](#_ENREF_49)].

While there is a very limited risk for sustainable HIV transmission, there remains a concern for other blood-borne and nosocomial infections. MENA has the highest levels of all regions in the proportion of incident HBV (58.3%) and HCV infections (81.7%) that are attributable to contaminated injections[[25](#_ENREF_25)]. Every year in MENA, contaminated injections appear to be the cause of 2.5 million HBV infections, 645,000 HCV infections, and 2200 HIV infections[[25](#_ENREF_25)]. In Kuwait, hospital acquired infections occurred in 5.1% of all inpatients costing its national healthcare system an estimate of $267000 daily[[108](#_ENREF_108)]. More recently, in Saudi Arabia, 8.5% of admitted patients developed nosocomial infections with the rates being highest for nursery (35.8%), intensive care (19.8%), gynecological (16.2%) and surgical (11.7%) patients[[109](#_ENREF_109)].

There have been steady improvements in recent years in MENA in infection control and safety measures related to parenteral modes of infection transmission, with only a few countries still lagging in achieving satisfactory standards. HCV prevalence is a proxy for the cumulative risk of parenteral exposures over an extended period of time and thus may not be representative of more recent trends. Improvements in blood safety measures have apparently reduced HIV infections due to contaminated blood in the region from 12.1% of all infections in 1993 to 0.4% in 2003[[110](#_ENREF_110)]. In Lebanon and Palestine, no new HIV cases through blood transfusion have been detected for several years[[111](#_ENREF_111),[112](#_ENREF_112)]. In Iran, HCV prevalence among thalassemia patients decreased from 22.8% to 2.6% following the implementation of blood donor screening[[113](#_ENREF_113)]. Also in Iran, HCV prevalence among hemodialysis patients decreased from 18% in 2001 to 12% in 2006 in one study[[114](#_ENREF_114)], and from 14.4% in 1999 to 4.5% in 2006 in another study[[115](#_ENREF_115)]. Similar reductions were also achieved for HBV in both Iran and Turkey[[44](#_ENREF_44),[115](#_ENREF_115),[116](#_ENREF_116)]. HBV prevalence in Iran decreased from 3.4%-3.5% in 1979-1980 to 0.61% in 2005-2006[[44](#_ENREF_44)]. Similary in Turkey, HBV prevalence among blood donors fell from 5.98% in 1987 to 2.07% in 2003[[116](#_ENREF_116)]. In Egypt, 95% of women in the 2005 Demographic and Health Survey reported that the medical provider followed basic injection safety procedures[[117](#_ENREF_117)].

However, these improvements may have not been uniform across MENA. A study in Pakistan suggested an increase in HCV prevalence in recent years[[118](#_ENREF_118)]. There is evidence of ongoing HCV incidence at dental and medical facilities[[91-94](#_ENREF_91)], and at the household and population levels in Egypt[[77](#_ENREF_77),[89](#_ENREF_89),[119](#_ENREF_119),[120](#_ENREF_120)]. There appears to be intrafamilial and household clustering of HCV infection in Pakistan[[121](#_ENREF_121)]. Talaat *et al*[[108](#_ENREF_108)] reported on an assessment survey of infection control practices conducted in a random selection of healthcare facilities in Egypt. The survey revealed poor concept of infection control in most healthcare settings[[108](#_ENREF_108)]. Infection control guidelines were not available, efforts to prevent transmission of nosocomial infections were deficient, and there was a shortage of critical basic supplies such as antiseptics, gloves, masks, gowns and disposable syringes[[108](#_ENREF_108)].

There is room for improvement in infection control and safety measures in healthcare settings in MENA. These improvements should be grounded on training and capacity building of infection control staff, the regular monitoring and supervision of infection control programs in healthcare facilities, and the establishment of surveillance systems for hospital acquired infections[[108](#_ENREF_108),[122](#_ENREF_122)]. Additionally, the availability of critical supplies and equipment such as disinfectants and protective barriers is often challenging in settings with limited resources, and need to be improved[[108](#_ENREF_108),[122](#_ENREF_122)]. Budgetary allocations and efficient advanced ordering are necessary to overcome these challenges. Finally, the promotion of occupational safety and health among HCWs is critical to reduce the incidence of unsafe practices and needle stick injuries among this population. This is key as healthcare facilities constitute the main settings of exposure to blood-borne infections.

**Conclusion**

Some HIV transmission may be present along the same pathways that HCV is using to spread in MENA. However, the parenteral modes of HIV transmission in the region, other than injecting drug use, are not of a scale that can sustain an HIV epidemic. Isolated HIV outbreaks though could still occur in some MENA countries as they have occurred in the past. Despite the steady improvements in infection control and safety measures, there are continued exposures to blood and bodily fluids in MENA countries which poses a concern for the transmission of other blood-borne infections. More precautions, including infection-control training and capacity building, monitoring and supervision of infection control programs, surveillance systems for nosocomial infections, availability of infection control supplies and equipment, in addition to more coverage and evaluation of HBV immunization programs, need to be implemented to avoid the unnecessary spread of HCV, HIV and other blood-borne pathogens along the parenteral modes of transmission.

**References**

1 **Frank C,** Mohamed MK, Strickland GT, Lavanchy D, Arthur RR, Magder LS, El Khoby T, Abdel-Wahab Y, Aly Ohn ES, Anwar W, Sallam I. The role of parenteral antischistosomal therapy in the spread of hepatitis C virus in Egypt. *Lancet* 2000; **355**: 887-891 [PMID: 10752705 DOI: 10.1016/S0140-6736(99)06527-7]

2 **Hassan NF**, el Ghorab NM, Abdel Rehim MS, el Sharkawy MS, el Sayed NM, Emara K, Soltant Y, Sanad M, Hibbs RG, Arthur RR. HIV infection in renal dialysis patients in Egypt. *AIDS* 1994; **8**: 853 [PMID: 8086148 DOI: 10.1097/00002030-199406000-00023]

3 **El Sayed NM**, Gomatos PJ, Beck-Sagué CM, Dietrich U, von Briesen H, Osmanov S, Esparza J, Arthur RR, Wahdan MH, Jarvis WR. Epidemic transmission of human immunodeficiency virus in renal dialysis centers in Egypt. *J Infect Dis* 2000; **181**: 91-97 [PMID: 10608755 DOI: 10.1086/315167]

4 **Visco-Comandini U**, Cappiello G, Liuzzi G, Tozzi V, Anzidei G, Abbate I, Amendola A, Bordi L, Budabbus MA, Eljhawi OA, Mehabresh MI, Girardi E, Antinori A, Capobianchi MR, Sönnerborg A, Ippolito G. Monophyletic HIV type 1 CRF02-AG in a nosocomial outbreak in Benghazi, Libya. *AIDS Res Hum Retroviruses* 2002; **18**: 727-732 [PMID: 12167281 DOI: 10.1089/088922202760072366]

5 **de Oliveira T**, Pybus OG, Rambaut A, Salemi M, Cassol S, Ciccozzi M, Rezza G, Gattinara GC, D'Arrigo R, Amicosante M, Perrin L, Colizzi V, Perno CF. Molecular epidemiology: HIV-1 and HCV sequences from Libyan outbreak. *Nature* 2006; **444**: 836-837 [PMID: 17171825 DOI: 10.1038/444836a]

6 **Yerly S**, Quadri R, Negro F, Barbe KP, Cheseaux JJ, Burgisser P, Siegrist CA, Perrin L. Nosocomial outbreak of multiple bloodborne viral infections. *J Infect Dis* 2001; **184**: 369-372 [PMID: 11443566 DOI: 10.1086/322036]

7 **Kane A**, Lloyd J, Zaffran M, Simonsen L, Kane M. Transmission of hepatitis B, hepatitis C and human immunodeficiency viruses through unsafe injections in the developing world: model-based regional estimates. *Bull World Health Organ* 1999; **77**: 801-807 [PMID: 10593027]

8 **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 [PMID: 10593026]

9  **WHO/EMRO**. Progress Report on HIV/AIDS and ‘3 by 5’. WHO. Cairo, July 2005

10 **Khawaja ZA**, Gibney L, Ahmed AJ, Vermund SH. HIV/AIDS and its risk factors in Pakistan. *AIDS* 1997; **11**: 843-848 [PMID: 9189208 DOI: 10.1097/00002030-199707000-00002]

11 **World Bank Group**. World Bank Update 2005: HIV/AIDS in Pakistan. 2005. available from: URL: http: //siteresources.worldbank.org/INTPAKISTAN/Resources/HIV-AIDS-brief-June2005-PK.pdf

12 **World Bank**. HIV/AIDS in Afghanistan. 2006. available from: URL: http: //www.aidsdatahub.org/sites/default/files/documents/Afghanistan\_2006\_HIV\_AIDS\_brief\_World\_Bank.pdf.pdf

13 **UNAIDS**. Country alignment and harmonisation support to scaling up the HIV/AIDS resposne: the Somali Experience. 2006

14 **WHO/EMRO**. Progress Towards Universal Access to HIV Prevention, Treatment and Care in the Health Sector. Report on a baseline survey for the year 2005 in the WHO Eastern Mediterranean Region. Draft. 2006

15 **Luby S**, Khanani R, Zia M, Vellani Z, Ali M, Qureshi AH, Khan AJ, Abdul Mujeeb S, Shah SA, Fisher-Hoch S. Evaluation of blood bank practices in Karachi, Pakistan, and the government's response. *Health Policy Plan* 2000; **15**: 217-222 [PMID: 10837045 DOI: 10.1093/heapol/15.2.217]

16 **Zafar A**, Aslam N, Nasir N, Meraj R, Mehraj V. Knowledge, attitudes and practices of health care workers regarding needle stick injuries at a tertiary care hospital in Pakistan. *J Pak Med Assoc* 2008; **58**: 57-60 [PMID: 18333520]

17 **Askarian M**, Mirzaei K, McLaws ML. Attitudes, beliefs, and infection control practices of Iranian dentists associated with HIV-positive patients. *Am J Infect Control* 2006; **34**: 530-533 [PMID: 17015160 DOI: 10.1016/j.ajic.2006.03.006]

18 **Askarian M**, Mirzaei K, Cookson B. Knowledge, attitudes, and practice of iranian dentists with regard to HIV-related disease. *Infect Control Hosp Epidemiol* 2007; **28**: 83-87 [PMID: 17230393 DOI: 10.1086/509851]

19 **Kabbash IA**, El-Sayed NM, Al-Nawawy AN, Abou Salem Mel-S, El-Deek B, Hassan NM. Risk perception and precautions taken by health care workers for HIV infection in haemodialysis units in Egypt. *East Mediterr Health J* 2007; **13**: 392-407 [PMID: 17684860]

20 **Khattab HAS**, Gineidy MA, Shorbagui N, Elnahal N. Report on a study of women living with HIV in Egypt. Egyptian Society for Population Studies and Reproductive Health, 2007

21 **Burans JP**, McCarthy M, el Tayeb SM, el Tigani A, George J, Abu-Elyazeed R, Woody JN. Serosurvey of prevalence of human immunodeficiency virus amongst high risk groups in Port Sudan, Sudan. *East Afr Med J* 1990; **67**: 650-655 [PMID: 2253574]

22 **Hossini CH**, Tripodi D, Rahhali AE, Bichara M, Betito D, Curtes JP, Verger C. [Knowledge and attitudes of health care professionals with respect to AIDS and the risk of occupational transmission of HIV in 2 Moroccan hospitals]. *Sante* 2000; **10**: 315-321 [PMID: 11125337]

23 **Yemen Ministry of Health**. National Strategic Framework for the Control and Prevention of HIV/AIDS in the Republic of Yemen. 2002. Available from: URL: <http://hivaidsclearinghouse.unesco.org/search/format_long.php?lang=en&ret=topics.php&fiche=6312>

24 **Kennedy M**, O'Reilly D, Mah MW. The use of a quality-improvement approach to reduce needlestick injuries in a Saudi Arabian hospital. *Clin Perform Qual Health Care* 1998; **6**: 79-83 [PMID: 10180126]

25 **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 [PMID: 14769164 DOI: 10.1258/095646204322637182]

26 **Janjua NZ**, Hutin YJ, Akhtar S, Ahmad K. Population beliefs about the efficacy of injections in Pakistan's Sindh province. *Public Health* 2006; **120**: 824-833 [PMID: 16876212 DOI: 10.1016/j.puhe.2006.05.004]

27 **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**: 35-38 [PMID: 15631369]

28 **Mujeeb SA.** Blood transfusion – a potential source of HIV/AIDS spread. *J Pakistan Med Assoc* 1993; **43**: 1 [PMID: 8474211]

29 **Ahmed SM**. University Students. Situation Analysis-Behavioral Survey. Results & Discussions. Report. Sudan National AIDS Control Program. 2004

30 **Ahmed SM.** Truck Drivers. Situation Analysis-Behavioral Survey. Results & Discussions. Report. Sudan National AIDS Control Program. 2004

31 **Ahmed SM.** Tea Sellers. Situation Analysis-Behavioral Survey. Results & Discussions. Report. Sudan National AIDS Control Program. 2004

32 **Ahmed SM.** TB Patients. Situation Analysis-Behavioral Survey. Results & Discussions. Report. Sudan National AIDS Control Program. 2004

33 **Ahmed SM.** Street Children. Situation Analysis-Behavioral Survey. Results & Discussions. Report. Sudan National AIDS Control Program. 2004

34 **Ahmed SM.** STDs. Situation Analysis-Behavioral Survey. Results & Discussions. Report. Sudan National AIDS Control Program. 2004

35 **Ahmed SM.** Sex Sellers. Situation Analysis-Behavioral Survey. Results & Discussions. Report. Sudan National AIDS Control Program. 2004

36 **Ahmed SM.** Military. Situation Analysis-Behavioral Survey. Results & Discussions. Report. Sudan National AIDS Control Program. 2004

37 **Ahmed SM.** Internally Displaced People. Situation Analysis-Behavioral Survey. Results & Discussions. Report. Sudan National AIDS Control Program. 2004

38 **Ahmed SM.** Antenatal. Situation Analysis-Behavioral Survey. Results & Discussions. Report. Sudan National AIDS Control Program. 2004

39 **Ahmed SM.** AIDS Patients. Situation Analysis-Behavioral Survey. Results & Discussions. Report. Sudan National AIDS Control Program. 2004

40 **Miller FD**, Abu-Raddad LJ. Evidence of intense ongoing endemic transmission of hepatitis C virus in Egypt. *Proc Natl Acad Sci USA* 2010; **107**: 14757-14762 [PMID: 20696911 DOI: 1008877107]

41 **Choo Q**, Kuo G, Weiner A, Overby L, Bradley D, Houghton M. Isolation of a cDNA clone derived from a blood-borne non-A, non-B viral hepatitis genome. *Science* 1989; **244**: 359-362 [PMID: 2523562 DOI: 10.1126/science.2523562]

42 **Alter MJ**. Epidemiology of hepatitis C virus infection. *World J Gastroenterol* 2007; **13**: 2436-2441 [PMID: 17552026 DOI: 10.3748/wjg.v19.i40.6703]

43 **Colombo M**, Rumi MG, Ninno ED. Treatment of chronic hepatitis C in Europe. *J Hepatobiliary Pancreat Surg* 2003; **10**: 168-171 [PMID: 14505151 DOI: 10.1007/s00534-002-0728-4]

44 **Rezvan H**, Abolghassemi H, Kafiabad SA. Transfusion-transmitted infections among multitransfused patients in Iran: a review. *Transfus Med* 2007; **17**: 425-433 [PMID: 18067646 DOI: 10.1111/j.1365-3148.2007.00794.x]

45 **Blower SM**, Dowlatabadi H. Sensitivity and Uncertainty Analysis of Complex Models of Disease Transmission: An HIV Model, as an Example. *Int Stat Rev* 1994; **62**: 229-243 [DOI: 10.2307/1403510]

46 **Shepard CW**, Finelli L, Alter MJ. Global epidemiology of hepatitis C virus infection. *Lancet Infect Dis* 2005; **5**: 558-567 [PMID: 16122679 DOI: 10.1016/S1473-3099(05)70216-4]

47 **Baggaley RF**, Boily MC, White RG, Alary M. Risk of HIV-1 transmission for parenteral exposure and blood transfusion: a systematic review and meta-analysis. *AIDS* 2006; **20**: 805-812 [PMID: 16549963 DOI: 10.1097/01.aids.0000218543.46963.6d]

48 **Boily MC**, Pickles M, Vickerman P, Buzdugan R, Isac S, Deering KN, Blanchard JF, Moses S, Lowndes CM, Ramesh BM, Demers E, Alary M. Using mathematical modelling to investigate the plausibility of attributing observed antenatal clinic declines to a female sex worker intervention in Karnataka state, India. *AIDS* 2008; **22** Suppl 5: S149-S164 [PMID: 19098475 DOI: 10.1097/01.aids.0000343773.59776.5b]

49 **Goldmann DA**. Blood-borne pathogens and nosocomial infections. *J Allergy Clin Immunol* 2002; **110**: S21-S26 [PMID: 12170239 DOI: 10.1067/mai.2002.125337]

50 **Walker PR**, Worobey M, Rambaut A, Holmes EC, Pybus OG. Epidemiology: Sexual transmission of HIV in Africa. *Nature* 2003; **422**: 679 [PMID: 12700750 DOI: 10.1038/422679a]

51 **Schmid GP**, Buvé A, Mugyenyi P, Garnett GP, Hayes RJ, Williams BG, Calleja JG, De Cock KM, Whitworth JA, Kapiga SH, Ghys PD, Hankins C, Zaba B, Heimer R, Boerma JT. Transmission of HIV-1 infection in sub-Saharan Africa and effect of elimination of unsafe injections. *Lancet* 2004; **363**: 482-488 [PMID: 14962531 DOI: 10.1016/S0140-6736(04)15497-4]

52 **Vickerman P**, Hickman M, May M, Kretzschmar M, Wiessing L. Can hepatitis C virus prevalence be used as a measure of injection-related human immunodeficiency virus risk in populations of injecting drug users? An ecological analysis. *Addiction* 2010; **105**: 311-318 [PMID: 19922515 DOI: 10.1111/j.1360-0443.2009.02759.x]

53 **Vickerman P**, Martin NK, Hickman M. Understanding the trends in HIV and hepatitis C prevalence amongst injecting drug users in different settings--implications for intervention impact. *Drug Alcohol Depend* 2012; **123**: 122-131 [PMID: 22138540 DOI: 10.1016/j.drugalcdep.2011.10.032]

54 **Vickerman P**, Martin NK, Roy A, Beattie T, Jarlais DD, Strathdee S, Wiessing L, Hickman M. Is the HCV-HIV co-infection prevalence amongst injecting drug users a marker for the level of sexual and injection related HIV transmission? *Drug Alcohol Depend* 2013; **132**: 172-181 [PMID: 23453261 DOI: 10.1016/j.drugalcdep.2013.01.020]

55 **Maayan S**, Shufman EN, Engelhard D, Shouval D. Exposure to hepatitis B and C and to HTLV-1 and 2 among Israeli drug abusers in Jerusalem. *Addiction* 1994; **89**: 869-874 [PMID: 8081185 DOI: 10.1111/j.1360-0443.1994.tb00990.x]

56 **Mumtaz G**, Hilmi N, McFarland W, Kaplan RL, Akala FA, Semini I, Riedner G, Tawil O, Wilson D, Abu-Raddad LJ. Are HIV epidemics among men who have sex with men emerging in the Middle East and North Africa?: a systematic review and data synthesis. *PLoS Med* 2010; **8**: e1000444 [PMID: 21829329 DOI: 10.1371/journal.pmed.1000444]

57 **Mumtaz G**, Hilmi N, Akala FA, Semini I, Riedner G, Wilson D, Abu-Raddad LJ. HIV-1 molecular epidemiology evidence and transmission patterns in the Middle East and North Africa. *Sex Transm Infect* 2011; **87**: 101-106 [PMID: 21036790 DOI: 10.1136/sti.2010.043711]

58 **Abu-Raddad LJ**, Hilmi N, Mumtaz G, Benkirane M, Akala FA, Riedner G, Tawil O, Wilson D. Epidemiology of HIV infection in the Middle East and North Africa. *AIDS* 2010; **24** Suppl 2: S5-23 [PMID: 20610949 DOI: 10.1097/01.aids.0000386729.56683.33]

59 **Abu-Raddad L**, Akala FA, Semini I, Riedner G, Wilson D, Tawil O. Characterizing the HIV/AIDS epidemic in the Middle East and North Africa: Time for Strategic Action. Middle East and North Africa HIV/AIDS Epidemiology Synthesis Project. World Bank/UNAIDS/WHO Publication. Washington DC: The World Bank Press, 2010 [DOI: 10.1596/978-0-8213-8137-3]

60 **Sy T**, Jamal MM. Epidemiology of hepatitis C virus (HCV) infection. *Int J Med Sci* 2006; **3**: 41-46 [PMID: 16614741 DOI: 10.7150/ijms.3.41]

61 **Lavanchy D**. Evolving epidemiology of hepatitis C virus. *Clin Microbiol Infect* 2011; **17**: 107-115 [PMID: 21091831 DOI: 10.1111/j.1469-0691.2010.03432.x]

62 **El-Zanaty F**, Way A. Egypt Demographic and Health Survey 2008. Egyptian: Ministry of Health. Cairo: El-Zanaty and Associates, and Macro International, 2009. Available from: URL: https: //www.measuredhs.com/pubs/pdf/FR220/FR220.pdf

63 **Mohamoud YA**, Mumtaz GR, Riome S, Miller D, Abu-Raddad LJ. The epidemiology of hepatitis C virus in Egypt: a systematic review and data synthesis. *BMC Infect Dis* 2013; **13**: 288 [PMID: 23799878 DOI: 10.1186/1471-2334-13-288]

64 **Umar M**, Bushra HT, Ahmad M, Data A, Ahmad M, Khurram M, Usman S, Arif M, Adam T, Minhas Z, Arif A, Naeem A, Ejaz K, Butt Z, Bilal M. Hepatitis C in Pakistan: a review of available data. *Hepat Mon* 2010; **10**: 205-214 [PMID: 22308140]

65 **Raja NS**, Janjua KA. Epidemiology of hepatitis C virus infection in Pakistan. *J Microbiol Immunol Infect* 2008; **41**: 4-8 [PMID: 18327420]

66 **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**: 534-536 [PMID: 15353136]

67 **Aslam M**, Aslam J, Mitchell BD, Munir KM. Association between smallpox vaccination and hepatitis C antibody positive serology in Pakistani volunteers. *J Clin Gastroenterol* 2005; **39**: 243-246 [PMID: 15718868 DOI: 10.1097/01.mcg.0000153286.02694.14]

68 **Strickland GT**. Liver disease in Egypt: hepatitis C superseded schistosomiasis as a result of iatrogenic and biological factors. *Hepatology* 2006; **43**: 915-922 [PMID: 16628669 DOI: 10.1002/hep.21173]

69 **Idrees M**,Riazuddin S. Frequency distribution of hepatitis C virus genotypes in different geographical regions of Pakistan and their possible routes of transmission. *BMC Infect Dis* 2008; **8**: 69 [PMID: 18498666 DOI: 10.1186/1471-2334-8-69]

70 **Bakir TM**,Kurbaan KM, al Fawaz I, Ramia S. Infection with hepatitis viruses (B and C) and human retroviruses (HTLV-1 and HIV) in Saudi children receiving cycled cancer chemotherapy. *J Trop Pediatr* 1995; **41**: 206-209 [PMID: 7563271 DOI: 10.1093/tropej/41.4.206]

71 **al-Faleh FZ**, Ayoola EA, al-Jeffry M, al-Rashed R, al-Mofarreh M, Arif M, Ramia S, al-Karawi M, al-Shabrawy M. Prevalence of antibody to hepatitis C virus among Saudi Arabian children: a community-based study. *Hepatology* 1991; **14**: 215-218 [PMID: 1650324 DOI: 10.1002/hep.1840140202]

72 **Shobokshi OA**,Serebour FE, Al-Drees AZ, Mitwalli AH, Qahtani A, Skakni LI. Hepatitis C virus seroprevalence rate among Saudis. *Saudi Med J* 2003; **24** Suppl 2: S81**-**S86 [PMID: 12897907]

73 **Aceti A**, Taliani G, Bruni R, Sharif OS, Moallin KA, Celestino D, Quaranta G, Sebastiani A. Hepatitis C virus infection in chronic liver disease in Somalia. *Am J Trop Med Hyg* 1993; **48**: 581-584 [PMID: 7683179]

74 **Bile K**, Mohamud O, Aden C, Isse A, Norder H, Nilsson L, Magnius L. The risk for hepatitis A, B, and C at two institutions for children in Somalia with different socioeconomic conditions. *Am J Trop Med Hyg* 1992; **47**: 357-364 [PMID: 1524149]

75 **Butt T**, Amin MS. Seroprevalence of hepatitis B and C infections among young adult males in Pakistan. *East Mediterr Health J* 2008; **14**: 791-797 [PMID: 19166161]

76 **Ali SA**, Donahue RM, Qureshi H, Vermund SH. Hepatitis B and hepatitis C in Pakistan: prevalence and risk factors. *Int J Infect Dis* 2009; **13**: 9-19 [PMID: 18835208 DOI: 10.1016/j.ijid.2008.06.019]

77 **Mohamed MK**, Abdel-Hamid M, Mikhail NN, Abdel-Aziz F, Medhat A, Magder LS, Fix AD, Strickland GT. Intrafamilial transmission of hepatitis C in Egypt. *Hepatology* 2005; **42**: 683-687 [PMID: 16032698 DOI: 10.1002/hep.20811]

78 **Plancoulaine S**, Mohamed MK, Arafa N, Bakr I, Rekacewicz C, Trégouët DA, Obach D, El Daly M, Thiers V, Féray C, Abdel-Hamid M, Abel L, Fontanet A. Dissection of familial correlations in hepatitis C virus (HCV) seroprevalence suggests intrafamilial viral transmission and genetic predisposition to infection. *Gut* 2008; **57**: 1268-1274 [PMID: 18480169 DOI: 10.1136/gut.2007.140681]

79 **Morad WS**. Transmission of hepatitis C between spouses an epidemiological study at National Liver Institute hospital.*Inter J Infect Dis* 2011; **15**: S81

80 **Shebl FM**, El-Kamary SS, Saleh DA, Abdel-Hamid M, Mikhail N, Allam A, El-Arabi H, Elhenawy I, El-Kafrawy S, El-Daly M, Selim S, El-Wahab AA, Mostafa M, Sharaf S, Hashem M, Heyward S, Stine OC, Magder LS, Stoszek S, Strickland GT. Prospective cohort study of mother-to-infant infection and clearance of hepatitis C in rural Egyptian villages. *J Med Virol* 2009; **81**: 1024-1031 [PMID: 19382251 DOI: 10.1002/jmv.21480]

81 **El-Zayadi A**, Khalifa AA, El-Misiery A, Naser AM, Dabbous H, Aboul-Ezz AA. Evaluation of risk factors for intrafamilial transmission of HCV infection in Egypt. *J Egypt Public Health Assoc* 1997; **72**: 33-51 [PMID: 17265624]

82 **Kandil ME**, Rasheed MA, Saad NE. Hepatitis C and B viruses among some high risk groups of Egyptian children**.** *J Med Sci* 2007; **7**: 1259-1267

83 **Hammad AM**, Zaghloul MH. Hepatitis G virus infection in Egyptian children with chronic renal failure (single centre study). *Ann Clin Microbiol Antimicrob* 2009; **8**: 36 [PMID: 20015406 DOI: 10.1186/1476-0711-8-36]

84 **el-Nanawy AA**, el Azzouni OF, Soliman AT, Amer AE, Demian RS, el-Sayed HM. Prevalence of hepatitis-C antibody seropositivity in healthy Egyptian children and four high risk groups. *J Trop Pediatr* 1995; **41**: 341-343 [PMID: 8606441 DOI: 10.1093/tropej/41.6.341]

85 **El-Karaksy H**, Anwar GH, El-Raziky MS, El-Hawary M, Hashem M, El-Sayed R, El-Shabrawi M, Mohsen N, Fouad H, Esmat G. Anti-HCV prevalence among diabetic and non-diabetic Egyptian children. *Curr Diabetes Rev* 2010; **6**: 388-392 [PMID: 20879976 DOI: 10.2174/157339910793499137]

86 **Saidane N,** Saidi M, Derdous C, Rouabhia S, Soltani F, Ouarhlent Y. Various complications in haemophiliacs managed by Hospital University of Batna, Algeria. *J Thromb Haemost* 2011; **9**: 923

87 **Ben Othman S**, Bouzgarrou N, Achour A, Bourlet T, Pozzetto B, Trabelsi A. [High prevalence and incidence of hepatitis C virus infections among dialysis patients in the East-Centre of Tunisia]. *Pathol Biol (Paris)* 2004; **52**: 323-327 [PMID: 15261374 DOI: 10.1016/j.patbio.2003.07.001]

88 **Sekkat S**,Kamal N, Benali B, Fellah H, Amazian K, Bourquia A, El Kholti A, Benslimane A.[Prevalence of anti-HCV antibodies and seroconversion incidence in five haemodialysis units in Morocco]. *Nephrol Ther* 2008; **4**: 105-110 [PMID: 18272446 DOI: 10.1016/j.nephro.2007.11.007]

89 **Saleh DA,** Shebl F, Abdel-Hamid M, Narooz S, Mikhail N, El-Batanony M, El-Kafrawy S, El-Daly M, Sharaf S, Hashem M, El-Kamary S, Magder LS, Stoszek SK, Strickland GT. Incidence and risk factors for hepatitis C infection in a cohort of women in rural Egypt. *Trans R Soc Trop Med Hyg* 2008; **102**: 921-928 [PMID: 18514243 DOI: 10.1016/j.trstmh.2008.04.011]

90 **Arafa N**, El Hoseiny M, Rekacewicz C, Bakr I, El-Kafrawy S, El Daly M, Aoun S, Marzouk D, Mohamed MK, Fontanet A. Changing pattern of hepatitis C virus spread in rural areas of Egypt. *J Hepatol* 2005; **43**: 418-424 [PMID: 16019104 DOI: 10.1016/j.jhep.2005.03.021]

91 **el-Sadawy M**, Ragab H, el-Toukhy H, el-Mor Ael-L, Mangoud AM, Eissa MH, Afefy AF, el-Shorbagy E, Ibrahem IA, Mahrous S, Abdel-Monem A, Sabee EI, Ismail A, Morsy TA, Etewa S, Nor Edin E, Mostafa Y, Abouel-Magd Y, Hassan MI, Lakouz K, Abdel-Aziz K, el-Hady G, Saber M. Hepatitis C virus infection at Sharkia Governorate, Egypt: seroprevalence and associated risk factors. *J Egypt Soc Parasitol* 2004; **34**: 367-384 [PMID: 15124747]

92 **Habib M**, Mohamed MK, Abdel-Aziz F, Magder LS, Abdel-Hamid M, Gamil F, Madkour S, Mikhail NN, Anwar W, Strickland GT, Fix AD, Sallam I. Hepatitis C virus infection in a community in the Nile Delta: risk factors for seropositivity. *Hepatology* 2001; **33**: 248-253 [PMID: 11124843 DOI: 10.1053/jhep.2001.20797]

93 **Kalil KA**, Farghally HS, Hassanein KM, Abd-Elsayed AA, Hassanein FE. Hepatitis C virus infection among paediatric patients attending University of Assiut Hospital, Egypt. *East Mediterr Health J* 2010; **16**: 356-361 [PMID: 20795415]

94 **Barakat SH**, El-Bashir N. Hepatitis C virus infection among healthy Egyptian children: prevalence and risk factors. *J Viral Hepat* 2011; **18**: 779-784 [PMID: 21992795 DOI: 10.1111/j.1365-2893.2010.01381.x]

95 **Mohamed MK**, Hussein MH, Massoud AA, Rakhaa MM, Shoeir S, Aoun AA, Aboul Naser M. Study of the risk factors for viral hepatitis C infection among Egyptians applying for work abroad. *J Egypt Public Health Assoc* 1996; **71**: 113-147 [PMID: 17217004]

96 **Cacoub P**, Ohayon V, Sekkat S, Dumont B, Sbai A, Lunel F, Benslimane A, Godeau P, Archane MI. [Epidemiologic and virologic study of hepatitis C virus infections in Morocco]. *Gastroenterol Clin Biol* 2000; **24**: 169-173 [PMID: 12687957]

97 **Kutrani H**, El-Gatit A, Shekhteryea A, El-Gitait Y, Sudani O, Akoub S. [Demographic factors influencing hepatitis B and C infection in Benghazi, Libyan Arab Jamahiriya]. *East Mediterr Health J* 2007; **13**: 85-97 [PMID: 17546910]

98 **Laraqui O**, Laraqui S, Tripodi D, Zahraoui M, Caubet A, Verger C, Laraqui CH. [Assessing knowledge, attitude, and practice on occupational blood exposure in caregiving facilities, in Morocco]. *Med Mal Infect* 2008; **38**: 658-666 [PMID: 18954949 DOI: S0399-077X(08)00275-8]

99 **Zahraoui-Mehadji M**, Baakrim MZ, Laraqui S, Laraqui O, El Kabouss Y, Verger C, Caubet A, Laraqui CH. [Infectious risks associated with blood exposure for traditional barbers and their customers in Morocco]. *Sante* 2004; **14**: 211-216 [PMID: 15745870]

100 **Candan F**, Alagözlü H, Poyraz O, Sümer H. Prevalence of hepatitis B and C virus infection in barbers in the Sivas region of Turkey. *Occup Med* (Lond) 2002; **52**: 31-34 [PMID: 11872792 DOI: 10.1093/occmed/52.1.31]

101 **Khattak MN**, Akhtar S, Mahmud S, Roshan TM. Factors influencing Hepatitis C virus sero-prevalence among blood donors in north west Pakistan. *J Public Health Policy* 2008; **29**: 207-225 [PMID: 18523475 DOI: jphp20087]

102 **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**: 116-119 [PMID: 15129868]

103 **Quinti I**, Renganathan E, El Ghazzawi E, Divizia M, Sawaf G, Awad S, Pana A, Rocchi G. Seroprevalence of HIV and HCV infections in Alexandria, Egypt. *Zentralbl Bakteriol* 1995; **283**: 239-244 [PMID: 8825115 DOI: 10.1016/S0934-8840(11)80205-7]

104 **Mohammad Alizadeh AH**, Alavian SM, Jafari K, Yazdi N. Prevalence of hepatitis C virus infection and its related risk factors in drug abuser prisoners in Hamedan--Iran. *World J Gastroenterol* 2005; **11**: 4085-4089 [PMID: 15996035]

105 **Nassirimanesh B**. Proceedings of the abstract for the Fourth National Harm Reduction Conference, Seattle, USA. 2002

106 **Ansari JA**, Salman M, Safdar RM, Ikram N, Mahmood T, Zaheer HA, Walke H, Asghar RJ. HIV/AIDS outbreak investigation in Jalalpur Jattan (JPJ), Gujrat, Pakistan. *J Epidemiol Glob Health* 2013; **3**: 261-268 [PMID: 24206797 DOI: 10.1016/j.jegh.2013.06.001]

107 **Ramia S**, Eid-Fares J. Distribution of hepatitis C virus genotypes in the Middle East. *Int J Infect Dis* 2006; **10**: 272-277 [PMID: 16564719 DOI: 10.1016/j.ijid.2005.07.008]

108 **Talaat M**, Kandeel A, Rasslan O, Hajjeh R, Hallaj Z, El-Sayed N, Mahoney FJ. Evolution of infection control in Egypt: achievements and challenges. *Am J Infect Control* 2006; **34**: 193-200 [PMID: 16679176 DOI: 10.1016/j.ajic.2005.05.028]

109 **Al-Ghamdi S**, Gedebou M, Bilal NE. Nosocomial infections and misuse of antibiotics in a provincial community hospital, Saudi Arabia. *J Hosp Infect* 2002; **50**: 115-121 [PMID: 11846538 DOI: 10.1053/jhin.2001.1149]

110 **UNAIDS RST MENA.** Notes on AIDS in the Middle East and North Africa. 2008. Available from: URL: http://www.worldbank.org/en/region/mena

111 **Jurjus AR**, Kahhaleh J; National AIDS Program; Organization-EMRO WH. Knowledge, Attitudes, Beliefs, and Practices of the Lebanese Concerning HIV/AIDS. Beirut, Lebanon. 2004

112 **UNAIDS**. Key Findings on HIV Status in the West Bank and Gaza. Working Document. UNAIDS Regional Support Team For the Middle East and North Africa. 2007

113 **Mirmomen S**, Alavian SM, Hajarizadeh B, Kafaee J, Yektaparast B, Zahedi MJ, Zand V, Azami AA, Hosseini MM, Faridi AR, Davari K, Hajibeigi B. Epidemiology of hepatitis B, hepatitis C, and human immunodeficiency virus infecions in patients with beta-thalassemia in Iran: a multicenter study. *Arch Iran Med* 2006; **9**: 319-323 [PMID: 17061602]

114 **Taziki O**, Espahbodi F. Prevalence of hepatitis C virus infection in hemodialysis patients. *Saudi J Kidney Dis Transpl* 2008; **19**: 475-478 [PMID: 18445917]

115 **Alavian SM**, Bagheri-Lankarani K, Mahdavi-Mazdeh M, Nourozi S. Hepatitis B and C in dialysis units in Iran: changing the epidemiology. *Hemodial Int* 2008; **12**: 378-382 [PMID: 18638096 DOI: HDI284]

116 **Kocak N**, Hepgul S, Ozbayburtlu S, Altunay H, Ozsoy MF, Kosan E, Aksu Y, Yilmaz G, Pahsa A. Trends in major transfusion-transmissible infections among blood donors over 17 years in Istanbul, Turkey. *J Int Med Res* 2006; **32**: 671-675 [PMID: 15587762 DOI: 10.1177/147323000403200613]

117 **Measure DHS**. Egypt: Demographic and Health Survey 2005. In: Africa MEaN, editor. Demographic and Health Surveys, 2006

118 **Mujeeb SA**, Pearce MS. Temporal trends in hepatitis B and C infection in family blood donors from interior Sindh, Pakistan. *BMC Infect Dis* 2008; **8**: 43 [PMID: 18402660 DOI: 1471-2334-8-43]

119 **Mohamed MK**, Magder LS, Abdel-Hamid M, El-Daly M, Mikhail NN, Abdel-Aziz F, Medhat A, Thiers V, Strickland GT. Transmission of hepatitis C virus between parents and children. *Am J Trop Med Hyg* 2006; **75**: 16-20 [PMID: 16837701 DOI: 75/1/16]

120 **Magder LS**, Fix AD, Mikhail NN, Mohamed MK, Abdel-Hamid M, Abdel-Aziz F, Medhat A, Strickland GT. Estimation of the risk of transmission of hepatitis C between spouses in Egypt based on seroprevalence data. *Int J Epidemiol* 2005; **34**: 160-165 [PMID: 15647312 DOI: dyh370]

121 **Abbas Z**, Jeswani NL, Kakepoto GN, Islam M, Mehdi K, Jafri W. Prevalence and mode of spread of hepatitis B and C in rural Sindh, Pakistan. *Trop Gastroenterol* 2008; **29**: 210-216 [PMID: 19323090]

122 **Memish ZA**. Infection control in Saudi Arabia: meeting the challenge. *Am J Infect Control* 2002; **30**: 57-65 [PMID: 11852419 DOI: 10.1067/mic.2002.120905]

123 **Dupire B**, Abawi AK, Ganteaume C, Lam T, Truze P, Martet G. [Establishment of a blood transfusion center at Kabul (Afghanistan)]. *Sante* 1999; **9**: 18-22 [PMID: 10210798]

124 **Afghanistan Central Blood Bank**. Report of Testing of Blood Donors from March – December, 2006. Ministry of Public Health, Kabul, Afghanistan. 2006

125 **Todd CS**, Ahmadzai M, Atiqzai F, Miller S, Smith JM, Ghazanfar SA, Strathdee SA. Seroprevalence and correlates of HIV, syphilis, and hepatitis B and C virus among intrapartum patients in Kabul, Afghanistan. *BMC Infect Dis* 2008; **8**: 119 [PMID: 18798996 DOI: 1471-2334-8-119]

126 **Ayed Z**, Houinato D, Hocine M, Ranger-Rogez S, Denis F. [Prevalence of serum markers of hepatitis B and C in blood donors and pregnant women in Algeria]. *Bull Soc Pathol Exot* 1995; **88**: 225-228 [PMID: 8646011]

127 **Aidaoui M**, Bouzbid S, Laouar M. [Seroprevalence of HIV infection in pregnant women in the Annaba region (Algeria)]. *Rev Epidemiol Sante Publique* 2008; **56**: 261-266 [PMID: 18687541 DOI: 10.1016/j.respe.2008.05.023]

128 **Almawi WY**, Qadi AA, Tamim H, Ameen G, Bu-Ali A, Arrayid S, Abou Jaoude MM. Seroprevalence of hepatitis C virus and hepatitis B virus among dialysis patients in Bahrain and Saudi Arabia. *Transplant Proc* 2004; **36**: 1824-1826 [PMID: 15350487 DOI: 10.1016/j.transproceed.2004.07.019]

129 **Dray X**, Dray-Spira R, Bronstein JA, Mattera D. [Prevalences of HIV, hepatitis B and hepatitis C in blood donors in the Republic of Djibouti]. *Med Trop* (Mars) 2005; **65**: 39-42 [PMID: 15903075]

130 **Abdel-Wahab MF,** Zakaria S, Kamel M, Abdel-Khaliq MK, Mabrouk MA, Salama H, Esmat G, Thomas DL, Strickland GT. High seroprevalence of hepatitis C infection among risk groups in Egypt**.** *Am J Trop Med Hyg* 1994; **51**: 563-567 [PMID: 7527186]

131 **El-Gilany AH**, El-Fedawy S. Bloodborne infections among student voluntary blood donors in Mansoura University, Egypt. *East Mediterr Health J* 2006; **12**: 742-748 [PMID: 17333818]

132 **Wasfi OA**, Sadek NA. Prevalence of hepatitis B surface antigen and hepatitis C virus antibodies among blood donors in Alexandria, Egypt. *East Mediterr Health J* 2011; **17**: 238-242 [PMID: 21735965]

133 **Farawela H**, Khorshied M, Shaheen I, Gouda H, Nasef A, Abulata N, Mahmoud HA, Zawam HM, Mousa SM. The association between hepatitis C virus infection, genetic polymorphisms of oxidative stress genes and B-cell non-Hodgkin's lymphoma risk in Egypt. *Infect Genet Evol* 2012; **12**: 1189-1194 [PMID: 22522002 DOI: 10.1016/j.meegid.2012.04.007]

134 **Khattab MA**, Eslam M, Sharwae MA, Hamdy L. Seroprevalence of hepatitis C and B among blood donors in Egypt: Minya Governorate, 2000-2008. *Am J Infect Control* 2010; **38**: 640-641 [PMID: 20400204 DOI: 10.1016/j.ajic.2009.12.016]

135 **Tanaka Y**, Agha S, Saudy N, Kurbanov F, Orito E, Kato T, Abo-Zeid M, Khalaf M, Miyakawa Y, Mizokami M. Exponential spread of hepatitis C virus genotype 4a in Egypt. *J Mol Evol* 2004; **58**: 191-195 [PMID: 15042339 DOI: 10.1007/s00239-003-2541-3]

136 **Darwish MA**, Raouf TA, Rushdy P, Constantine NT, Rao MR, Edelman R. Risk factors associated with a high seroprevalence of hepatitis C virus infection in Egyptian blood donors. *Am J Trop Med Hyg* 1993; **49**: 440-447 [PMID: 7692754]

137 **Gohary A**, Hassan A, Nooman Z, Lavanchy D, Mayerat C, el Ayat A, Fawaz N, Gobran F, Ahmed M, Kawano F. High prevalence of hepatitis C virus among urban and rural population groups in Egypt. *Acta Trop* 1995; **59**: 155-161 [PMID: 7545863 DOI: 0001706X9500075P]

138 **Awadalla HI**, Ragab MH, Nassar NA, Osman MA. Risk factors of hepatitis C infection among Egyptian blood donors. *Cent Eur J Public Health* 2011; **19**: 217-221 [PMID: 22432397]

139 **Arthur RR**, Hassan NF, Abdallah MY, el-Sharkawy MS, Saad MD, Hackbart BG, Imam IZ. Hepatitis C antibody prevalence in blood donors in different governorates in Egypt. *Trans R Soc Trop Med Hyg* 1997; **91**: 271-274 [PMID: 9231192 DOI: 10.1016/S0035-9203(97)90070-5]

140 **Bassily S**, Hyams KC, Fouad RA, Samaan MD, Hibbs RG. A high risk of hepatitis C infection among Egyptian blood donors: the role of parenteral drug abuse. *Am J Trop Med Hyg* 1995; **52**: 503-505 [PMID: 7541968]

141 **El-Raziky MS**, El-Hawary M, Esmat G, Abouzied AM, El-Koofy N, Mohsen N, Mansour S, Shaheen A, Abdel Hamid M, El-Karaksy H. Prevalence and risk factors of asymptomatic hepatitis C virus infection in Egyptian children. *World J Gastroenterol* 2007; **13**: 1828-1832 [PMID: 17465475]

142 **El Sherbini A**, Mohsen SA, Hasan W, Mostafa S, El Gohary K, Moneib A, Abaza AH. The peak impact of an Egyptain outbreak of hepatitis C virus: has it passed or has not yet occurred? *Liver Int* 2007; **27**: 876-877 [PMID: 17617132 DOI: 10.1111/j.1478-3231.2007.01501.x]

143 **Madwar MA**, El-Gindy I, Fahmy HM, Shoeb NM, Massoud BA. Hepatitis C virus transmission in family members of Egyptian patients with HCV related chronic liver disease. *J Egypt Public Health Assoc* 1999; **74**: 313-332 [PMID: 17219873]

144 **Shemer-Avni Y**, el Astal Z, Kemper O, el Najjar KJ, Yaari A, Hanuka N, Margalith M, Sikuler E. Hepatitis C virus infection and genotypes in Southern Israel and the Gaza Strip. *J Med Virol* 1998; **56**: 230-233 [PMID: 9783690 DOI: 10.1002/(SICI)1096-9071(199811)56:3<230::AID-JMV9>3.0.CO;2-8]

145 **el-Ghazzawi E**, Drew L, Hamdy L, El-Sherbini E, Sadek Sel-D, Saleh E. Intravenous drug addicts: a high risk group for infection with human immunodeficiency virus, hepatitis viruses, cytomegalo virus and bacterial infections in Alexandria Egypt. *J Egypt Public Health Assoc* 1995; **70**: 127-150 [PMID: 17214204]

146 **Salama KM**, Selim Oel-S. Hepatitis G virus infection in multitransfused Egyptian children. *Pediatr Hematol Oncol* 2009; **26**: 232-239 [PMID: 19437325 DOI: 10.1080/08880010902897591]

147 **Lehman EM**, Wilson ML. Epidemiology of hepatitis viruses among hepatocellular carcinoma cases and healthy people in Egypt: a systematic review and meta-analysis. *Int J Cancer* 2009; **124**: 690-697 [PMID: 18973270 DOI: 10.1002/ijc.23937]

148 **Kumar RM**, Frossad PM, Hughes PF. Seroprevalence and mother-to-infant transmission of hepatitis C in asymptomatic Egyptian women. *Eur J Obstet Gynecol Reprod Biol* 1997; **75**: 177-182 [PMID: 9447371 DOI: 10.1016/S0301-2115(97)00130-9]

149 **Hassan MM**, Zaghloul AS, El-Serag HB, Soliman O, Patt YZ, Chappell CL, Beasley RP, Hwang LY. The role of hepatitis C in hepatocellular carcinoma: a case control study among Egyptian patients. *J Clin Gastroenterol* 2001; **33**: 123-126 [PMID: 11468438 DOI: 10.1097/00004836-200108000-00006]

150 **Strickland GT**, Elhefni H, Salman T, Waked I, Abdel-Hamid M, Mikhail NN, Esmat G, Fix A. Role of hepatitis C infection in chronic liver disease in Egypt. *Am J Trop Med Hyg* 2002; **67**: 436-442 [PMID: 12452500]

151 **Hassan NF**, Kotkat A. Prevalence of antibodies to hepatitis C virus in pregnant women in Egypt. *J Infect Dis* 1993; **168**: 248-249 [PMID: 8390542 DOI: 10.1093/infdis/168.1.248]

152 **Zahran KM**, Badary MS, Agban MN, Abdel Aziz NH. Pattern of hepatitis virus infection among pregnant women and their newborns at the Women's Health Center of Assiut University, Upper Egypt. *Int J Gynaecol Obstet* 2010; **111**: 171-174 [PMID: 20708181 DOI: 10.1016/j.ijgo.2010.06.013]

153 **Abo Elmagd EK**,Abdel-Wahab KS, Alrasheedy ZE, Khalifa AS. An Egyptian study of mother to child transmission of hepatitis C virus. *Inter J Virol* 2011; **7**: 100-108

154 **Kassem AS**, el-Nawawy AA, Massoud MN, el-Nazar SY, Sobhi EM. Prevalence of hepatitis C virus (HCV) infection and its vertical transmission in Egyptian pregnant women and their newborns. *J Trop Pediatr* 2000; **46**: 231-233 [PMID: 10996985 DOI:10.1093/tropej/46.4.231]

155 **Nafeh MA**, Medhat A, Shehata M, Mikhail NN, Swifee Y, Abdel-Hamid M, Watts S, Fix AD, Strickland GT, Anwar W, Sallam I. Hepatitis C in a community in Upper Egypt: I. Cross-sectional survey. *Am J Trop Med Hyg* 2000; **63**: 236-241 [PMID: 11421370]

156 **Abdel-Aziz F**, Habib M, Mohamed MK, Abdel-Hamid M, Gamil F, Madkour S, Mikhail NN, Thomas D, Fix AD, Strickland GT, Anwar W, Sallam I. Hepatitis C virus (HCV) infection in a community in the Nile Delta: population description and HCV prevalence. *Hepatology* 2000; **32**: 111-115 [PMID: 10869297 DOI: 10.1053/jhep.2000.8438]

157 **Aguilar CE**, Soliman AS, McConnell DS, Zekri AR, Banerjee M, Omar A, Sharawy M, Omar S, Raouf A, Sowers MR. Androgen profiles among Egyptian adults considering liver status. *J Gastroenterol Hepatol* 2008; **23**: e137-e145 [PMID: 17524040 DOI: 10.1111/j.1440-1746.2007.04949.x]

158 **Darwish MA**, Faris R, Darwish N, Shouman A, Gadallah M, El-Sharkawy MS, Edelman R, Grumbach K, Rao MR, Clemens JD. Hepatitis c and cirrhotic liver disease in the Nile delta of Egypt: a community-based study. *Am J Trop Med Hyg* 2001; **64**: 147-153 [PMID: 11442209]

159 **el-Sayed NM,** Gomatos PJ, Rodier GR, Wierzba TF, Darwish A, Khashaba S, Arthur RR. Seroprevalence survey of Egyptian tourism workers for hepatitis B virus, hepatitis C virus, human immunodeficiency virus, and Treponema pallidum infections: association of hepatitis C virus infections with specific regions of Egypt. *Am J Trop Med Hyg* 1996; **55**: 179-184 [PMID: 8780457]

160 **Ansar MM**, Kooloobandi A. Prevalence of hepatitis C virus infection in thalassemia and haemodialysis patients in north Iran-Rasht. *J Viral Hepat* 2002; **9**: 390-392 [PMID: 12225335 DOI: 10.1046/j.1365-2893.2002.00368.x]

161 **Karimi M**, Ghavanini AA. Seroprevalence of HBsAg, anti-HCV, and anti-HIV among haemophiliac patients in Shiraz, Iran. *Haematologia (Budap)* 2001; **31**: 251-255 [PMID: 11855788 DOI: 10.1163/15685590152763809]

162 **Ghavanini AA**, Sabri MR. Hepatitis B surface antigen and anti-hepatitis C antibodies among blood donors in the Islamic Republic of Iran. *East Mediterr Health J* 2000; **6**: 1114-1116 [PMID: 12197336]

163 **Rezvan H**, Ahmadi J, Farhadi M, Taroyan S. A preliminary study on the prevalence of anti-HCV amongst healthy blood donors in Iran. *Vox Sang* 1994; **67**: 100

164 **Rahbar AR**, Rooholamini S, Khoshnood K. Prevalence of HIV infection and other blood-borne infections in incarcerated and non-incarcerated injection drug users (IDUs) in Mashhad, Iran. *Int J Drug Policy* 2004; **15**: 151-155 [DOI: 10.1016/j.drugpo.2003.07.001]

165 **Pourshams A**, Malekzadeh R, Monavvari A, Akbari MR, Mohamadkhani A, Yarahmadi S, Seddighi N, Mohamadnejad M, Sotoudeh M, Madjlessi A. Prevalence and etiology of persistently elevated alanine aminotransferase levels in healthy Iranian blood donors. *J Gastroenterol Hepatol* 2005; **20**: 229-233 [PMID: 15683425 DOI: 10.1111/j.1440-1746.2004.03511.x]

166 **Khedmat H**, Fallahian F, Abolghasemi H, Alavian SM, Hajibeigi B, Miri SM, Jafari AM. Seroepidemiologic study of hepatitis B virus, hepatitis C virus, human immunodeficiency virus and syphilis infections in Iranian blood donors. *Pak J Biol Sci* 2007; **10**: 4461-4466 [PMID: 19093512 DOI: 10.3923/pjbs.2007.4461.4466]

167 **Vahdani P**, Hosseini-Moghaddam SM, Gachkar L, Sharafi K. Prevalence of hepatitis B, hepatitis C, human immunodeficiency virus, and syphilis among street children residing in southern Tehran, Iran. *Arch Iran Med* 2006; **9**: 153-155 [PMID: 16649359]

168 **Karimi M**, Ghavanini AA. Seroprevalence of hepatitis B, hepatitis C and human immunodeficiency virus antibodies among multitransfused thalassaemic children in Shiraz, Iran. *J Paediatr Child Health* 2001; **37**: 564-566 [PMID: 11903836 DOI: 10.1046/j.1440-1754.2001.00709.x]

169 **Hajiani E**, Hashemi J, Masjedizadeh R, Shayesteh AA, Idani E, Rajabi T. Seroepidemiology of hepatitis C and its risk factors in Khuzestan Province, south-west of Iran: a case-control study. *World J Gastroenterol* 2006; **12**: 4884-4887 [PMID: 16937474]

170 **Hosseini Asl SK**, Avijgan M, Mohamadnejad M. High Prevalence of HBV, HCV, and HIV Infections: In Gypsy Population Residing In Shar-e-kord. *Arch Iran Med* 2004; **7**: 22-24

171 **Gholamreza R**, Shahryar S, Abbasali K, Hamidreza J, Abdolvahab M, Khodaberdi K, Danyal R, Nafiseh A. Seroprevalence of hepatitis B virus and its co-infection with hepatitis D virus and hepatitis C virus in Iranian adult population. *Indian J Med Sci* 2007; **61**: 263-268 [PMID: 17478956 DOI: 10.4103/0019-5359.32092]

172 **Al-Kubaisy WA**, Niazi AD, Kubba K. History of miscarriage as a risk factor for hepatitis C virus infection in pregnant Iraqi women. *East Mediterr Health J* 2002; **8**: 239-244 [PMID: 15339110]

173 **Ameen R**, Sanad N, Al-Shemmari S, Siddique I, Chowdhury RI, Al-Hamdan S, Al-Bashir A. Prevalence of viral markers among first-time Arab blood donors in Kuwait. *Transfusion* 2005; **45**: 1973-1980 [PMID: 16371052 DOI: 10.1111/j.1537-2995.2005.00635.x]

174 **Chehadeh W**, Kurien SS, Abdella N, Ben-Nakhi A, Al-Arouj M, Almuaili T, Al-Mutairi O, Al-Nakib W. Hepatitis C virus infection in a population with high incidence of type 2 diabetes: impact on diabetes complications. *J Infect Public Health* 2011; **4**: 200-206 [PMID: 22000848 DOI: 10.1016/j.jiph.2011.05.004]

175 **Tamim H**, Irani-Hakime N, Aoun JP, Khoury S, Samaha H, Almawi WY. Seroprevalence of hepatitis C virus (HCV) infection among blood donors: a hospital-based study. *Transfus Apher Sci* 2001; **24**: 29-35 [PMID: 11515608 DOI: 10.1016/S0955-3886(00)00124-7]

176 **Irani-Hakime N**, Tamim H, Samaha H, Almawi WY. Prevalence of antibodies against hepatitis C virus among blood donors in Lebanon, 1997-2000. *Clin Lab Haematol* 2001; **23**: 317-323 [PMID: 11703415]

177 **Irani-Hakime N**, Musharrafieh U, Samaha H, Almawi WY. Prevalence of antibodies against hepatitis B virus and hepatitis C virus among blood donors in Lebanon, 1997-2003. *Am J Infect Control* 2006; **34**: 241-243 [PMID: 16679184 DOI: 10.1016/j.ajic.2005.06.009]

178 **Araj GF**, Kfoury-Baz EE, Barada KA, Nassif RE, Alami SY. Hepatitis C virus : prevalence in Lebanese blood donors and brief overview of the disease. *J Med Liban* 1995; **43**: 11-16 [PMID: 8676356]

179 **Baddoura R**, Haddad C, Germanos M. Hepatitis B and C seroprevalence in the Lebanese population. *East Mediterr Health J* 2002; **8**: 150-156 [PMID: 15330570]

180 **Daw MA**, Elkaber MA, Drah AM, Werfalli MM, Mihat AA, Siala IM. Prevalence of hepatitis C virus antibodies among different populations of relative and attributable risk. *Saudi Med J* 2002; **23**: 1356-1360 [PMID: 12506296]

181 **Elzouki AN**, Beeching NJ, Mutton KJ, Garson JA. Anti-HCV antibodies and HCV RNA in Libyan blood donors. *Vox Sang* 1995; **68**: 65 [PMID: 7536992 DOI: 10.1111/j.1423-0410.1995.tb02551.x]

182 **Saleh MG**, Pereira LM, Tibbs CJ, Ziu M, al-Fituri MO, Williams R, McFarlane IG. High prevalence of hepatitis C virus in the normal Libyan population. *Trans R Soc Trop Med Hyg* 1994; **88**: 292-294 [PMID: 7974663 DOI: 10.1016/0035-9203(94)90082-5]

183 **Shabash A,** Habas M, Alhajrasi A, Furarah A, Bouzedi A, Daw M. Forecast modelling for prediction of hepatitis B and hepatitis C seropositivity among Libyan population.*Clin Microbiol Infect* 2010; **16**: S310

184 **Libya National Center for the Prevention of and Control of Infectious Diseases.** Results of the National Seroprevalence Survey. 2005

185 **Benjelloun S**, Bahbouhi B, Sekkat S, Bennani A, Hda N, Benslimane A. Anti-HCV seroprevalence and risk factors of hepatitis C virus infection in Moroccan population groups. *Res Virol* 1996; **147**: 247-255 [PMID: 8837233]

186 **Zohoun A**, Hadef R, Zahid H, Benkirane M. [Seroprevalence of HBV and HCV in blood donors at the Blood Transfusion Center of Mohammed V Military Teaching Hospital in Rabat Morocco]. *Med Trop (Mars)* 2011; **71**: 513-514 [PMID: 22235634]

187 **Lahlou Amine I**, Zouhair S, Chegri M, L'kassmi H. [Seroprevalence of anti-HCV in patients of the Military Hospital Moulay Ismail (Meknes, Morocco): Data analysis of the medical biology laboratory (2002-2005)]. *Bull Soc Pathol Exot* 2010; **103**: 255-258 [PMID: 20596810 DOI: http: 10.1007/s13149-010-0064-x]

188 **Aqodad N**, Lahbabi M, Elyousfi M, Mellouki I, Benajah D, Elabkari M, Ibrahimi A. Prevalence of VHC-Ab and HBsAg among blood donors in Guelmim in the south of Morocco. *Hepatol Inter* 2011; **5**: 96 [DOI: 10.1007/s12072-010-9241-z]

189 **WHO/EMRO**. Regional database on HIV/AIDS. WHO Regional Office for the Eastern Mediterranean. 2013. Available from: URL: http://www.emro.who.int/press-releases/2013/launch-of-a-new-who-hiv-campaign.html

190 **al-Dhahry SH**, Aghanashinikar PN, al-Hasani MK, Buhl MR, Daar AS. Prevalence of antibodies to hepatitis C virus among Omani patients with renal disease. *Infection* 1993; **21**: 164-167 [PMID: 7690010 DOI: 10.1007/BF01710538]

191 **Alnaqy A**, Al-Harthy S, Kaminski G, Al-Dhahry S. Detection of serum antibodies to hepatitis C virus in 'false-seronegative' blood donors in Oman. *Med Princ Pract* 2006; **15**: 111-113 [PMID: 16484837 DOI: 10.1159/000090914]

192 **Schuster H**, Serebour E, Nograles J, Al-Belushi I, Hassan K. Prevelance of blood-borne viruses amongst antenatal clinic patients and blood donors in a tertiary referral hospital in Oman. *Clin Microbiol Infect* 2009; **15**: S587

193 **Pathare N**,Al Abri SR, Al Siyabi B, Serebour F, Pathare A, Alkindi S. Seroprevalence of HBSAG, HCV, HIV, HBV PCR and RPR affecting the donor deferral patterns. *Transfusion* 2012; **52**: 216A

194 **Abdul Mujeeb S**, 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**: 269-270 [PMID: 10992712]

195 **Mujeeb SA**, Aamir K, Mehmood K. Seroprevalence of HBV, HCV and HIV infections among college going first time voluntary blood donors. *J Pak Med Assoc* 2006; **56**: S24-S25 [PMID: 16689479]

196 **Kakepoto GN**, Bhally HS, Khaliq G, Kayani N, Burney IA, Siddiqui T, Khurshid M. Epidemiology of blood-borne viruses: a study of healthy blood donors in Southern Pakistan. *Southeast Asian J Trop Med Public Health* 1996; **27**: 703-706 [PMID: 9253870]

197 **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**: 527-535 [PMID: 15500553 DOI: 10.1111/j.1365-2893.2004.00518.x]

198 **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**: 407-412 [PMID: 17331775 DOI: 10.1016/j.ijid.2006.10.004]

199 **Abdul Mujeeb S**, 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**: 735-741 [PMID: 17333817]

200 **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 [PMID: 12532573]

201 **Ahmad N**, Asgher M, Shafique M, Qureshi JA. An evidence of high prevalence of Hepatitis C virus in Faisalabad, Pakistan. *Saudi Med J* 2007; **28**: 390-395 [PMID: 17334466]

202 **Jafri W**, Jafri N, Yakoob J, Islam M, Tirmizi SF, Jafar T, Akhtar S, Hamid S, Shah HA, Nizami SQ. Hepatitis B and C: prevalence and risk factors associated with seropositivity among children in Karachi, Pakistan. *BMC Infect Dis* 2006; **6**: 101 [PMID: 16792819 DOI: 10.1186/1471-2334-6-101]

203 **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**: 545-549 [PMID: 7538098 DOI: 10.1007/BF02751716]

204 **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**: 309-314 [PMID: 12081609 DOI: 10.1046/j.1365-2893.2002.00350.x]

205 **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**: 2061-2063 [PMID: 10325381]

206 **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**: 407-411 [PMID: 11606859 DOI: 10.1097/00004836-200111000-00013]

207 **Lema AM**, Cox EA. Hepatitis C antibodies among blood donors in Qatar. *Vox Sang* 1992; **63**: 237 [PMID: 1333139 DOI: 10.1111/j.1423-0410.1992.tb05110.x]

208 **Fawzi Z**,Al Hilali A, Al Malki A, Al Matawa H, Yousef B, Ali Bin Ali A, Al Mansour S. Survey of hepatitis markers among donors in the State of Qatar. *Qatar* *Med J* 2007; **16**: 47-50

209 **Sharma M,** Matar K, Dweik NA, Kaabi SA, John AK, Mohannadi MA, Derbala MF, Amin AA, Pasic F, Yakoob R, Butt T. Early detection of hepatitis C using a one minute visual qualitative based kit system in a community based setting in Doha, Qatar.*J Hepatol* 2010; **52:** S260

210 **Mahaba H**, el-Tayeb Ael-K, Elbaz H. The prevalence of antibodies to hepatitis C virus in Hail region, Saudi Arabia. *J Egypt Public Health Assoc* 1999; **74**: 69-80 [PMID: 17216953]

211 **Bashawri LA**, Fawaz NA, Ahmad MS, Qadi AA, Almawi WY. Prevalence of seromarkers of HBV and HCV among blood donors in eastern Saudi Arabia, 1998-2001. *Clin Lab Haematol* 2004; **26**: 225-228 [PMID: 15163322 DOI: 10.1111/j.1365-2257.2004.00601.x]

212 **El-Hazmi MM**. Prevalence of HBV, HCV, HIV-1, 2 and HTLV-I/II infections among blood donors in a teaching hospital in the Central region of Saudi Arabia. *Saudi Med J* 2004; **25**: 26-33 [PMID: 14758374]

213 **Abdelaal M**, Rowbottom D, Zawawi T, Scott T, Gilpin C. Epidemiology of hepatitis C virus: a study of male blood donors in Saudi Arabia. *Transfusion* 1994; **34**: 135-137 [PMID: 8310483 DOI: 10.1046/j.1537-2995.1994.34294143941.x]

214 **Al-Mofarreh M**, Fakunle YM, El-Karamany WM, Ezzat HO, Ballesteros MN, Khawaji MZ, El-Drees AZ. Prevalence of antibodies to hepatitis C virus in blood donors in Riyadh. *Ann Saudi Med* 1991; **11**: 501-503 [PMID: 17590781]

215 **Bernvil SS**, Andrews VJ, Kariem AA. Hepatitis C antibody prevalence in Saudi Arabian blood donor population. *Ann Saudi Med* 1991; **11**: 563-567 [PMID: 17590794]

216 **Al-Knawy B**,El Mekki AA, Hamdi J, Thiga R, Sheikha A. Prevalence of antibody to hepatitis C virus in Saudi blood donors, Prevalence De L'anticorps Anti-Virus De L'hepatite C Chez Des Donneurs De Sang Saoudiens. *Can J Gastroenterol* 1995; **9**: 141-143

217 **Al-Sohaibani MO**,Al-Sheikh EH, Al-Ballal SJ, Mirghani MAM, Ramia S. Occupational risk of hepatitis B and C infections in Saudi medical staff. *J Hospital Infect* 1995; **31:** 143-147

218 **Halawani M**, Bakir TM. Determination of hepatitis C virus genotypes in pruritus patients in saudi arabia. *Genet Test Mol Biomarkers* 2012; **16**: 46-49 [PMID: 21967468 DOI: 10.1089/gtmb.2011.0064]

219 **al Nasser MN**. Intrafamilial transmission of hepatitis C virus (HCV): a major mode of spread in the Saudi Arabia population. *Ann Trop Paediatr* 1992; **12**: 211-215 [PMID: 1381898]

220 **Njoh J**, Zimmo S. Prevalence of antibodies to hepatitis C virus in drug-dependent patients in Jeddah, Saudi Arabia. *East Afr Med J* 1997; **74**: 89-91 [PMID: 9185392]

221 **Fakeeh M**, Zaki AM. Hepatitis C: prevalence and common genotypes among ethnic groups in Jeddah, Saudi Arabia. *Am J Trop Med Hyg* 1999; **61**: 889-892 [PMID: 10674665]

222 **Bahakim H**, Bakir TM, Arif M, Ramia S. Hepatitis C virus antibodies in high-risk Saudi groups. *Vox Sang* 1991; **60**: 162-164 [PMID: 1907415 DOI: 10.1111/j.1423-0410.1991.tb00894.x]

223 **al Karawi MA**, Shariq S, el Shiekh Mohamed AR, Saeed AA, Ahmed AM. Hepatitis C virus infection in chronic liver disease and hepatocellular carcinoma in Saudi Arabia. *J Gastroenterol Hepatol* 1992; **7**: 237-239 [PMID: 1319221 DOI: 10.1111/j.1440-1746.1992.tb00970.x]

224 **Nur YA**, Groen J, Elmi AM, Ott A, Osterhaus AD. Prevalence of serum antibodies against bloodborne and sexually transmitted agents in selected groups in Somalia. *Epidemiol Infect* 2000; **124**: 137-141 [PMID: 10722141 DOI: 10.1017/S0950268899003441]

225 **Bile K**, Aden C, Norder H, Magnius L, Lindberg G, Nilsson L. Important role of hepatitis C virus infection as a cause of chronic liver disease in Somalia. *Scand J Infect Dis* 1993; **25**: 559-564 [PMID: 7506842 DOI: 10.3109/00365549309008543]

226 **McCarthy MC**, el-Tigani A, Khalid IO, Hyams KC. Hepatitis B and C in Juba, southern Sudan: results of a serosurvey. *Trans R Soc Trop Med Hyg* 1994; **88**: 534-536 [PMID: 7992329 DOI: 10.1016/0035-9203(94)90150-3]

227 **Elsheikh RM**, Daak AA, Elsheikh MA, Karsany MS, Adam I. Hepatitis B virus and hepatitis C virus in pregnant Sudanese women. *Virol J* 2007; **4**: 104 [PMID: 17958904 DOI: 10.1186/1743-422X-4-104]

228 **Othman BM**, Monem FS. Prevalence of hepatitis C virus antibodies among intravenous drug abusers and prostitutes in Damascus, Syria. *Saudi Med J* 2002; **23**: 393-395 [PMID: 11953762]

229 **Hatira SA**, Yacoub-Jemni S, Houissa B, Kaabi H, Zaeir M, Kortas M, Ghachem L. [Hepatitis C virus antibodies in 34130 blood donors in Tunisian Sahel]. *Tunis Med* 2000; **78**: 101-105 [PMID: 10894044]

230 **Slama H**, Mojaat N, Dahri R, Boukef K. [Epidemiologic study of anti-HCV antibodies in Tunisian blood donors]. *Rev Fr Transfus Hemobiol* 1991; **34**: 459-464 [PMID: 1663358 DOI: 10.1016/S1140-4639(05)80140-6]

231 **Mejri S**, Salah AB, Triki H, Alaya NB, Djebbi A, Dellagi K. Contrasting patterns of hepatitis C virus infection in two regions from Tunisia. *J Med Virol* 2005; **76**: 185-193 [PMID: 15834884 DOI: 10.1002/jmv.20342]

232 **Gorgi Y**, Yalaoui S, Ben Nejma HL, Azzouz MM, Hsairi M, Ben Khelifa H, Ayed K. [Detection of hepatitis C virus in the general population of Tunisia]. *Bull Soc Pathol Exot* 1998; **91**: 177 [PMID: 9642480]

233 **Triki H**, Said N, Ben Salah A, Arrouji A, Ben Ahmed F, Bouguerra A, Hmida S, Dhahri R, Dellagi K. Seroepidemiology of hepatitis B, C and delta viruses in Tunisia. *Trans R Soc Trop Med Hyg* 1997; **91**: 11-14 [PMID: 9093616 DOI: 10.1016/S0035-9203(97)90374-6]

234 **Ozsoy MF**, Oncul O, Cavuslu S, Erdemoglu A, Emekdas G, Pahsa A. Seroprevalences of hepatitis B and C among health care workers in Turkey. *J Viral Hepat* 2003; **10**: 150-156 [PMID: 12614472 DOI: 10.1046/j.1365-2893.2003.00404.x]

235 **Gurol E**, Saban C, Oral O, Cigdem A, Armagan A. Trends in hepatitis B and hepatitis C virus among blood donors over 16 years in Turkey. *Eur J Epidemiol* 2006; **21**: 299-305 [PMID: 16685581 DOI: 10.1007/s10654-006-0001-2]

236 **Sakarya S**, Oncu S, Ozturk B, Oncu S. Effect of preventive applications on prevalence of hepatitis B virus and hepatitis C virus infections in West Turkey. *Saudi Med J* 2004; **25**: 1070-1072 [PMID: 15322600]

237 **Altindis M**, Yilmaz S, Dikengil T, Acemoglu H, Hosoglu S. Seroprevalence and genotyping of hepatitis B, hepatitis C and HIV among healthy population and Turkish soldiers in Northern Cyprus. *World J Gastroenterol* 2006; **12**: 6792-6796 [PMID: 17106927]

238 **Mutlu B**, Meriç M, Willke A. [Seroprevalence of hepatitis B and C virus, human immunodeficiency virus and syphilis in the blood donors]. *Mikrobiyol Bul* 2004; **38**: 445-448 [PMID: 15700672]

239 **Afsar I**, Gungor S, Sener AG, Yurtsever SG. The prevalence of HBV, HCV and HIV infections among blood donors in Izmir, Turkey. *Indian J Med Microbiol* 2008; **26**: 288-289 [PMID: 18695343 DOI: 10.4103/0255-0857.42074]

240 **Gulcan A**, Gulcan E, Toker A, Bulut I, Akcan Y. Evaluation of risk factors and seroprevalence of hepatitis B and C in diabetic patients in Kutahya, Turkey. *J Investig Med* 2008; **56**: 858-863 [PMID: 18667903 DOI: 10.231/JIM.0b013e3181788d28]

241 **Alim A**, Artan MO, Baykan Z, Alim BA. Seroprevalence of hepatitis B and C viruses, HIV, and syphilis infections among engaged couples. *Saudi Med J* 2009; **30**: 541-545 [PMID: 19370284 DOI: 2009008']

242 **Tahan V**, Karaca C, Yildirim B, Bozbas A, Ozaras R, Demir K, Avsar E, Mert A, Besisik F, Kaymakoglu S, Senturk H, Cakaloglu Y, Kalayci C, Okten A, Tozun N. Sexual transmission of HCV between spouses. *Am J Gastroenterol* 2005; **100**: 821-824 [PMID: 15784025 DOI: 10.1111/j.1572-0241.2005.40879.x]

243 **Bozkurt H**, Kurtoglu MG, Bayram Y, Kesli R, Berktas M. Distribution of hepatitis C prevalence in individuals according to their age level in Eastern Turkey. *Eur J Gastroenterol Hepatol* 2008; **20**: 1249 [PMID: 18989151 DOI: 10.1097/MEG.0b013e328305ba19]

244 **Yildirim B**, Barut S, Bulut Y, Yenişehirli G, Ozdemir M, Cetin I, Etikan I, Akbaş A, Atiş O, Ozyurt H, Sahin S. Seroprevalence of hepatitis B and C viruses in the province of Tokat in the Black Sea region of Turkey: A population-based study. *Turk J Gastroenterol* 2009; **20**: 27-30 [PMID: 19330732]

245 **Tekay F**, Ozbek E. [Short communication: hepatitis B, hepatitis C and human immunodeficiency virus seropositivities in women admitted to Sanliurfa Gynecology and Obstetrics Hospital]. *Mikrobiyol Bul* 2006; **40**: 369-373 [PMID: 17205695]

246 **Demirtürk N**, Demirdal T, Toprak D, Altindiş M, Aktepe OC. Hepatitis B and C virus in West-Central Turkey: seroprevalence in healthy individuals admitted to a university hospital for routine health checks. *Turk J Gastroenterol* 2006; **17**: 267-272 [PMID: 17205404]

247 **Akcam FZ**, Uskun E, Avsar K, Songur Y. Hepatitis B virus and hepatitis C virus seroprevalence in rural areas of the southwestern region of Turkey. *Int J Infect Dis* 2009; **13**: 274-284 [PMID: 18945630 DOI: S1201-9712(08)01448-3]

248 **Al Shaer L**, AbdulRahman M, John TJ, AlHashimi A. Trends in prevalence, incidence, and residual risk of major transfusion-transmissible viral infections in United Arab Emirates blood donors: impact of individual-donation nucleic acid testing, 2004 through 2009. *Transfusion* 2012; **52**: 2300-2309 [PMID: 22691239 DOI: 10.1111/j.1537-2995.2012.03740.x]

249 **Raouf M**,Al Amiri A, Gammon R. Demographic profile of blood donors and its influence on the safety of blood transfusion in the United Arab Emirates. *Transfusion* 2010; **50**: 205A [DOI: 10.1111/j.1537-2995.2010.02833-1.x]

250 **Sheek-Hussein M**, Hashmey R, Alsuwaidi AR, Al Maskari F, Amiri L, Souid AK. Seroprevalence of measles, mumps, rubella, varicella-zoster and hepatitis A-C in Emirati medical students. *BMC Public Health* 2012; **12**: 1047 [PMID: 23217121 DOI: 10.1186/1471-2458-12-1047]

251 **Fakhry SM**, Al Dawilah TA, Mehta SH. Prevalence of hepatitis B virus (HBV) and hepatitis C virus (HCV) in young adults in United Arab Emirates (UAE). *Hepatology* 2011; **54**: 607A [DOI: 10.1002/hep.24666]

252 **Haidar NA**. Prevalence of hepatitis B and hepatitis C in blood donors and high risk groups in Hajjah, Yemen Republic. *Saudi Med J* 2002; **23**: 1090-1094 [PMID: 12370719]

253 **el Guneid AM**, Gunaid AA, O'Neill AM, Zureikat NI, Coleman JC, Murray-Lyon IM. Prevalence of hepatitis B, C, and D virus markers in Yemeni patients with chronic liver disease. *J Med Virol* 1993; **40**: 330-333 [PMID: 8228926 DOI: 10.1002/jmv.1890400413]

254 **Al-Moslih MI**, Al-Huraibi MA. Prevalence of hepatitis C virus among patients with liver disease in the Republic of Yemen. *East Mediterr Health J* 2001; **7**: 771-778 [PMID: 15332778]

255 **Todd CS**, Abed AM, Strathdee SA, Scott PT, Botros BA, Safi N, Earhart KC. HIV, hepatitis C, and hepatitis B infections and associated risk behavior in injection drug users, Kabul, Afghanistan. *Emerg Infect Dis* 2007; **13**: 1327-1331 [PMID: 18252103 DOI: 10.3201/eid1309.070036]

256 **Qadi AA**, Tamim H, Ameen G, Bu-Ali A, Al-Arrayed S, Fawaz NA, Almawi WY. Hepatitis B and hepatitis C virus prevalence among dialysis patients in Bahrain and Saudi Arabia: a survey by serologic and molecular methods. *Am J Infect Control* 2004; **32**: 493-495 [PMID: 15573057 DOI: 10.1016/j.ajic.2003.12.009]

257 **al-Mahroos FT**, Ebrahim A. Prevalence of hepatitis B, hepatitis C and human immune deficiency virus markers among patients with hereditary haemolytic anaemias. *Ann Trop Paediatr* 1995; **15**: 121-128 [PMID: 7677412]

258 **Waked IA**, Saleh SM, Moustafa MS, Raouf AA, Thomas DL, Strickland GT. High prevalence of hepatitis C in Egyptian patients with chronic liver disease. *Gut* 1995; **37**: 105-107 [PMID: 7545630 DOI: 10.1136/gut.37.1.105]

259 **Mabrouk GM**. Prevalence of hepatitis C infection and schistosomiasis in Egyptian patients with hepatocellular carcinoma. *Dis Markers* 1997; **13**: 177-182 [PMID: 9405930]

260 **Hindy AM**, Abdelhaleem ES, Aly RH. Hepatitis B and C viruses among Egyptian dentists. *Egypt Dent J* 1995; **41**: 1217-1226 [PMID: 9497659]

261 **Gohar SA**, Khalil RY, Elaish NM, Khedr EM, Ahmed MS. Prevalence of antibodies to hepatitis C virus in hemodialysis patients and renal transplant recipients. *J Egypt Public Health Assoc* 1995; **70**: 465-484 [PMID: 17214170]

262 **Hassan AA**, Khalil R. Hepatitis C in dialysis patients in egypt: relationship to dialysis duration, blood transfusion, and liver disease. *Saudi J Kidney Dis Transpl* 2000; **11**: 72-73 [PMID: 18209303]

263 **El Yazeed SA**, N.A EL-G, Younes K, El-Ghobary A. Antiphospholipid antibodies in Egyptian patients with chronic renal failure. *J Med Sci* 2006; **6**: 468-473

264 **Saleh E**, McFarland W, Rutherford G, Mandel J, El-Shazaly M, Coates T. Sentinel surveillance for HIV and markers for high risk behaviors among STD clinic attendees in Alexandria, Egypt. XIII International AIDS Conference, Durban, South Africa, Poster MoPeC2398. Proceedings of the XIII International AIDS Conference; 2000. Available from: URL: http://caps.ucsf.edu/uploads/pubs/presentations/pdf/saleh.pdf

265 **Quinti I**, el-Salman D, Monier MK, Hackbart BG, Darwish MS, el-Zamiaty D, Paganelli R, Pandolfi F, Arthur RR. HCV infection in Egyptian patients with acute hepatitis. *Dig Dis Sci* 1997; **42**: 2017-2023 [PMID: 9365128 DOI: 10.1023/A: 1018897813268]

266 **Gheith OA**, Saad MA, Hassan AA, A-Eldeeb S, Agroudy AE, Sheashaa H, Ghoneim MA. Hepatic dysfunction in kidney transplant recipients: prevalence and impact on graft and patient survival. *Clin Exp Nephrol* 2007; **11**: 309-315 [PMID: 18085393 DOI: 10.1007/s10157-007-0490-7]

267 **Tonbary YA**, Elashry R, Zaki Mel S. Descriptive epidemiology of hemophilia and other coagulation disorders in mansoura, egypt: retrospective analysis. *Mediterr J Hematol Infect Dis* 2010; **2**: e2010025 [PMID: 21415978 DOI: 10.4084/mjhid.2010.025]

268 **Said ZN**, El-Sayed MH, El-Bishbishi IA, El-Fouhil DF, Abdel-Rheem SE, El-Abedin MZ, Salama II. High prevalence of occult hepatitis B in hepatitis C-infected Egyptian children with haematological disorders and malignancies. *Liver Int* 2009; **29**: 518-524 [PMID: 19192168 DOI: 10.1111/j.1478-3231.2009.01975.x]

269 **El-Faramawy AA**, El-Rashidy OF, Tawfik PH, Hussein GH. Transfusion transmitted hepatitis: where do we stand now? A one center study in upper egypt. *Hepat Mon* 2012; **12**: 286-291 [PMID: 22690237 DOI: 10.5812/hepatmon.852]

270 **Mansour AK**, Aly RM, Abdelrazek SY, Elghannam DM, Abdelaziz SM, Shahine DA, Elmenshawy NM, Darwish AM. Prevalence of HBV and HCV infection among multi-transfused Egyptian thalassemic patients. *Hematol Oncol Stem Cell Ther* 2012; **5**: 54-59 [PMID: 22446611 DOI: 10.5144/1658-3876.2012.54]

271 **Omar N**, Salama K, Adolf S, El-Saeed GS, Abdel Ghaffar N, Ezzat N. Major risk of blood transfusion in hemolytic anemia patients. *Blood Coagul Fibrinolysis* 2011; **22**: 280-284 [PMID: 21508832 DOI: 10.1097/MBC.0b013e3283451255]

272 **Ali F**, Abdel-Aziz A, Helmy MF, Abdel-Mobdy A, Darwish M. Prevalence of certain sexually transmitted viruses in Egypt. *J Egypt Public Health Assoc* 1998; **73**: 181-192 [PMID: 17219920]

273 **Jahani MR**, Alavian SM, Shirzad H, Kabir A, Hajarizadeh B. Distribution and risk factors of hepatitis B, hepatitis C, and HIV infection in a female population with "illegal social behaviour". *Sex Transm Infect* 2005; **81**: 185 [PMID: 15800109 DOI: 10.1136/sti.2004.011114]

274 **Semnani S**, Roshandel G, Abdolahi N, Besharat S, Keshtkar AA, Joshaghani H, Moradi A, Kalavi K, Jabbari A, Kabir MJ, Hosseini SA, Sedaqat SM, Danesh A, Roshandel D. Hepatitis B/C virus co-infection in Iran: a seroepidemiological study. *Turk J Gastroenterol* 2007; **18**: 20-21 [PMID: 17450490]

275 **Rais-Jalali G**, Khajehdehi P. Anti-HCV seropositivity among haemodialysis patients of Iranian origin. *Nephrol Dial Transplant* 1999; **14**: 2055-2056 [PMID: 10462312]

276 **Nobakht Haghighi A**, Zali MR, Nowroozi A. Hepatitis C antibody and related risk factors in hemodialysis patients in Iran. *J Am Soc Nephrol* 2001; **12**: 233A

277 **Khamispoor G**, Tahmasebi R. Prevalence of HIV, HBV, HCV and syphilis in high risk groups of Bushehr province (Farsi). *Iran South Med J* 1999; **1**: 59–53

278 **Mohammad Alizadeh AH**, Alavian SM, Jafari K, Yazdi N. Prevalence Of Hbs Ag, Hc Ab & Hiv Ab In The Addict Prisoners Of Hammadan Prison (Iran, 1998). *J Resear Med Sci* 2003; **7**: 311-313

279 **Amiri ZM**, Shakib AJ, Toorchi M. Seroprevalence of hepatitis C and risk factors in haemodialysis patients in Guilan, Islamic Republic of Iran. *East Mediterr Health J* 2005; **11**: 372-376 [PMID: 16602456]

280 **Sharifi-Mood B**, Alavi-Naini R, Salehi M, Hashemi M, Rakhshani F. Spectrum of clinical disease in a series of hospitalized HIV-infected patients from southeast of Iran. *Saudi Med J* 2006; **27**: 1362-1366 [PMID: 16951774]

281 **Alavian SM**, Ardeshiri A, Hajarizadeh B. Prevalence of HCV, HBV and HIV infections among hemophiliacs. *Transfusion Today* 2001; **49**: 4–5

282 **Karimi M**, Yarmohammadi H, Ardeshiri R. Inherited coagulation disorders in southern Iran. *Haemophilia* 2002; **8**: 740-744 [DOI: 10.1046/j.1365-2516.2002.00699.x]

283 **Torabi SA**, Abed-Ashtiani K, Dehkhoda R, Moghadam AN, Bahram MK, Dolatkhah R, Babaei J, Taheri N. Prevalence of hepatitis B, C and HIV in hemophiliac patients of East Azarbaijan in 2004. *Blood* 2006; **2** (Sup 7): 291-299

284 **Javadzadeh H**, Attar M, Taher Yavari M. Study of the prevalence of HBV, HCV, and HIV infection in hemophilia and thalassemia population of Yazd (Farsi). *Khoon* (Blood) 2006; **2**: 315–322

285 **Samimi-Rad K**, Shahbaz B. Hepatitis C virus genotypes among patients with thalassemia and inherited bleeding disorders in Markazi province, Iran. *Haemophilia* 2007; **13**: 156-163 [PMID: 17286768 DOI: 10.1111/j.1365-2516.2006.01415.x]

286 **Sharifi-Mood B**, Eshghi P, Sanei-Moghaddam E, Hashemi M. Hepatitis B and C virus infections in patients with hemophilia in Zahedan, southeast Iran. *Saudi Med J* 2007; **28**: 1516-1519 [PMID: 17914511]

287 **Mansour-Ghanaei F**, Fallah MS, Shafaghi A, Yousefi-Mashhoor M, Ramezani N, Farzaneh F, Nassiri R. Prevalence of hepatitis B and C seromarkers and abnormal liver function tests among hemophiliacs in Guilan (northern province of Iran). *Med Sci Monit* 2002; **8**: CR797-CR800 [PMID: 12503038]

288 **Alavian SM**, Gholami B, Masarrat S. Hepatitis C risk factors in Iranian volunteer blood donors: a case-control study. *J Gastroenterol Hepatol* 2002; **17**: 1092-1097 [PMID: 12201870 DOI: 10.1046/j.1440-1746.2002.02843.x]

289 **Nakhaie S**, Talachian E. Prevalence and characteristic of liver involvement in thalassemia patients with HCV in Ali-Asghar children hospital, Tehran, Iran (Farsi). *J of Iran Univer Med Sci* 2003; **37**: 799–806

290 **Kadivar MR**, Mirahmadizadeh AR, Karimi A, Hemmati A. The prevalence of HCV and HIV in thalassemia patients in Shiraz, Iran. *Med J Iran Hospital* 2001; **4**: 18–20

291 **Basiratnia M**, HosseiniAsl SMK, Avijegan M. Hepatitis C prevalence in thalassemia patients in Sharkord, Iran (Farsi). *Shahr Univer Med Sci J* 1999; **4**: 13–18

292 **Jafroodi M**, Asadi R. Prevalence of HCV in thalassemia major patients in Guilan province, Iran. The 4th congress of Iranian Pediatric Hematology, Oncology Society, September 2006

293 **Kashef S**, Karimi M, Amirghofran Z, Ayatollahi M, Pasalar M, Ghaedian MM, Kashef MA. Antiphospholipid antibodies and hepatitis C virus infection in Iranian thalassemia major patients. *Int J Lab Hematol* 2008; **30**: 11-16 [PMID: 18190462]

294 **Talaie H**, Shadnia SH, Okazi A, Pajouhmand A, Hasanian H, Arianpoor H. The prevalence of hepatitis B, hepatitis C and HIV infections in non-IV drug opioid poisoned patients in Tehran-Iran. *Pak J Biol Sci* 2007; **10**: 220-224 [PMID: 19070018 DOI: 10.3923/pjbs.2007.220.224]

295 **Kheirandish P**,SeyedAlinaghi S, Jahani M, Shirzad H, Seyed Ahmadian M, Majidi A, Sharifi A, Hosseini M, Mohraz M, McFarland W. Prevalence and Correlates of Hepatitis C Infection among Male Injection Drug Users in Detention, Tehran, Iran. *J Urban Health* 2009; **86**(6):902-8 [PMID: 19844670 DOI: 10.1007/s11524-009-9393-0]

296 **Zamani S**, Ichikawa S, Nassirimanesh B, Vazirian M, Ichikawa K, Gouya MM, Afshar P, Ono-Kihara M, Ravari SM, Kihara M. Prevalence and correlates of hepatitis C virus infection among injecting drug users in Tehran. *Int J Drug Policy* 2007; **18**: 359-363 [PMID: 17854723 DOI: S0955-3959(07)00042-4]

297 **Khani M**, Vakili MM. Prevalence and risk factors of HIV, hepatitis B virus, and hepatitis C virus infections in drug addicts among Zanjan prisoners. *Arch Iran Med* 2003; **6**: 1-4

298 **Zali MR**, Aghazadeh R, Nowroozi A, Amir-Rasouly H. Anti-HCV antibody among Iranian IV drug users: is it a serious problem. *Arch Iran Med* 2001; **4**: 115-119

299 **Imani R**, Karimi A, Rouzbahani R, Rouzbahani A. Seroprevalence of HBV, HCV and HIV infection among intravenous drug users in Shahr-e-Kord, Islamic Republic of Iran. *East Mediterr Health J* 2008; **14**: 1136-1141 [PMID: 19161086]

300 **Mohtasham Amiri Z**, Rezvani M, Jafari Shakib R, Jafari Shakib A. Prevalence of hepatitis C virus infection and risk factors of drug using prisoners in Guilan province. *East Mediterr Health J* 2007; **13**: 250-256 [PMID: 17684845]

301 **Javadi AA**, Avijgan M, Hafizi M. Prevalence of HBV and HCV Infections and Associated Risk Factors in Addict Prisoners. *Iran J Publ Health* 2006; **35**: 33-36

302 **Al-Kubaisy WA**, Al-Naib KT, Habib MA. Prevalence of HCV/HIV co-infection among haemophilia patients in Baghdad. *East Mediterr Health J* 2006; **12**: 264-269 [PMID: 17037693]

303 **Al-Kubaisy WA**, Al-Naib KT, Habib M. Seroprevalence of hepatitis C virus specific antibodies among Iraqi children with thalassaemia. *East Mediterr Health J* 2006; **12**: 204-210 [PMID: 17037239]

304 **Al-Sheyyab M**, Batieha A, El-Khateeb M. The prevalence of hepatitis B, hepatitis C and human immune deficiency virus markers in multi-transfused patients. *J Trop Pediatr* 2001; **47**: 239-242 [PMID: 11523766 DOI: 10.1093/tropej/47.4.239]

305 **al-Nakib B**, Koshy A, Kaloui M, al-Ramahi S, al-Mufti S, Radhakrishnan S, al-Nakib W. Hepatitis C virus antibody in Kuwait. *Vox Sang* 1992; **63**: 75-76 [PMID: 1384237 DOI: 10.1111/j.1423-0410.1992.tb01224.x]

306 **Kapoor M**, el-Reshaid K, al-Mufti S, Sanad NA, Koshy A. Is dialysis environment more important than blood transfusion in transmission of hepatitis C virus during hemodialysis? *Vox Sang* 1993; **65**: 331 [PMID: 7508661 DOI: 10.1111/j.1423-0410.1993.tb02176.x]

307 **El-Reshaid K**, Kapoor M, Sugathan T, Al-Mufti S, Al-Hilali N. Hepatitis C virus infection in patients on maintenance dialysis in kuwait: epidemiological profile and efficacy of prophylaxis. *Saudi J Kidney Dis Transpl* 1995; **6**: 144-150 [PMID: 18583854]

308 **al-Fuzae L**, Aboolbacker KC, al-Saleh Q. beta-Thalassaemia major in Kuwait. *J Trop Pediatr* 1998; **44**: 311-312 [PMID: 9819498 DOI: 10.1093/tropej/44.5.311]

309 **Irani-Hakime N**, Aoun J, Khoury S, Samaha HR, Tamim H, Almawi WY. Seroprevalence of hepatitis C infection among health care personnel in Beirut, Lebanon. *Am J Infect Control* 2001; **29**: 20-23 [PMID: 11172314 DOI: 10.1067/mic.2001.110777]

310 **Ramia S**, Mokhbat J, Sibai A, Klayme S, Naman R. Exposure rates to hepatitis C and G virus infections among HIV-infected patients: evidence of efficient transmission of HGV by the sexual route. *Int J STD AIDS* 2004; **15**(7): 463-466 [PMID: 15228731]

311 **Alashek W**,McIntyre C, Taal M.Morbidity of diabetic end-stage kidney disease patients treated by dialysis in Libya. *Diabetes Obes Metab* 2010; **12**: 76-77 *[*DOI: [10.1111/j.1463-1326.2010.01284.x](http://dx.doi.org/10.1111/j.1463-1326.2010.01284.x)]

312 **Franka E**, El-Zoka AH, Hussein AH, Elbakosh MM, Arafa AK, Ghenghesh KS. Hepatitis B virus and hepatitis C virus in medical waste handlers in Tripoli, Libya. *J Hosp Infect* 2009; **72**: 258-261 [PMID: 19443080 DOI: 10.1016/j.jhin.2009.03.019]

313 **El-Zouki AY**, Bendard AB, Sharif MS. HCV in hemodialysis patients in Benghazi, Libya. *Ann Saudi Med* 1993; **13**: 203 [PMID: 17590656]

314 **Belbacha I**, Cherkaoui I, Akrim M, Dooley KE, El Aouad R. Seroprevalence of hepatitis B and C among barbers and their clients in the Rabat region of Morocco. *East Mediterr Health J* 2011; **17**: 911-919 [PMID: 22355943]

315 **Radoui A**, Skalli Z, Haddiya I, Benamar L, Ezzaitouni F, Ouzeddoun N, Bayahia R, Rhou H. Prevalence and predictive factors of anemia after renal transplantation: a Moroccan report. *Transplant Proc* 2010; **42**: 3542-3549 [PMID: 21094812 DOI: 10.1016/j.transproceed.2010.07.092]

316 **Boulaajaj K**, Elomari Y, Elmaliki B, Madkouri B, Zaid D, Benchemsi N. [Prevalence of hepatitis C, hepatitis B and HIV infection among haemodialysis patients in Ibn-Rochd university hospital, Casablanca]. *Nephrol Ther* 2005; **1**(5): 274-284 [PMID: 16895696]

317 **El Khorassani M**,Kababri M, Hessissen L, Khattab M, Kili A. Hemophilia in Morocco: Current state and prospects. *Haemophilia* 2010; **16**: 61 [PMID: 70225085 DOI:[10.1111/j.1365-2516.2010.02283.x](http://dx.doi.org/10.1111/j.1365-2516.2010.02283.x)]

318 **Bousfiha AA**,Hachim J, Benjelloun S, Benslimane A, Mikou N, Hadj Khalifa H.Prevalence of infection with the hepatitis B and C viruses and the human immunodeficiency virus in 39 Maroccan children with hemophilia.*Annales de Pediatrie* 1999; **46**: 199-204

319 HIV Risk among Heroin and Injecting Drug Users in Muscat, Oman. Quantitative Survey. Preliminary Data. 2006

320 **Abdul Mujeeb S**, Jamal Q, Khanani R, Iqbal N, Kaher S. Prevalence of hepatitis B surface antigen and HCV antibodies in hepatocellular carcinoma cases in Karachi, Pakistan. *Trop Doct* 1997; **27**: 45-46 [PMID: 9030022]

321 **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**: 133-137 [PMID: 9522291 DOI: 10.1016/S0195-6701(98)90066-4]

322 **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**: 92-94 [PMID: 12071075]

323 **Gul A**, Iqbal F. Prevalence of hepatitis C in patients on maintenance haemodialysis. *J Coll Physicians Surg Pak* 2003; **13**: 15-18 [PMID: 12685968]

324 **Khan MS**, Jamil M, Jan S, Zardad S, Sultan S, Sahibzada AS. Prevalence of hepatitis 'B' and 'C' in orthopaedics patients at Ayub Teaching Hospital Abbottabad. *J Ayub Med Coll Abbottabad* 2007; **19**: 82-84 [PMID: 18693606]

325 **Kuo I**, ul-Hasan S, Galai N, Thomas DL, Zafar T, Ahmed MA, Strathdee SA. High HCV seroprevalence and HIV drug use risk behaviors among injection drug users in Pakistan. *Harm Reduct J* 2006; **3**: 26 [PMID: 16914042 DOI: 10.1186/1477-7517-3-26]

326 **United Nations Office for Drug Control and Crime Prevention and UNAIDS.** Baseline Study of the Relationship between Injecting Drug Use, HIV and Hepatitis C among Male Injecting Drug Users in Lahore. 1999

327 **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**: 43-45 [PMID: 17326891 DOI: 10.1258/004947507779951989]

328 **Pakistan National AIDS Control Programe.** National Study of Reproductive Tract and Sexually Transmitted Infections. Survey of High Risk Groups in Lahore and Karachi. Ministry of Health, Pakistan. 2005

329 **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**: 269-271 [PMID: 8714623]

330 **Akhtar S**, Moatter T. Hepatitis C virus infection in polytransfused thalassemic children in Pakistan. *Indian Pediatr* 2004; **41**: 1072-1073 [PMID: 15523144]

331 **Rizvi TJ**, Fatima H. Frequency of hepatitis C in obstetric cases. *J Coll Physicians Surg Pak* 2003; **13**: 688-690 [PMID: 15569552]

332 **Khan AJ**, Luby SP, Fikree F, Karim A, Obaid S, Dellawala S, Mirza S, Malik T, Fisher-Hoch S, McCormick JB. Unsafe injections and the transmission of hepatitis B and C in a periurban community in Pakistan. *Bull World Health Organ* 2000; **78**: 956-963 [PMID: 10994278]

333 **Ali SS**, Ali IS, Aamir AH, Jadoon Z, Inayatullah S. Frequency of hepatitis C infection in diabetic patients. *J Ayub Med Coll Abbottabad* 2007; **19**: 46-49 [PMID: 17867480]

334 **Abboud O**, Rashid A, Al-Kaabi S. Hepatitis C virus infection in hemodialysis patients in qatar. *Saudi J Kidney Dis Transpl* 1995; **6**: 151-153 [PMID: 18583855]

335 **Ayoola EA**, al-Mofleh IA, al-Faleh FZ, al-Rashed R, Arif MA, Ramia S, Mayet I. Prevalence of antibodies to hepatitis C virus among Saudi patients with chronic liver diseases. *Hepatogastroenterology* 1992; **39**: 337-339 [PMID: 1385286]

336 **Khan ZA**, Alkhalife IS, Fathalla SE. Prevalence of hepatitis C virus among bilharziasis patients. *Saudi Med J* 2004; **25**: 204-206 [PMID: 14968219]

337 **Karkar A**. Hepatitis C in dialysis units: the Saudi experience. *Hemodial Int* 2007; **11**: 354-367 [PMID: 17576302 DOI: 10.1111/j.1542-4758.2007.00192.x]

338 **Saxena AK**, Panhotra BR. The vulnerability of middle-aged and elderly patients to hepatitis C virus infection in a high-prevalence hospital-based hemodialysis setting. *J Am Geriatr Soc* 2004; **52**: 242-246 [PMID: 14728634 DOI: 10.1111/j.1532-5415.2004.52062.x]

339 **Huraib S**, al-Rashed R, Aldrees A, Aljefry M, Arif M, al-Faleh FA. High prevalence of and risk factors for hepatitis C in haemodialysis patients in Saudi Arabia: a need for new dialysis strategies. *Nephrol Dial Transplant* 1995; **10**: 470-474 [PMID: 7623989]

340 **Souqiyyeh MZ**, Shaheen FA, Huraib SO, Al-Khader AA. The annual incidence of seroconversion of antibodies to the hepatitis C virus in the hemodialysis population in saudi arabia. *Saudi J Kidney Dis Transpl* 1995; **6**: 167-173 [PMID: 18583859]

341 **Shaheen FA**, Huraib SO, Al-Rashed R, Aldrees A, Arif M, Al Jeffry M, Tashkandy MA, Safwat M. Prevalence of hepatitis C antibodies among hemodialysis patients in the Western province of saudi arabia. *Saudi J Kidney Dis Transpl* 1995; **6**: 136-139 [PMID: 18583852]

342 **Omar MN**, Tashkandy MA, El Tonsy AH. Liver enzymes and protein electrophoretic patterns in hemodialysis patients with antibodies against the hepatitis C virus. *Saudi J Kidney Dis Transpl* 1995; **6**: 163-166 [PMID: 18583858]

343 **Ahmad MS**, Mahtab AM, Abdullatif AS, Tashkandy MA, Kashreed MS, Maulana A. Prevalence of antibodies against the hepatitis C virus among voluntary blood donors at a makkah hospital. *Saudi J Kidney Dis Transpl* 1995; **6**: 122-124 [PMID: 18583848]

344 **Zaher G**, Adam S. Outcomes of congenital bleeding disorders. *Bahrain Medical Bulletin* 2012; **34**(2) [PMID: 2012354081]

345 **Al-Hawsawi ZM**. Prevalence of hepatitis C virus antibody [1]. *Annals of Saudi Medicine* 2000; **20**(5-6): 488-489 [PMID: 2001324979]

346 **al-Fawaz I**, al-Rasheed S, al-Mugeiren M, al-Salloum A, al-Sohaibani M, Ramia S. Hepatitis E virus infection in patients from Saudi Arabia with sickle cell anaemia and beta-thalassemia major: possible transmission by blood transfusion. *Journal of Viral Hepatitis* 1996; **3**(4): 203-205 [PMID: 8871882]

347 **al-Fawaz I**, Ramia S. Decline in hepatitis B infection in sickle cell anaemia and beta thalassaemia major. *Archives* *of Disease in Childhood* 1993; **69**(5): 594-596 [PMID: 1993355872]

348 **Harakati MS**, Abualkhair OA, Al-Knawy BA. Hepatitis C Virus infection in Saudi Arab patients with B-cell non-Hodgkin's lymphoma. *Saudi Med J* 2000; **21**(8): 755-758 [PMID: 11423889]

349 **Watts DM**,Corwin AL, Omar MA, Hyams KC. Low risk of sexual transmission of hepatitis C virus in Somalia. *Trans R Soc Trop Med Hyg* 1994; **88**(1): 55-56 [PMID: 8154002]

350 **El-Amin HH**, Osman EM, Mekki MO, Abdelraheem MB, Ismail MO, Yousif ME, Abass AM, El-haj HS, Ammar HK. Hepatitis C virus infection in hemodialysis patients in Sudan: two centers' report. *Saudi J Kidney Dis Transpl* 2007; **18**(1): 101-106 [PMID: 17237901]

351 **Kose S**, Gurkan A, Akman F, Kelesoglu M, Uner U. Treatment of hepatitis C in hemodialysis patients using pegylated interferon alpha-2a in Turkey. *J Gastroenterol* 2009; **44**(4): 353-358 [PMID: 19277451 DOI: 10.1007/s00535-009-0016-z]

352 **Ati HA**. HIV/AIDS/STIs Social and Geographical Mapping of Prisoners, Tea Sellers and Commercial Sex Workers in Port Sudan Town, Red Sea State. Ockenden International, Sudan. Draft 2. 2005

353 **Mudawi HM**, Smith HM, Rahoud SA, Fletcher IA, Babikir AM, Saeed OK, Fedail SS. Epidemiology of HCV infection in Gezira state of central Sudan. *J Med Virol* 2007; **79**: 383-385 [PMID: 17311341]

354 **Othman BM**, Monem FS. Prevalence of hepatitis C virus antibodies among health care workers in Damascus, Syria. *Saudi Med J* 2001; **22**: 603-605 [PMID: 11479642 DOI: 10.1002/jmv.20780]

355 **Moukeh G**, Yacoub R, Fahdi F, Rastam S, Albitar S. Epidemiology of hemodialysis patients in Aleppo city. *Saudi J Kidney Dis Transpl* 2009; **20**: 140-146 [PMID: 19112237]

356 **Kaabia N**, Ben Jazia E, Slim I, Fodha I, Hachfi W, Gaha R, Khalifa M, Hadj Kilani A, Trabelsi H, Abdelaziz A, Bahri F, Letaief A. Association of hepatitis C virus infection and diabetes in central Tunisia. *World J Gastroenterol* 2009; **15**: 2778-2781 [PMID: 19522029 DOI: 10.3748/wjg.15.2778]

357 **Kaabia N**, Ben Jazia E, Hannachi N, Khalifa M, Dhouibi S, Dabbabi F, Boukadida J, Bahri F, Brahem A, Mrizak N, Letaief A. [Prevalence of hepatitis C virus among health care workers in central Tunisia]. *Med Mal Infect* 2009; **39**: 66-67 [PMID: 19041206 DOI: 10.1016/j.medmal.2008.10.007]

358 **Hmaied F**, Ben Mamou M, Saune-Sandres K, Rostaing L, Slim A, Arrouji Z, Ben Redjeb S, Izopet J. Hepatitis C virus infection among dialysis patients in Tunisia: incidence and molecular evidence for nosocomial transmission. *J Med Virol* 2006; **78**: 185-191 [PMID: 16372289 DOI: 10.1002/jmv.20526]

359 **Hmida S**, Mojaat N, Chaouchi E, Mahjoub T, Khlass B, Abid S, Boukef K. [HCV antibodies in hemodialyzed patients in Tunisia]. *Pathol Biol (Paris)* 1995; **43**: 581-583 [PMID: 8570261]

360 **Jemni S**, Ikbel K, Kortas M, Mahjoub J, Ghachem L, Bidet JM, Boukef K. Seropositivity to hepatitis C virus in Tunisian haemodialysis patients. *Nouv Rev Fr Hematol* 1994; **36**: 349-351 [PMID: 7534398]

361 **Sassi F**, Gorgi Y, Ayed K, Abdallah TB, Lamouchi A, Maiz HB. Hepatitis C virus antibodies in dialysis patients in Tunisia: a single center study. *Saudi J Kidney Dis Transpl* 2000; **11**: 218-222 [PMID: 18209319]

362 **Kilani B**, Ammari L, Marrakchi C, Letaief A, Chakroun M, Ben Jemaa M, Ben Aïssa HT, Kanoun F, Ben Chaabène T. Seroepidemiology of HCV-HIV coinfection in Tunisia. *Tunis Med* 2007; **85**: 121-123 [PMID: 17665657]

363 **Hannachi N**, Boughammoura L, Marzouk M, Tfifha M, Khlif A, Soussi S, Skouri H, Boukadida J. [Viral infection risk in polytransfused adults: seroprevalence of seven viruses in central Tunisia]. *Bull Soc Pathol Exot* 2011; **104**: 220-225 [PMID: 21695497 DOI: 10.1007/s13149-010-0103-7]

364 **Djebbi A**, Bahri O, Langar H, Sadraoui A, Mejri S, Triki H. Genetic variability of genotype 1 hepatitis C virus isolates from Tunisian haemophiliacs. *New Microbiol* 2008; **31**: 473-480 [PMID: 19123302]

365 **Langar H**, Triki H, Gouider E, Bahri O, Djebbi A, Sadraoui A, Hafsia A, Hafsia R. [Blood-transmitted viral infections among haemophiliacs in Tunisia]. *Transfus Clin Biol* 2005; **12**: 301-305 [PMID: 16099190 DOI: 10.1016/j.tracli.2005.07.001]

366 **Kocabaş E**, Aksaray N, Alhan E, Tanyeli A, Köksal F, Yarkin F. Hepatitis B and C virus infections in Turkish children with cancer. *Eur J Epidemiol* 1997; **13**: 869-873 [PMID: 9476814 DOI: 10.1023/A:1007420725704]

367 **Kebudi R**, Ayan I, Yílmaz G, Akící F, Görgün O, Badur S. Seroprevalence of hepatitis B, hepatitis C, and human immunodeficiency virus infections in children with cancer at diagnosis and following therapy in Turkey. *Med Pediatr Oncol* 2000; **34**: 102-105 [PMID: 10657869 DOI: 10.1002/(SICI)1096-911X(200002)34:2<102::AID-MPO5>3.0.CO;2-#]

368 **Sonmez M**, Bektas O, Yilmaz M, Durmus A, Akdogan E, Topbas M, Erturk M, Ovali E, Omay SB. The relation of lymphoma and hepatitis B virus/hepatitis C virus infections in the region of East Black Sea, Turkey. *Tumori* 2007; **93**: 536-539 [PMID: 18338485]

369 **Ocak S**, Duran N, Kaya H, Emir I. Seroprevalence of hepatitis C in patients with type 2 diabetes mellitus and non-diabetic on haemodialysis. *Int J Clin Pract* 2006; **60**: 670-674 [PMID: 16805751 DOI: 10.1111/j.1368-5031.2006.00738.x]

370 **Gul U**, Kiliç A, Sakizligil B, Aksaray S, Bilgili S, Demirel O, Erinckan C. Magnitude of sexually transmitted infections among female sex workers in Turkey. *J Eur Acad Dermatol Venereol* 2008; **22**: 1123-1124 [PMID: 18194239 DOI: JDV2548]

371 **Köksal I**, Biberoğlu K, Biberoğlu S, Koç F, Ayma Y, Aker F, Köksal H. Hepatitis C virus antibodies among risk groups in Turkey. *Infection* 1991; **19**: 228-229 [PMID: 1917033 DOI: 10.1007/BF01644950]

372 **Selcuk H**, Kanbay M, Korkmaz M, Gur G, Akcay A, Arslan H, Ozdemir N, Yilmaz U, Boyacioglu S. Distribution of HCV genotypes in patients with end-stage renal disease according to type of dialysis treatment. *Dig Dis Sci* 2006; **51**: 1420-1425 [PMID: 16868830 DOI: 10.1007/s10620-005-9025-9]

373 **Yakaryilmaz F**, Gurbuz OA, Guliter S, Mert A, Songur Y, Karakan T, Keles H. Prevalence of occult hepatitis B and hepatitis C virus infections in Turkish hemodialysis patients. *Ren Fail* 2006; **28**: 729-735 [PMID: 17162434 DOI: 10.1080/08860220600925602]

374 **Bozdayi G**, Rota S, Verdi H, Derici U, Sindel S, Bali M, Başay T. [The presence of hepatitis C virus (HCV) infection in hemodialysis patients and determination of HCV genotype distribution]. *Mikrobiyol Bul* 2002; **36**: 291-300 [PMID: 12838663]

375 **Sit D**, Kadiroglu AK, Kayabasi H, Yilmaz ME, Goral V. Seroprevalence of hepatitis B and C viruses in patients with chronic kidney disease in the predialysis stage at a university hospital in Turkey. *Intervirology* 2007; **50**: 133-137 [PMID: 17191015 DOI: 10.1159/000098239]

376 **Kocabaş**  **E**, Aksaray N, Alhan E, Yarkin F, Köksal F, Kilinç Y. Hepatitis B and C virus infections in Turkish children with haemophilia. *Acta Paediatr* 1997; **86**: 1135-1137 [PMID: 9350900 DOI: 10.1111/j.1651-2227.1997.tb14824.x]

377 **El Shahat YI**, Varma S, Bari MZ, Shah Nawaz M, Abdulrahman S, Pingle A. Hepatitis C virus infection among dialysis patients in United arab emirates. *Saudi J Kidney Dis Transpl* 1995; **6**: 157-162 [PMID: 18583857]

378 **Trad O**,Hayek M, Jumaa P, Trad D, Uduman S. Seroprevalence of hepatitis B, hepatitis C and HIV among multiply transfused thalassemic children treated at Tawam Hospital. *Emirates**Med J* 2003; **21**: 17-20

379 **Shidrawi R**, Ali Al-Huraibi M, Ahmad Al-Haimi M, Dayton R, Murray-Lyon IM. Seroprevalence of markers of viral hepatitis in Yemeni healthcare workers. *J Med Virol* 2004; **73**: 562-565 [PMID: 15221900 DOI: 10.1002/jmv.20126]

380 **Watts DM**, Constantine NT, Sheba MF, Kamal M, Callahan JD, Kilpatrick ME. Prevalence of HIV infection and AIDS in Egypt over four years of surveillance (1986-1990). *J Trop Med Hyg* 1993; **96**: 113-117 [PMID: 8459484]

381 **El-Shabrawi MH**, Zein El Abedin MY, Omar N, Kamal NM, Elmakarem SA, Khattab S, El-Sayed HM, El-Hennawy A, Ali AS. Predictive accuracy of serum hyaluronic acid as a non-invasive marker of fibrosis in a cohort of multi-transfused Egyptian children with β-thalassaemia major. *Arab J Gastroenterol* 2012; **13**: 45-48 [PMID: 22980590 DOI: 10.1016/j.ajg.2012.06.006]

382 **Abdelwahab MS**, El-Raziky MS, Kaddah NA, Abou-Elew HH. Prevalence of hepatitis C virus infection and human immunodeficiency virus in a cohort of Egyptian hemophiliac children. *Ann Saudi Med* 2012; **32**: 200-202 [PMID: 22366833]

383 **Marcelin AG**, Grandadam M, Flandre P, Nicand E, Milliancourt C, Koeck JL, Philippon M, Teyssou R, Agut H, Dupin N, Calvez V. Kaposi's sarcoma herpesvirus and HIV-1 seroprevalences in prostitutes in Djibouti. *J Med Virol* 2002; **68**: 164-167 [PMID: 12210403 DOI: 10.1002/jmv.10184]

384 **Mokhbat JE**, Naman RE, Rahme FS, Farah AE, Zahar KL, Maalouf A. Clinical and serological study of the human immunodeficiency virus infection in a cohort of multitransfused persons. *J Med Liban* 1989; **38**: 9-14 [PMID: 2519339]

385 **Mujeeb SA**, Hafeez A. Prevalence and pattern of HIV infection in Karachi. *J Pak Med Assoc* 1993; **43**: 2-4 [PMID: 8474215]

386 **Novelli VM**, Mostafavipour H, Abulaban M, Ekteish F, Milder J, Azadeh B. High prevalence of human immunodeficiency virus infection in children with thalassemia exposed to blood imported from the United States. *Pediatr Infect Dis J* 1987; **6**: 765-766 [PMID: 3670941 DOI: 10.1097/00006454-198708000-00019]

387 **el-Hazmi MA**, Ramia S. Frequencies of hepatitis B, delta and human immune deficiency virus markers in multitransfused Saudi patients with thalassaemia and sickle-cell disease. *J Trop Med Hyg* 1989; **92**: 1-5 [PMID: 2918572]

388 **Al Saran K**, Sabry A, Hassan AH, Al Halawany Z. Evaluation of quality of care in a large Saudi Hemodialysis Center (Prince Salman Center for Kidney Diseases, Riyadh, KSA). *Ren Fail* 2011; **33**: 555-561 [PMID: 21663385 DOI: 10.3109/0886022x.2011.581402]

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**Table 1 Hepatitis C virus prevalence among general population groups in the Middle East and North Africa**

| **Country** | **Population** | **Seroprevalence (%)** | **Ref.** |
| --- | --- | --- | --- |
| **Afghanistan** | Blood donors | 0.3-1.9 | [[123](#_ENREF_123),[124](#_ENREF_124)] |
|  | Pregnant women | 0.31 | [[125](#_ENREF_125)] |
| **Algeria** | Blood donors | 0.18 | [[126](#_ENREF_126)] |
|  | Pregnant women | 0.19-0.63 | [[126](#_ENREF_126),[127](#_ENREF_127)] |
| **Bahrain** | Blood donors | 0.3 | [[128](#_ENREF_128)] |
| **Djibouti** | Blood donors | 0.3 | [[129](#_ENREF_129)] |
| **Egypt** | Army recruits | 22.1 | [[130](#_ENREF_130)] |
|  | Blood donors | 2.7-26.6 | [[103](#_ENREF_103),[131-140](#_ENREF_131)] |
|  | Children | 2.1-12.1 | [[84](#_ENREF_84),[94](#_ENREF_94),[103](#_ENREF_103),[130](#_ENREF_130),[141](#_ENREF_141),[142](#_ENREF_142)] |
|  | Family of HCV positive patients | 0-14 | [[143](#_ENREF_143)] |
|  | Fire brigade personnel | 39 | [[103](#_ENREF_103)] |
|  | General population | 10-41.9 | [[91](#_ENREF_91),[144](#_ENREF_144),[145](#_ENREF_145)] |
|  | Healthy populations | 5-46.7 | [[95](#_ENREF_95),[146-150](#_ENREF_146)] |
|  | National survey | 14.7 | [[62](#_ENREF_62)] |
|  | Pregnant women | 4.3-19 | [[151-154](#_ENREF_151)] |
|  | Rural populations | 2.7-60 | [[90](#_ENREF_90),[155-158](#_ENREF_155)] |
|  | Tourism workers | 14.3 | [[159](#_ENREF_159)] |
|  | Visa applicants | 31.5 | [[95](#_ENREF_95)] |
| **Iran** | Blood donors | 0.1-2.1 | [[114](#_ENREF_114),[160-166](#_ENREF_160)]  |
|  | Children | 0-0.6 | [[167](#_ENREF_167),[168](#_ENREF_168)] |
|  | Family of HCV positive patients | 1.3 | [[169](#_ENREF_169)] |
|  | General population | 0.1-3.1 | [[170](#_ENREF_170)] |
|  | Healthy populations | 12.3 | [[171](#_ENREF_171)] |
| **Iraq** | Pregnant women | 3.2 | [[172](#_ENREF_172)] |
| **Kuwait** | Blood donors | 0.8-5.4 | [[173](#_ENREF_173)] |
|  | Outpatients | 1 | [[174](#_ENREF_174)] |
| **Lebanon** | Blood donors | 0.4-0.7 | [[175-178](#_ENREF_175)] |
|  | General population | 0.7 | [[179](#_ENREF_179)] |
| **Libya** | Blood donors | 0.9-6.6 | [[180-183](#_ENREF_180)] |
|  | Healthy populations | 1.6-7.9 | [[180](#_ENREF_180),[182](#_ENREF_182)] |
|  | National survey | 1.2 | [[184](#_ENREF_184)] |
| **Morocco** | Blood donors | 0.2-1.1 | [[185-188](#_ENREF_185)] |
|  | Pregnant women | 0.5-1 | [[185](#_ENREF_185),[189](#_ENREF_189)] |
| **Oman** | Blood donors | 0.4-1.5 | [[190-193](#_ENREF_190)] |
| **Pakistan** | Blood donors | 0.5-16 | [[64](#_ENREF_64),[76](#_ENREF_76),[194-201](#_ENREF_194)] |
|  | Children | 1.7-2.1 | [[75](#_ENREF_75),[76](#_ENREF_76)] |
|  | Family of HCV positive patients | 0.4-20.5 | [[202-204](#_ENREF_202)] |
|  | General population | 4.7-5.4 | [[64](#_ENREF_64),[76](#_ENREF_76)] |
|  | Healthy adults | 3 | [[76](#_ENREF_76)] |
|  | Rural populations | 4.6-33.7 | [[66](#_ENREF_66),[67](#_ENREF_67),[121](#_ENREF_121),[205](#_ENREF_205),[206](#_ENREF_206)] |
|  | Vaccinated population with smallpox | 21 | [[67](#_ENREF_67)] |
|  | Women | 6.7 | [[205](#_ENREF_205)] |
| **Palestine** | General population | 2.2 | [[144](#_ENREF_144)] |
| **Qatar** | Blood donors | 0.4-2.8 | [[207](#_ENREF_207),[208](#_ENREF_208)] |
|  | General population | 0.9 | [[209](#_ENREF_209)] |
| **Saudi Arabia** | Blood donors | 0.4-4.6 | [[72](#_ENREF_72),[210-218](#_ENREF_210)] |
|  | Children | 0.1-1.8 | [[70-72](#_ENREF_70)] |
|  | General population | 1.7-3.6 | [[219](#_ENREF_219),[220](#_ENREF_220)] |
|  | Outpatients | 2.1-22.5 | [[221](#_ENREF_221)] |
|  | Pregnant women | 0.1-4.6 | [[72](#_ENREF_72),[222](#_ENREF_222),[223](#_ENREF_223)] |
|  | Subjects tested for HCV | 5.1 | [[210](#_ENREF_210)] |
| **Somalia** | Blood donors | 0.6 | [[224](#_ENREF_224)] |
|  | Blood donors and hospitalized populations | 2.4 | [[224](#_ENREF_224)] |
|  | Children | 0-1.5 | [[73](#_ENREF_73),[74](#_ENREF_74)] |
|  | Healthy populations | 1-6.5 | [[73](#_ENREF_73),[225](#_ENREF_225)] |
| **Sudan** | Outpatients | 3 | [[226](#_ENREF_226)] |
|  | Pregnant women | 0.6 | [[227](#_ENREF_227)] |
| **Syria** | Blood donors | 0.95 | [[228](#_ENREF_228)] |
| **Tunisia** | Blood donors | 0.6-1.1 | [[229](#_ENREF_229),[230](#_ENREF_230)] |
|  | General population | 0.2-1.7 | [[231-233](#_ENREF_231)] |
| **Turkey** | Blood donors | 0.2-0.4 | [[234-239](#_ENREF_234)]  |
|  | Controls | 1.3 | [[240](#_ENREF_240)] |
|  | Engaged couples | 0.1 | [[241](#_ENREF_241)] |
|  | Family of HCV positive patients | 2 | [[242](#_ENREF_242)] |
|  | General population | 0.6-2.3 | [[241](#_ENREF_241),[243](#_ENREF_243),[244](#_ENREF_244)] |
|  | Obstetrics and gynecology patients | 0.9 | [[245](#_ENREF_245)] |
|  | Outpatients | 2.2 | [[246](#_ENREF_246)] |
|  | Rural populations | 1 | [[247](#_ENREF_247)] |
|  | Soldiers | 0.5-0.6 | [[237](#_ENREF_237)] |
| **UAE** | Blood donors | 0.5-1.10 | [[248](#_ENREF_248),[249](#_ENREF_249)] |
|  | College students | 0-0.4 | [[250](#_ENREF_250),[251](#_ENREF_251)] |
| **Yemen** | Blood donors | 1.1 | [[252](#_ENREF_252)] |
|  | Healthy populations | 2.1-4.2 | [[253](#_ENREF_253),[254](#_ENREF_254)] |

results shown are not of an exhaustive and systematic literature review. HCV: Hepatitis C virus.

**Table 2 Hepatitis C virus prevalence among different populations at higher risk of hepatitis C virus infection in the Middle East and North Africa**

| **Country** | **Population** | **Seroprevalence (%)** | **Ref.** |
| --- | --- | --- | --- |
| **Afghanistan** | People who inject drugs | 36.6 | [[255](#_ENREF_255)] |
| **Algeria** | Multi-transfused patients | 30 | [[86](#_ENREF_86)] |
| **Bahrain** | Hemodialysis patients | 7.4-9.24 | [[128](#_ENREF_128),[256](#_ENREF_256)] |
|  | Multi-transfused patients | 40 | [[257](#_ENREF_257)] |
| **Egypt** | Children with hepatosplenomegaly | 16.4 | [[130](#_ENREF_130)] |
|  | Chronic liver disease patients | 46.2-73.5 | [[130](#_ENREF_130),[258](#_ENREF_258)] |
|  | Hepatocellular carcinoma patients | 78.5-84 | [[147](#_ENREF_147),[259](#_ENREF_259)] |
|  | Healthcare workers | 1.4-7.7 | [[137](#_ENREF_137),[260](#_ENREF_260)] |
|  | Hemodialysis patients | 46.2-100 | [[130](#_ENREF_130),[137](#_ENREF_137),[261-263](#_ENREF_261)] |
|  | People who inject drugs | 63 | [[145](#_ENREF_145),[264](#_ENREF_264)] |
|  | Jaundice patients | 27.3 | [[265](#_ENREF_265)] |
|  | Kidney transplant patients | 23.3 | [[266](#_ENREF_266)] |
|  | Multi-transfused patients | 11.1-81.6 | [[84](#_ENREF_84),[103](#_ENREF_103),[130](#_ENREF_130),[137](#_ENREF_137),[267-271](#_ENREF_267)] |
|  | Prisoners | 31.4 | [[103](#_ENREF_103)] |
|  | Sexually transmitted infections patients | 5.3 | [[272](#_ENREF_272)] |
| **Iran** | Female sex workers | 2.7 | [[273](#_ENREF_273)] |
|  | Hepatitis B virus patients | 12.3 | [[274](#_ENREF_274)] |
|  | Hemodialysis patients | 2.9-55.9 | [[160](#_ENREF_160),[275-279](#_ENREF_275)] |
|  | HIV positive patients | 11.5 | [[280](#_ENREF_280)] |
|  | Multi-transfused patients | 5.1-71.3 | [[44](#_ENREF_44),[113](#_ENREF_113),[160](#_ENREF_160),[161](#_ENREF_161),[168](#_ENREF_168),[277](#_ENREF_277),[281-293](#_ENREF_281)] |
|  | Injecting and non-injecting drug users | 7.4-80 | [[104](#_ENREF_104),[105](#_ENREF_105),[164](#_ENREF_164),[278](#_ENREF_278),[294-299](#_ENREF_294)] |
|  | Prisoners | 30-78 | [[104](#_ENREF_104),[105](#_ENREF_105),[297](#_ENREF_297),[300](#_ENREF_300),[301](#_ENREF_301)] |
| **Iraq** | HIV positive patients | 66 | [[302](#_ENREF_302)] |
|  | Multi-transfused patients | 67.3 | [[303](#_ENREF_303)] |
| **Jordan** | Multi-transfused patients | 40.5 | [[304](#_ENREF_304)] |
| **Kuwait** | Hemodialysis patients | 27-40 | [[305-307](#_ENREF_305)] |
|  | Multi-transfused patients | 33 | [[308](#_ENREF_308)] |
| **Lebanon** | Healthcare workers | 2.6 | [[309](#_ENREF_309)] |
|  | HIV positive patients | 25 | [[310](#_ENREF_310)] |
| **Libya** | Diabetics | 24.4 | [[311](#_ENREF_311)] |
|  | Healthcare workers | 2-6.8 | [[180](#_ENREF_180),[182](#_ENREF_182),[312](#_ENREF_312)] |
|  | Hemodialysis patients | 20.5-42.5 | [[180](#_ENREF_180),[313](#_ENREF_313)] |
|  | Multi-transfused patients | 10.8 | [[180](#_ENREF_180)] |
| **Morocco** | Barbers | 1.1-5 | [[99](#_ENREF_99),[314](#_ENREF_314)] |
|  | Hemodialysis patients | 10.1-76 | [[88](#_ENREF_88),[185](#_ENREF_185),[315](#_ENREF_315),[316](#_ENREF_316)] |
|  | Multi-transfused patients | 2.3-42.4 | [[185](#_ENREF_185),[316-318](#_ENREF_316)] |
| **Oman** | Hemodialysis patients | 26.5 | [[190](#_ENREF_190)] |
|  | People who inject drugs | 11-53 | [[319](#_ENREF_319)] |
|  | Kidney transplant patients | 13.4 | [[190](#_ENREF_190)] |
|  | Medical students | 0 | [[190](#_ENREF_190)] |
| **Pakistan** | HCC patients | 33 | [[320](#_ENREF_320)] |
|  | Healthcare workers | 5.5-31 | [[76](#_ENREF_76),[321](#_ENREF_321),[322](#_ENREF_322)] |
|  | Hemodialysis patients | 68 | [[65](#_ENREF_65),[323](#_ENREF_323)] |
|  | Hospital attendees | 3.1 | [[324](#_ENREF_324)] |
|  | Injecting and non-injecting drug users | 22-91 | [[325-328](#_ENREF_325)] |
|  | Multi-transfused patients | 13.2-60.0 | [[329-331](#_ENREF_329)] |
|  | Patients receiving frequent injections | 44 | [[332](#_ENREF_332)] |
|  | Type 2 diabetes patients | 36 | [[333](#_ENREF_333)] |
| **Qatar** | Hemodialysis patients | 44.6 | [[334](#_ENREF_334)] |
| **Saudi Arabia** | Cancer patients | 11 | [[70](#_ENREF_70)] |
|  | Chronic liver disease patients | 63.6 | [[335](#_ENREF_335)] |
|  | Healthcare workers | 2.2 | [[336](#_ENREF_336)] |
|  | Hemodialysis patients | 6.9-84.6 | [[72](#_ENREF_72),[210](#_ENREF_210),[219](#_ENREF_219),[256](#_ENREF_256),[337-343](#_ENREF_337)] |
|  | Injecting and non-injecting drug users | 10.5-74.6 | [[72](#_ENREF_72),[220](#_ENREF_220)] |
|  | Multi-transfused patients | 4.6-78.6 | [[222](#_ENREF_222),[344-347](#_ENREF_344)] |
|  | Non-Hodgkins lymphoma patients | 21 | [[348](#_ENREF_348)] |
|  | Schistosomiasis patients | 17.9 | [[336](#_ENREF_336)] |
| **Somalia** | Chronic liver disease patients | 40.3 | [[225](#_ENREF_225)] |
|  | Female sex workers, sexually transmitted infection patients, soldiers, Tuberculosis patients | 1.8 | [[349](#_ENREF_349)] |
|  | Hospitalized patients | 2.2 | [[73](#_ENREF_73)] |
| **Sudan** | Hemodialysis patients | 19-34 | [[350](#_ENREF_350),[351](#_ENREF_351)] |
|  | Hospital attendees | 0.4 | [[352](#_ENREF_352)] |
|  | High schistosomiasis region | 2.2 | [[353](#_ENREF_353)] |
| **Syria** | Female sex workers | 1.96 | [[228](#_ENREF_228)] |
|  | Healthcare workers | 0-6 | [[354](#_ENREF_354)] |
|  | Hemodialysis patients | 54.4 | [[355](#_ENREF_355)] |
|  | People who inject drugs | 60.5 | [[228](#_ENREF_228)] |
| **Tunisia** | Diabetics | 1.3 | [[356](#_ENREF_356)] |
|  | Healthcare workers | 1 | [[357](#_ENREF_357)] |
|  | Hemodialysis patients | 20-46.5 | [[358-361](#_ENREF_358)]  |
|  | HIV positive patients | 39.7 | [[362](#_ENREF_362)] |
|  | Multi-transfused patients | 42-50.5 | [[363-365](#_ENREF_363)] |
| **Turkey** | Barbers | 2.8 | [[100](#_ENREF_100)] |
|  | Cancer patients | 2.8-5.8 | [[366-368](#_ENREF_366)] |
|  | Diabetic patients | 3.2-20.8 | [[240](#_ENREF_240),[369](#_ENREF_369)] |
|  | Female sex workers | 0.8 | [[370](#_ENREF_370)] |
|  | Healthcare workers | 0.3-1.5 | [[234](#_ENREF_234),[371](#_ENREF_371)] |
|  | Hemodialysis patients | 0-51.2 | [[369](#_ENREF_369),[371-374](#_ENREF_371)] |
|  | Chronic kidney disease patients | 7 | [[375](#_ENREF_375)] |
|  | Multi-transfused patients | 4-24.4 | [[371](#_ENREF_371),[376](#_ENREF_376)] |
| **United Arab Emirates** | Hemodialysis patients | 24.4 | [[377](#_ENREF_377)] |
|  | Multi-transfused patients | 18.8 | [[378](#_ENREF_378)] |
| **Yemen** | Chronic liver disease patients | 21.5-37.1 | [[253](#_ENREF_253),[254](#_ENREF_254)] |
|  | Healthcare workers | 0.5-3.5 | [[252](#_ENREF_252),[379](#_ENREF_379)] |

Results shown are not of an exhaustive and systematic literature review.

**Table 3 Human immunodeficiency virus prevalence among high risk human immunodeficiency virus parenteral-transmission population groups in the Middle East and North Africa (other than people who inject drugs)**

| **Country**  | **Population** | **Seroprevalence (%)** | **Ref.** |
| --- | --- | --- | --- |
| **Bahrain** | Children with hereditary hemolytic anemia | 1.6 | [[257](#_ENREF_257)] |
| **Egypt** | Blood or blood products recipients | 4.8 | [[380](#_ENREF_380)] |
|  | Thalassemia patients | 0 | [[381](#_ENREF_381)] |
|  | Children with hemophilia | 0 | [[382](#_ENREF_382)] |
| **Iran** | Thalassemia patients | 0 | [[44](#_ENREF_44),[113](#_ENREF_113),[160](#_ENREF_160),[168](#_ENREF_168),[277](#_ENREF_277),[284](#_ENREF_284),[288-291](#_ENREF_288),[383](#_ENREF_383)] |
|  | Hemophilia patients | 0-2.3 | [[161](#_ENREF_161),[277](#_ENREF_277),[281-284](#_ENREF_281),[287](#_ENREF_287)] |
| **Jordan** | Multi-transfused patients | 0 | [[304](#_ENREF_304)] |
| **Lebanon** | Multi-transfused patients | 0 | [[384](#_ENREF_384)] |
| **Morocco** | Hemodialysis patients | 0 | [[316](#_ENREF_316)] |
| **Pakistan** | Multi-transfused patients | 0.98 | [[385](#_ENREF_385)] |
|  | Hemodialysis patients | 0.98 | [[277](#_ENREF_277)] |
| **Qatar** | Children with thalassemia | 38.5 | [[386](#_ENREF_386)] |
| **Saudi Arabia** | Multi-transfused, thalassemia and sickle cell disease patients | 1.3 | [[387](#_ENREF_387)] |
|  | Children undergoing cancer therapy | 0 | [[70](#_ENREF_70)] |
|  | Hemodialysis patients | 0 | [[388](#_ENREF_388)] |
| **Tunisia** | Hemodialysis patients | 0 | [[359](#_ENREF_359)] |
|  | Hemophiliacs | 8.6 | [[365](#_ENREF_365)] |

results shown are not of an exhaustive and systematic literature review.