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Systematic Review

Prevalence of Hepatitis B and C in Pakistan from 2001 to 2022: A Systematic Review

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ABSTRACT

Background: Hepatitis B and C represent a significant public health concern globally, with a substantial burden in developing countries, particularly Pakistan. The country's diverse demographic and socio-economic landscape presents challenges in the surveillance and management of these infectious diseases.

Objective: This systematic review aims to consolidate and analyse the prevalence data of Hepatitis B and C infections reported across Pakistan from 2001 to 2022 to understand the epidemiological trends and to inform public health interventions.

Methods: A thorough search of various research databases was conducted to identify studies that reported the prevalence of Hepatitis B surface antigen (HBsAg) and anti-Hepatitis C virus (anti-HCV) antibodies. Studies were selected based on inclusion criteria focused on the population of Pakistan between 2001 and 2022. Data extraction was systematic, although a comprehensive quality assessment of each study was not completed.

Results: The review included 54 studies with varying sample sizes and methodologies, including ELISA, ICT, PCR, and other serological assays. Prevalence rates for HBsAg and anti-HCV varied significantly, with HBsAg ranging from 0.9% to 44.4% and anti-HCV from 0.3% to 62.6%. These findings highlight a considerable regional variability and suggest an upward trend in HCV prevalence over the past two decades.

Conclusion: The elevated prevalence rates of Hepatitis B and C across Pakistan underscore the need for robust public health policies, standardized surveillance, and targeted interventions. Despite the systematic approach to data extraction, the review is limited by the absence of a comprehensive quality assessment, which is essential for future research to build upon.

Keywords: Hepatitis B, Hepatitis C, Prevalence, Pakistan, Public Health, Systematic Review, Epidemiology, Infectious Diseases.

INTRODUCTION

The prevalence of hepatitis B and C in Pakistan has been a significant public health concern, particularly over the last two decades. Hepatitis, a term with Latin origins, signifies inflammation of the liver tissue. It is a global public health challenge, especially in developing countries in Asia. The disease is primarily viral in origin, often leading to other liver complications and in some cases, hepatocellular carcinoma. Although a single virus subtype usually causes infections, co-infections involving multiple viruses are also possible. The manifestation of hepatitis can be acute or chronic, potentially progressing to severe conditions like liver cirrhosis or cancer. While there are non-viral causes such as drugs and autoimmune disorders, viral infections remain the predominant cause (1-3).

Hepatitis B Virus (HBV) is a global concern, with a significant burden in developing countries. It affects about 2 billion people worldwide, with approximately 400 million suffering from its chronic form. Pakistan, a developing

country, has seen a high prevalence of HBV, affecting nearly nine million people. Newborns are particularly vulnerable to HBV, with infection rates dropping from over 90% at birth to about 25% by the age of five (4, 5). The Hepatitis C Virus (HCV), belonging to the Flaviviridae family, has a 9.6 kb positive sense RNA genome. Approximately 3% of the global population is infected with HCV, with the highest endemic rates in Africa and Egypt. In Pakistan, around 10 million people have been diagnosed with HCV, which can lead to chronic conditions like liver cirrhosis (6, 7).

The epidemiology of these viruses is complex, influenced by multiple risk factors. In developed countries, transmission occurs primarily through needlestick injuries, intravenous drug use, blood transfusions, sexual contact, maternal exposure, and tattooing. However, in developing countries, including Pakistan, the transmission is often due to the use of unsterilized medical equipment, particularly contaminated injections, contributing to 8-16 million HBV and 2-5 million HCV infections (8-11).

Despite a decline in HCV infections in developed countries, the incidence in developing nations is rising. In Pakistan, the spread of these viruses has been rapid in the past two decades. The first comprehensive nationwide assessment of HCV and HBV prevalence was conducted in 2007-2008 by the United States. Following this, in June 2010, Pakistan launched a national hepatitis sentry site surveillance system. However, this system's scope is limited to regional capitals and Islamabad due to resource constraints, and it did not include high-risk populations in the national survey, focusing only on seropositivity among the general population. The prevalence of hepatitis B and C in Pakistan is a significant public health issue (12). This review aims to consolidate available data to provide a clearer picture of the prevalence rates and highlight the need for more comprehensive surveillance and targeted interventions to address this growing challenge.

MATERIAL AND METHODS

In the systematic review conducted to evaluate the prevalence of hepatitis B and C in Pakistan, a comprehensive literature search was performed using a range of established biomedical and general citation databases. This search involved querying PubMed, OpenMD, Google Scholar, the Directory of Open Access Journals (DOAJ), ScienceDirect, and Web of Science (13, 14). The approach focused on deconstructing the main topic into key terms and phrases, notably "Prevalence of hepatitis B and C in Pakistan" and "Incidence of hepatitis B and C in Pakistan," to ensure a wide-ranging and thorough search.

The research team set specific criteria for including studies in the review. Primarily, the focus was on studies that concentrated on the Pakistani population, encompassing research at local, regional, and national levels. This included investigations conducted in various geographic settings within Pakistan such as cities, districts, provinces, and communities. The diagnostic methods used in these studies were a crucial inclusion criterion; only those that employed Polymerase Chain Reaction (PCR) or Enzyme-Linked Immunosorbent Assay (ELISA) for confirming HBV or HCV infections were considered (15). These methods were chosen due to their high accuracy and reliability in detecting hepatitis infections (15, 16).

Additionally, the researchers required that the studies provide reliable estimates of their sample sizes and detailed demographic information. This requirement was crucial to ensure that the findings were representative of the broader population and could be generalized to the entire country. By adhering to these strict criteria, the team aimed to compile a comprehensive and trustworthy dataset that accurately reflects the state of hepatitis B and C prevalence and incidence in Pakistan.

RESULTS

In the systematic review entitled "Prevalence of Hepatitis B and C in Pakistan from 2001 to 2022," the authors followed a structured methodology to identify and select relevant studies for inclusion. The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow chart provided a visual summary of the literature search and study selection process.

Initially, a comprehensive search was conducted across various research databases, resulting in the identification of 257 records. Prior to screening, 84 records were removed due to duplications, ineligibility as determined by automation tools, irrelevance to the condition of interest, and other unspecified reasons.

Subsequently, the remaining 173 records underwent a meticulous screening process. Of these, 61 records were excluded based on criteria such as improper outcome measures and inappropriate research methods, leaving 112 reports that were sought for retrieval. The retrieval process encountered challenges, as 39 reports could not be retrieved, which necessitated the assessment of 73 reports for eligibility. This assessment further narrowed the field, with 19 reports being excluded due to reasons such as unsuitable comparison groups, the use of pseudo equipment, and other miscellaneous factors.

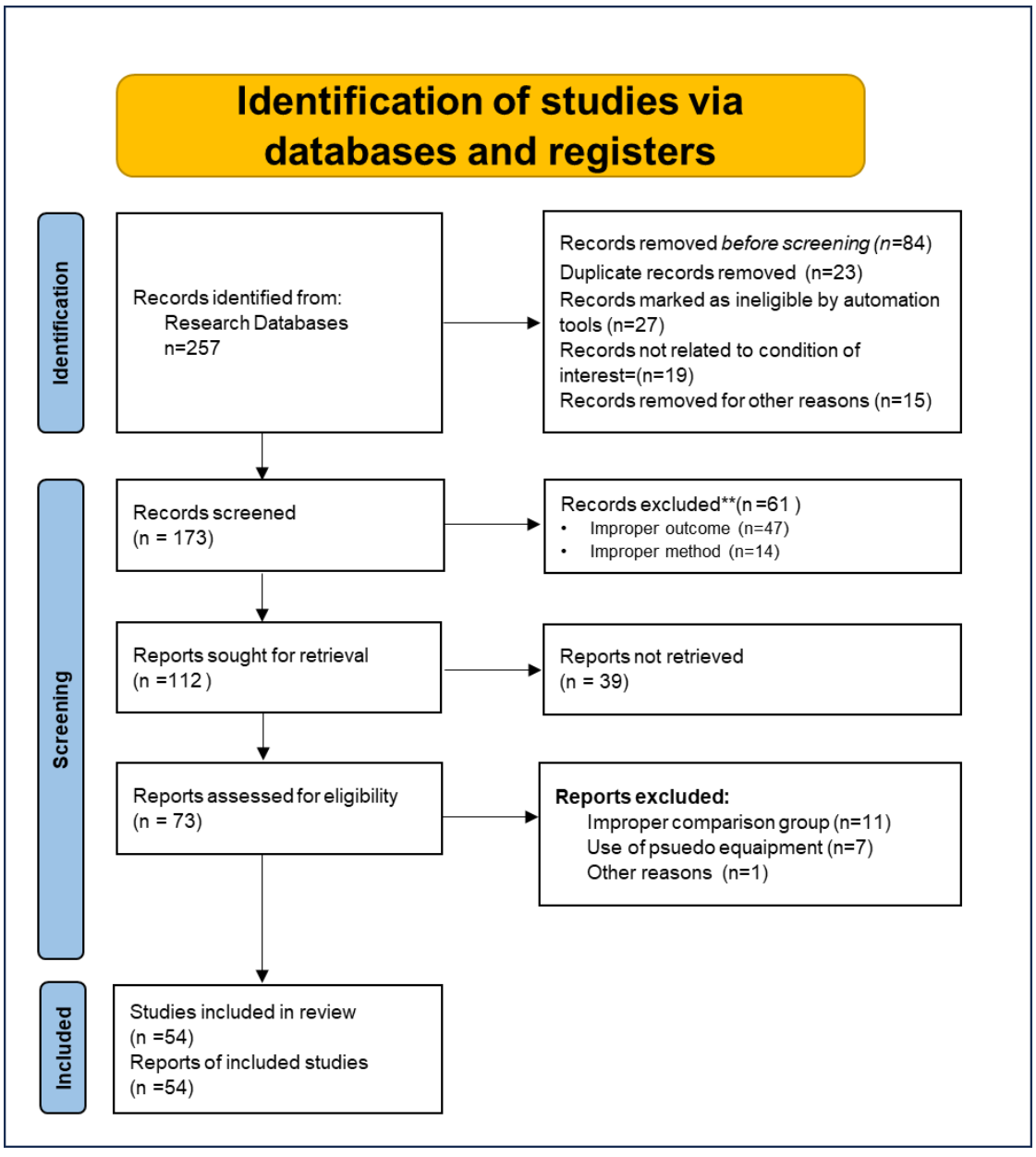

Figure 1 PRISMA Flow Chart

Ultimately, the review included 54 studies that met all the inclusion criteria and were deemed suitable for a comprehensive analysis of the prevalence of Hepatitis B and C in Pakistan over the specified period. These studies provided the data necessary for a detailed synthesis and understanding of the epidemiological trends of these infections in the region (11, 12, 14, 17-67).

Table 1 Prevalence of HBsAg and Anti-HCV

References	Author Year	Location	Method	HBsAg	Anti-HCV	Sample size
(62)	Butt and Amin, 2008	Pakistan	ELISA	2.97	1.7	5707
(49)	Ali et al., 2011	Pakistan	–	4.8	5.1	–
(57)	Hashmi et al., 2010	Islamabad	ICT	24.6	-	252
(24)	Asad et al., 2015	Islamabad	ELISA	9	33	345
(39)	Satti et al., 2012	Islamabad	ELISA,	–	17.4	503
(38)	Siddiqui et al., 2012	Punjab	RIC	2.82	3.13	15,793
(23)	Ashraf et al., 2015	Punjab	-	–	62.6	3262
(29)	Afridi et al., 2014	Punjab	ELISA	–	12.5	995
(61)	Idrees et al., 2008	Punjab	ELISA	–	14.6	6817
(56)	Hyder et al., 2010	Punjab	-	–	6.9	58,680
(25)	Akhtar et al., 2015	Lahore	ELISA	–	14.6	904
(34)	Anwar et al., 2013	Lahore	PCR	–	4.9	4246
(27)	Maan et al., 2014	Gujrat	ELISA	12.8	34.8	250
(50)	Ali et al., 2011	KPK	PCR	–	15.27	167
(65)	Jafri et al., 2006	Karachi	ELISA	1.8	1.6	3533
(21)	Shafiq et al., 2015	Peshawar	ELISA	–	–	500
(35)	Altaf et al., 2013	Tando Allahyar	-	–	–	300
(30)	Abbasi et al., 2014	Sukkur	-	2.1	–	385
(53)	Majid et al., 2010	Bannu	ELISA	1.93	3.27	25,944
(28)	Ilyas and Ahmad, 2014	Peshawar	CMIR	–	13.4	982
(43)	Ahmed et al., 2012	Kech	-	–	5.5	2000
(55)	Jamil et al., 2010	Manesha	ICT	–	10.3	648
(66)	Abdul Mujeeb et al., 2006	Karachi	HBsAg, anti-HCV	4.7	3.6	7325
(60)	Mujeeb and Pearce, 2008	Sindh	Serodia kit, HCV™ V.3 Kit	6.2	7.5	5345
(37)	YASMIN, 2012	Gujranwala	EIA	4.0	-	852
(20)	Akhtar et al., 2016	Bunner	HCV strips	24.3	44.3	230
(14)	Asif et al., 2004	Northern area	AxSYM	3.3	7.6	3430
(40)	Safi et al., 2012	NWFP	ELISA	-	2.6	62,251
(31)	Khan et al., 2013	Quetta	ICT, ELISA	-	20.8	356
(51)	Sarwar et al., 2010	Kotli, AJK	ICT, ELISA	1.5	-	9564
(63)	Sultan et al., 2007	Pakistan	Nova Path HBsAg EIA	2.2	3.7	41,498
(48)	Ilyas et al., 2011	Gujranwala	EIA	1.8	2.3	2502
(26)	Zaheer et al., 2014	Islamabad	ELISA	2.4	3.3	160,376
(67)	Khokhar et al., 2004	Multan	EIA	3.4	0.3	6000
(18)	Saeed et al., 2017	Lahore	ICT	1.1	2.6	18,274
(41)	Memon et al., 2012	Punjab	ELISA	4.6	8.97	457
(54)	Kazi et al., 2010	Pakistan	ELISA	5.9	15.2	365
(32)	IJAZ and Bhatti, 2013	Lahore	ICT	2.0	6.3	7000
(47)	Khan et al., 2011a	Malakand	ELISA	5.5	–	950
(58)	Gorar and Zulfikar, 2010	Sindh	ELISA	-	12.8	7539
(42)	Ali et al., 2012	North Waziristan	ELISA	16.0	–	790
(45)	Rauf et al., 2011	Swat	ICT	0.9	8.81	590
(11)	Hussain and Ali, 2016	Kurram Agency	ICT	15.0	–	4922
(52)	Qazi et al., 2010	Islamabad	ICT	-	24.6	252
(64)	Quddus et al., 2006	Balochistan	-	8.3	–	903
(44)	ur Rehman et al., 2011	KPK	PCR	-	24	200
(33)	Bibi et al., 2013	Hyderabad	ELISA	-	4.7	343
(59)	Gul et al., 2009	Hazara	ELISA	-	8.9	500
(36)	AKHTAR et al., 2013	Lahore	ELISA	-	36.1	241
(19)	Mansha et al., 2017	Lahore	ELISA	6	55	100
(46)	Khan et al., 2011b	Punjab	ELISA, PCR	44.4	-	4890
(17)	Shafi et al., 2017	Pakistan	ELISA	-	27.2	180
(12)	Khan et al., 2015	Mardan	ICT	7	7.8	400
(22)	Fayyaz et al., 2015	Abbottabad	–	1.4	2.7	3549

The table presents a comprehensive set of data from various studies included in the systematic review on the prevalence of Hepatitis B and C in Pakistan from 2001 to 2022. Here's a way to describe the results in a summary:

The systematic review aggregated data from 54 studies encompassing a wide geographical spread across Pakistan, including major cities and provinces such as Islamabad, Punjab, Khyber Pakhtunkhwa (KPK), Sindh, Lahore, and Balochistan. These studies employed diverse methodologies, predominantly Enzyme-Linked Immunosorbent Assay (ELISA), Immunochromatographic Test (ICT), Polymerase Chain Reaction (PCR), and other serological assays, to detect Hepatitis B surface antigen (HBsAg) and anti-Hepatitis C virus (anti-HCV) antibodies. The prevalence rates of HBsAg and anti-HCV varied significantly across studies, with HBsAg rates ranging from as low as 0.9% in Swat to as high as 44.4% in Punjab, and anti-HCV rates ranging from 0.3% in Multan to 62.6% in Punjab. The sample sizes of the studies were equally diverse, from a small sample of 252 in Islamabad to a large cohort of 160,376 in the same city, indicating a broad representation of the population.

Several studies did not report either HBsAg, anti-HCV, or both prevalences, and a few did not specify the sample size. It is noteworthy that the highest anti-HCV prevalence (55%) was reported in a study with a sample size of 100 from Lahore, and the highest HBsAg prevalence (44.4%) was reported in Punjab with a sample size of 4,890. This wide range in prevalence rates underscores the heterogeneity of Hepatitis B and C infection rates within different regions and populations in Pakistan. The review highlights the critical public health concern these infections pose and underscores the necessity for targeted interventions and sustained surveillance to address this health burden.

DISCUSSION

The systematic review on the "Prevalence of Hepatitis B and C in Pakistan from 2001 to 2022" has elucidated the varying prevalence of these viral infections, showcasing a critical public health issue. This review's findings suggest that the prevalence rates of Hepatitis B and C in Pakistan are not only higher than those reported in many other countries but also exhibit a remarkable inter-regional variability.

When juxtaposed with studies from other regions, the prevalence of Hepatitis B in Pakistan as reported by Butt and Amin in 2008 (62) (2.97% HBsAg) appears to be comparable to the 3.5% prevalence in sub-Saharan Africa as reported by Schweitzer et al. in 2015 (68) but lower than the 5.3% reported by Zampino et al. in 2015 for East Asia (69). However, for Hepatitis C, the situation seems dire. The prevalence rate of 62.6% reported by Ashraf et al. in 2015 far exceeds the global average of 2.5% as noted by Gower et al. in 2014, indicating a potential regional epidemic in Punjab, which demands urgent attention (70). Comparatively, neighbouring India, as reported by Sievert et al. in 2011, has a relatively lower HCV prevalence rate of approximately 1% (16). This stark contrast underscores the significant disparities in hepatitis prevalence within the South Asian region and calls for a deeper investigation into the drivers of these differences.

The review's findings also beg comparison with historical data from Pakistan itself. A study by Zuberi et al. in 2008 reported an anti-HCV prevalence of 5.3%, which is notably lower than several findings in the current review (71). This suggests an upward trend in the prevalence of HCV over the years, highlighting the escalating nature of this health issue. One of the review's limitations, however, lies in the quality assessment of the included studies. While data extraction was conducted systematically, the evaluation of study quality remained incomplete, posing a risk to the validity of the findings. The lack of quality assessment means that the reported prevalence rates might be affected by biases inherent in the individual studies, such as selection bias or reporting bias.

Furthermore, the heterogeneity of the methodologies used in the studies, including different diagnostic tests and sampling strategies, presents a challenge in drawing definitive conclusions. This methodological variability might lead to discrepancies in the reported prevalence rates, potentially affecting the overall synthesis of data. In light of these findings, it becomes imperative for policymakers and healthcare providers to develop targeted interventions tailored to regional needs. The establishment of standardized surveillance and reporting mechanisms could aid in generating more reliable data, which is crucial for the effective management and prevention of hepatitis in Pakistan. For future research, a more rigorous quality appraisal of studies is

recommended to ensure the robustness of the systematic review's conclusions. Additionally, there is a need to explore the factors contributing to the high variability in hepatitis prevalence across different regions of Pakistan.

CONCLUSION

The systematic review has shed light on the alarming prevalence of Hepatitis B and C in Pakistan, with rates that suggest an urgent public health crisis. The data underscores a significant challenge facing the healthcare system and necessitates immediate action to curtail the spread of these infections. Despite systematic data extraction, the absence of a thorough quality assessment of the included studies marks a limitation of the review, potentially impacting the reliability of the prevalence rates reported. The implications of these findings are profound. There is a clear need for enhanced public health strategies, including effective screening programs, vaccination campaigns, and educational initiatives to increase awareness about transmission routes and prevention methods. The healthcare infrastructure must be bolstered to manage the existing caseload and to implement preventive strategies effectively.

Furthermore, the government and public health agencies should prioritize the formulation of policy frameworks that address the regional disparities in hepatitis prevalence. Such frameworks should encourage the use of standardized diagnostic criteria and reporting to better monitor and control the epidemic. Collaborative efforts with international health bodies could provide the necessary support and resources to implement these strategies. Investment in research is also crucial. Future studies should focus on identifying the socio-economic, cultural, and biological factors contributing to the high prevalence rates, particularly in the hardest-hit regions. Understanding these factors is essential for tailoring interventions to the needs of specific populations.

In conclusion, while the review presents a concerning picture of hepatitis prevalence in Pakistan, it also offers a foundation upon which to build comprehensive and effective public health responses. The need for action is immediate, and the potential benefits of such interventions extend beyond the immediate reduction in hepatitis prevalence to the broader improvement of public health and well-being in Pakistan and the region at large.

REFERENCES

1. Zhang Ch, Cheng Y, Zhang S, Fan J, Gao Q. Changing epidemiology of hepatocellular carcinoma in Asia. Liver International. 2022;42(9):2029-41.
2. You MW, Kim KW, Shim JJ, Pyo J. Impact of liver-stiffness measurement on hepatocellular carcinoma development in chronic hepatitis C patients treated with direct-acting antivirals: a systematic review and time-to-event meta-analysis. Journal of gastroenterology and hepatology. 2021;36(3):601-8.
3. Tariq R, Abbas A, Saeed F, Qureshi ZA. Frequency of hepatocellular carcinoma and associated sociodemographic factors in treated patients of chronic hepatitis C. Pakistan Armed Forces Medical Journal. 2021;71(Suppl-1):S52-6.
4. Tahata Y, Sakamori R, Yamada R, Kodama T, Hikita H, Hagiwara H, et al. Prediction model for hepatocellular carcinoma occurrence in patients with hepatitis C in the era of direct-acting anti-virals. Alimentary Pharmacology & Therapeutics. 2021;54(10):1340-9.
5. McGlynn KA, Petrick JL, El-Serag HB. Epidemiology of hepatocellular carcinoma. Hepatology. 2021;73:4-13.
6. Bhatti ABH. Hepatocellular carcinoma in Pakistan: an update. Liver Cancer in the Middle East. 2021:387-96.
7. Abro IB, Bhatti JM, Siddiqui AA. Hepatocellular Carcinoma in Hepatitis C-Associated Cirrhotic Patients Treated With Different Combinations of Direct-Acting Antiviral Agents Available in Pakistan: A Prospective Observational Study. 2021.

8. Yang M, Parikh ND, Liu H, Wu E, Rao H, Feng B, et al. Incidence and risk factors of hepatocellular carcinoma in patients with hepatitis C in China and the United States. Scientific Reports. 2020;10(1):20922.
9. Shiels MS, Engels EA, Yanik EL, McGlynn KA, Pfeiffer RM, O'Brien TR. Incidence of hepatocellular carcinoma among older Americans attributable to hepatitis C and hepatitis B: 2001 through 2013. Cancer. 2019;125(15):2621-30.
10. Haqqi A, Munir R, Khalid M, Khurram M, Zaid M, Ali M, et al. Prevalence of hepatitis C virus genotypes in Pakistan: current scenario and review of literature. Viral immunology. 2019;32(9):402-13.
11. Hussain S, Ali Z. Prevalence of hepatitis B virus in the Kurram Agency, Pakistan: A 5-year observational study in a war-affected region. Journal of Clinical Virology. 2016;82:17-9.
12. Khan M, Hussain U, Irshad A, Khan A. Prevalence of hepatitis B and C seropositivity in patients presenting for dental treatment. Pakistan Oral & Dental Journal. 2015;35(2).
13. Moosavy SH, Davoodian P, Nazarnezhad MA, Nejatizaheh A, Eftekhar E, Mahboobi H. Epidemiology, transmission, diagnosis, and outcome of Hepatitis C virus infection. Electronic physician. 2017;9(10):5646.
14. Asif N, Khokhar N, Ilahi F. Sero-prevalence of HBV, HCV, and HIV infection among voluntary non remunerated & replacement donors in Northern Pakistan. Pakistan journal of medical sciences. 2004;20(1):24-8.
15. Avni T, Leibovici L, Paul M. PCR diagnosis of invasive candidiasis: systematic review and meta-analysis. Journal of clinical microbiology. 2011;49(2):665-70.
16. Sievert W, Altraif I, Razavi HA, Abdo A, Ahmed EA, AlOmair A, et al. A systematic review of hepatitis C virus epidemiology in Asia, Australia and Egypt. Liver international. 2011;31:61-80.
17. Shafi ST, Hassan MZ, Saleem M, Anjum R, Abdullah W, Shafi T. Frequency of Hepatitis C in hospitalized patients with chronic kidney disease. Pakistan journal of medical sciences. 2017;33(1):18.
18. Saeed M, Hussain S, Rasheed F, Ahmad M, Arif M, MT HR. Silent killers: Transfusion Transmissible Infections-TTI, among asymptomatic population of Pakistan. JPMA The Journal of the Pakistan Medical Association. 2017;67(3):369-74.
19. Mansha S, Imran M, Shah AMUH, Jamal M, Ahmed F, Atif M, et al. Hepatitis B and C virus infections among human immunodeficiency virus-infected people who inject drugs in Lahore, Pakistan. Viral immunology. 2017;30(5):366-70.
20. Akhtar N, Ilyas M, Muhammad K, Shams S, Saeed K, Asadullah A. Prevalence of Hepatitis C virus infections among the general population of Buner, Khyber Pakhtunkhwa, Pakistan. Biomedical Research and Therapy. 2016;3(12):1003-17.
21. Shafiq M, Nadeem M, Sattar Z, Khan SM, Faheem SM, Ahsan I, et al. Identification of risk factors for hepatitis B and C in Peshawar, Pakistan. HIV/AIDS-Research and Palliative Care. 2015:223-31.
22. Fayyaz M, Ghous SM, Ullah F, Abbas I, Ahmed N, Ahmed A. Frequency of hepatitis B and C in patients seeking treatment at the dental section of a tertiary care hospital. Journal of Ayub Medical College Abbottabad. 2015;27(2):395-7.
23. Ashraf F, Rasheed A, Ullah S, Shaukat M. HCV IN PUNJAB: ZONAL MOLECULAR DISTRIBUTION. The Professional Medical Journal. 2015;22(10):1268-72.
24. Asad M, Ahmed F, Zafar H, Farman S. Frequency and determinants of Hepatitis B and C virus in general population of Farash Town, Islamabad. Pakistan journal of medical sciences. 2015;31(6):1394.
25. Akhtar AM, Majeed S, Jamil M, Rehman A. Prevalence of hepatitis C infection: General patients attending various hospitals of Lahore, Pakistan: a cross sectional study. The Professional Medical Journal. 2015;22(11):1390-6.

26. Zaheer H, Saeed U, Waheed Y, Karimi S, Waheed U. Prevalence and trends of hepatitis B, hepatitis C and human immunodeficiency viruses among blood donors in Islamabad, Pakistan 2005-2013. J Blood Disorders Transf. 2014;5(217):2.
27. Maan MA, Fatma H, Muhammad J. Epidemiology of hepatitis C viral infection in Faisalabad, Pakistan: a retrospective study (2010-2012). African health sciences. 2014;14(4):810-4.
28. Ilyas M, Ahmad I. Chemiluminescent microparticle immunoassay based detection and prevalence of HCV infection in district Peshawar Pakistan. Virology journal. 2014;11:1-5.
29. Afridi SQ, Ali MM, Awan F, Zahid MN, Afridi IQ, Afridi SQ, et al. Molecular epidemiology and viral load of HCV in different regions of Punjab, Pakistan. Virology journal. 2014;11(1):1-5.
30. Abbasi IN, Fatmi Z, Kadir MM, Sathiakumar N. Prevalence of hepatitis B virus infection among barbers and their knowledge, attitude and practices in the district of Sukkur, Sindh. International journal of occupational medicine and environmental health. 2014;27:757-65.
31. Khan A, Tareen AM, Ikram A, Rahman H, Wadood A, Qasim M, et al. Prevalence of HCV among the young male blood donors of Quetta region of Balochistan, Pakistan. Virology journal. 2013;10:1-4.
32. IJAZ RR, Bhatti S. Risk of hepatitis C in factory workers and their relatives. Biomedica. 2013;29(1):42-3.
33. Bibi S, Dars S, Ashfaq S, Qazi RA, Akhund S. Seroprevalence and risk factors for hepatitis C virus (HCV) infection in pregnant women attending public sector tertiary care hospital in Hyderabad Sindh. Pakistan Journal of Medical Sciences. 2013;29(2):505.
34. Anwar MI, Rahman M, Hassan MU, Iqbal M. Prevalence of active hepatitis C virus infections among general public of Lahore, Pakistan. Virology journal. 2013;10(1):1-6.
35. Altaf A, Shah SA, Shaikh K, Constable FM, Khamassi S. Lessons learned from a community based intervention to improve injection safety in Pakistan. BMC research notes. 2013;6:1-6.
36. AKHTAR JAJ, QAMAR MU, SARWAR AHAWF, ANWAR J. Sero-prevalence of HBV and HCV in tuberculous patients at Sheikh Zayed hospital Rahim Yar khan, Pakistan. Biomedica. 2013;29(2):69-72.
37. YASMIN S. Prevalence of Hepatitis B virus infection among population of factory workers in Gujranwala (Punjab) Pakistan. Biologia (Pakistan). 2012;58:47-52.
38. Siddiqui TS, Lahrasab W, Sharif MA. Prevalence of hepatitis B and C in healthy adult males of paramilitary personnel in Punjab. Journal of Ayub Medical College Abbottabad. 2012;24(3-4):138-40.
39. Satti R, Farah M, Khan MI, Haq TS, Khan ZU, Zubair M, et al. Prevalence of hepatitis C virus in urban Ghettos of twin cities. Pakistan Journal of Zoology. 2012;44(4).
40. Safi AZ, Waheed Y, Sadat J, Salahuddin S, Saeed U, Ashraf M. Molecular study of HCV detection, genotypes and their routes of transmission in North West Frontier Province, Pakistan. Asian Pacific journal of tropical biomedicine. 2012;2(7):532-6.
41. Memon AR, Shafique K, Memon A, Draz AU, Rauf MUA, Afsar S. Hepatitis B and C prevalence among the high risk groups of Pakistani population. A cross sectional study. Archives of Public Health. 2012;70:1-6.
42. Ali A, Nisar M, Idrees M, Ahmad H, Hussain A, Rafique S, et al. Prevalence of HBV infection in suspected population of conflict-affected area of war against terrorism in North Waziristan FATA Pakistan. Infection, Genetics and Evolution. 2012;12(8):1865-9.
43. Ahmed F, Irving W, Anwar M, Myles P, Neal K. Prevalence and risk factors for hepatitis C virus infection in Kech District, Balochistan, Pakistan: most infections remain unexplained. A cross-sectional study. Epidemiology & Infection. 2012;140(4):716-23.
44. ur Rehman L, Ullah I, Ali I, Khan IA, Iqbal A, Khan S, et al. Active hepatitis C infection and HCV genotypes prevalent among the IDUs of Khyber Pakhtunkhwa. Virology Journal. 2011;8(1):327.

45. Rauf A, Nadeem MS, Ali A, Iqbal M, Mustafa M, Muzammal Latif M, et al. Prevalence of hepatitis B and C in internally displaced persons of war against terrorism in Swat, Pakistan. The European Journal of Public Health. 2011;21(5):638-42.
46. Khan F, Shams S, Qureshi ID, Israr M, Khan H, Sarwar MT, et al. Hepatitis B virus infection among different sex and age groups in Pakistani Punjab. Virology journal. 2011;8(1):1-5.
47. Khan F, Akbar H, Idrees M, Khan H, Shahzad K, Kayani MA. The prevalence of HBV infection in the cohort of IDPs of war against terrorism in Malakand Division of Northern Pakistan. BMC infectious diseases. 2011;11(1):1-6.
48. Ilyas M, Iftikhar M, Rasheed U. Prevalence of hepatitis B and hepatitis C in populations of college students in Gujranwala. Biol Pak. 2011;57(1&2):89-95.
49. Ali M, Idrees M, Ali L, Hussain A, Ur Rehman I, Saleem S, et al. Hepatitis B virus in Pakistan: a systematic review of prevalence, risk factors, awareness status and genotypes. Virology journal. 2011;8:1-9.
50. Ali I, Siddique L, Rehman LU, Khan NU, Iqbal A, Munir I, et al. Prevalence of HCV among the high risk groups in Khyber Pakhtunkhwa. Virology journal. 2011;8(1):1-4.
51. Sarwar J, Ahmad W, Saleem M, Jamshed F, Gul N, Idrees M. Frequency of hepatitis b in asymptomatic patients of District Headquarter Hospital Kotli, Azad Kashmir. Journal of Ayub Medical College Abbottabad. 2010;22(4):139-42.
52. Qazi HA, Saleem K, Mujtaba I, Hashmi A, Soomro JA. Prevalence and factors associated with HCV (hepatitis C virus) seropositivity in Islamabad, Pakistan. Acta Medica Iranica. 2010:394-8.
53. Majid A, Khan MS, Ullah S. Rising prevalence of hepatitis B and C and risk factors at district headquarter teaching hospital Bannu, Khyber Pakhtunkhwa. J Coll Physicians Surg Pak. 2010;20(7):492-3.
54. Kazi AM, Shah SA, Jenkins CA, Shepherd BE, Vermund SH. Risk factors and prevalence of tuberculosis, human immunodeficiency virus, syphilis, hepatitis B virus, and hepatitis C virus among prisoners in Pakistan. International Journal of Infectious Diseases. 2010;14:e60-e6.
55. Jamil MS, Ali H, Shaheen R, Basit A. Prevalence, knowledge and awareness of hepatitis C among residents of three Union Councils in Mansehra. Journal of Ayub Medical College Abbottabad. 2010;22(3):192-6.
56. Hyder O, Ijaz M, Arshad MA, Zahira T. Age-specific frequency of screen-detected hepatitis C virus seropositivity in men from the Punjab province of Pakistan. Journal of medical screening. 2010;17(4):214-6.
57. Hashmi A, Saleem K, Soomro JA. Prevalence and factors associated with hepatitis C virus seropositivity in female individuals in islamabad, pakistan. International journal of preventive medicine. 2010;1(4):252.
58. Gorar ZA, Zulfikar I. Seropositivity of hepatitis C in prison inmates of Pakistan—a cross sectional study in prisons of Sindh. JPMA The Journal of the Pakistan Medical Association. 2010;60(6):476-9.
59. Gul N, Sarwar J, Idris M, Farid J, Rizvi F, Suleman M, et al. Seroprevalence of hepatitis C in pregnant females of Hazara division. Journal of Ayub Medical College Abbottabad. 2009;21(4):83-6.
60. Mujeeb SA, Pearce MS. Temporal trends in hepatitis B and C infection in family blood donors from interior Sindh, Pakistan. BMC Infectious Diseases. 2008;8:1-6.
61. Idrees M, Lal A, Naseem M, Khalid M. High prevalence of hepatitis C virus infection in the largest province of Pakistan. Journal of digestive diseases. 2008;9(2):95-103.
62. Butt T, Amin M. Seroprevalence of hepatitis B and C infections among young adult males in Pakistan. EMHJ-Eastern Mediterranean Health Journal, 14 (4), 791-797, 2008. 2008.

63. Sultan F, Mehmood T, Mahmood MT. Infectious pathogens in volunteer and replacement blood donors in Pakistan: a ten-year experience. International Journal of Infectious Diseases. 2007;11(5):407-12.
64. Quddus A, Luby SP, Jamal Z, Jafar T. Prevalence of hepatitis B among Afghan refugees living in Balochistan, Pakistan. International Journal of Infectious Diseases. 2006;10(3):242-7.
65. Jafri W, Jafri N, Yakoob J, Islam M, Tirmizi SFA, Jafar T, et al. Hepatitis B and C: prevalence and risk factors associated with seropositivity among children in Karachi, Pakistan. BMC infectious diseases. 2006;6(1):1-10.
66. 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. EMHJ-Eastern Mediterranean Health Journal, 12 (6), 735-741, 2006. 2006.
67. Khokhar N, Gill ML, Malik GJ. General seroprevalence of hepatitis C and hepatitis B virus infections in population. Journal of the College of Physicians and Surgeons--pakistan: JCPSP. 2004;14(9):534-6.
68. Schweitzer A, Horn J, Mikolajczyk RT, Krause G, Ott JJ. Estimations of worldwide prevalence of chronic hepatitis B virus infection: a systematic review of data published between 1965 and 2013. The Lancet. 2015;386(10003):1546-55.
69. Zampino R, Boemio A, Sagnelli C, Alessio L, Adinolfi LE, Sagnelli E, et al. Hepatitis B virus burden in developing countries. World journal of gastroenterology. 2015;21(42):11941.
70. Gower E, Estes C, Blach S, Razavi-Shearer K, Razavi H. Global epidemiology and genotype distribution of the hepatitis C virus infection. Journal of hepatology. 2014;61(1):S45-S57.
71. Zuberi BF, Zuberi FF, Hasan SR, Kumar R, Memon SA, Afsar S. Frequency of acute Hepatitis C after needle stick injury and its treatment outcome. Consultant. 2009;6:02.9.

