

Assessment of Serological Markers Prevalence for Hemocontact Viral Hepatitis in the Osh Region Population, Kyrgyz Republic

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Received: 27 October 2025 / Received in revised form: 21 January 2026, Accepted: 24 January 2026, Published online: 15 March 2026

Abstract

The transmission of viral hepatitis through hemocontact continues to be a significant public health problem because it affects numerous people at high rates throughout the world. The ongoing surveillance efforts fail to detect numerous cases of infection, which makes prevention initiatives more challenging. The study measured viral hepatitis B (HBV) and viral hepatitis C (HCV) serological marker distribution and new cases among Osh region inhabitants from 2015 through 2024. Analytical, statistical, and laboratory methods were employed in the study. Official regional reporting forms served as the primary data sources. Incidence and carrier rates were calculated per 100,000 population, and long-term patterns were evaluated through retrospective analysis. Serological markers were detected using ELISA test systems in accordance with national laboratory standards. Statistical processing included calculation of extensive and intensive indicators, determination of mean values, and assessment of significance using the Student t test. The HBV/HCV epidemiological situation was tense throughout the research. Official registration showed the pattern but understated the burden. HBV and HCV carrier rates increased by 2.8 and 2, respectively. HBV marker prevalence remained 2.6 times higher than HCV marker prevalence. Injecting drug users, sex workers, chronic disease patients, detainees, and STD patients had higher carriage rates. Carriage of viral hepatitis markers exceeded officially reported incidence by 2.3 times. For HBV, this gap increased to 5.5 times by 2024, and for HCV it ranged from

3.1 to 5.7 times. Reliable assessment of the true burden of viral hepatitis requires enhanced monitoring of serological marker carriage alongside routine surveillance.

Keywords: Viral hepatitis B, Hemocontact, Morbidity, Carriage, Serological marker

Introduction

Every year, millions of people live their daily lives unaware that a silent infection may be progressing inside them. Viral hepatitis B remains one of the most persistent and dangerous infections transmitted through blood contact, and it continues to shape public health agendas around the world (Gerlich, 2013). Its resilience is the result of both its efficiency of transmission and its ability to remain hidden for years before symptoms appear. This combination makes hepatitis B not only a medical challenge but also a social and economic burden on communities (CDC, n.d.). Countries across the world, including Kazakhstan, Russia, and the Kyrgyz Republic, face a high prevalence of parenteral viral hepatitis. Studies show that infection rates rise across diverse groups such as healthy adults, working populations, professional athletes, and individuals in prisons (Akmatov *et al.*, 2023). The risk grows even higher among injecting drug users, migrants, medical workers, and people seeking frequent medical care. The wide range of affected groups highlights the disease's ability to penetrate every layer of society. Official data from Russia reports more than 1.9 million people living with chronic hepatitis C, with most patients falling within the working age of 20 to 40 years (Mackesy-Amiti *et al.*, 2023). Similar patterns are observed in Kazakhstan and Kyrgyzstan, where large numbers of adults live with chronic hepatitis B or C. Although vaccination programs and new regulations have helped lower infection rates in some regions, the threat remains significant. Persistent cases, emerging outbreaks, and gaps in prevention efforts underscore the need for ongoing research on hepatitis B and C (Jumabayeva *et al.*, 2022).

Despite progress in surveillance and prevention, parenteral viral hepatitis B and C continue to spread across large segments of the population. In many regions, including the Osh area, infection persists because of inconsistent preventive practices, limited access to quality healthcare, and low awareness of transmission risks (Kaewdech *et al.*, 2024). Outbreaks linked to medical procedures have occurred when standard precautions were not followed, demonstrating that healthcare settings themselves can become sources of infection. This creates a cycle in which patients

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seek care but are exposed to new health threats (Siddiqui *et al.*, 2023). Another challenge is the presence of hidden carriers who show no symptoms but can transmit the virus. High carrier rates among healthy populations and medical professionals indicate silent circulation within communities. In Russia, carrier markers among medical workers have reached nearly 20 percent for hepatitis B and over 13 percent for hepatitis C (Peng *et al.*, 2020). These numbers reveal major vulnerabilities in healthcare environments that should otherwise function as protective spaces. Migration also plays a significant role. Studies conducted by Russian scientists have shown elevated rates of hepatitis markers among migrant groups. These findings underscore how population movements affect the spread of infections, especially when migrants lack access to testing, vaccination, or treatment (Razavi-Shearer *et al.*, 2025). In the Kyrgyz Republic, around half a million people live with chronic hepatitis B, and a significant share of the population carries hepatitis C. Even with regulatory improvements, infection continues to circulate due to social, economic, and healthcare barriers. Because of these ongoing risks, there is a clear need to analyze local epidemiological patterns to understand how hepatitis B and C continue to persist in the Osh region.

The novelty of this study lies in its focus on a long-term, region-specific assessment of hepatitis B and C markers within the Osh population from 2015 to 2024. While many national and international studies examine general trends, fewer provide detailed insights into the epidemiological dynamics of a single region over nearly a decade. This approach allows for a more accurate understanding of how interventions, population movement, and healthcare practices shape local patterns of infection. Another original aspect of the study is its inclusion of both incidence and carrier states. Most research highlights only clinically diagnosed cases, which underestimates the scale of the epidemic. By examining serological markers, this study captures both active disease and silent carriers. This broader view helps clarify how the infection circulates even when diagnosis rates appear stable or declining. The research also contributes new evidence related to vulnerable groups within the Osh region. Although global studies mention high-risk populations, local data are often limited or outdated. This study provides updated information that can be used to refine prevention strategies, improve infection control in medical facilities, and strengthen targeted outreach to groups such as migrants, injecting drug users, and healthcare workers. Finally, the extended timeline of this study allows for the identification of trends that shorter investigations might miss. By analyzing changes over nine years, the research offers a clearer picture of how regulatory policies, vaccination programs, and public health measures influence the spread of hepatitis B and C. This positions the study as an important contribution to regional planning and future epidemiological work.

Materials and Methods

This study examined the incidence, prevalence, and carrier states of viral hepatitis B and C in the Osh region during the period from 2015 to 2024. The research focused on statistical records from the

Russian Federation and Central Asian countries that report infectious disease patterns, including documented markers of hepatitis B virus (HBV) and hepatitis C virus (HCV). The study population included all individuals whose diagnostic and surveillance data were captured within regional reporting systems. The study protocol was reviewed and approved by the Ethical Committee of Osh State University. All procedures were conducted in accordance with the ethical standards of the institutional research committee and the principles outlined in the Declaration of Helsinki (World Medical Association, 2013). Written informed consent was obtained from all participants prior to their inclusion in the study.

Data Sources

Statistical Reporting Forms

Data on HBV and HCV Morbidity and Carriage Were Collected From the Following Official Reporting Forms

Form No. 1: Report on the Movement of Infectious and Parasitic Diseases.

Form No. 12: Report on Morbidity and Preventive Work from Family Medicine Centers and Dispensaries of the Osh Center for Disease Prevention and the State Sanitary and Epidemiological Service.

Form No. 4-1: Report on Laboratory Findings for Viral Hepatitis B and C, Completed by Facilities in Osh City and the Osh Region.

These documents provided annual data on new cases, chronic carriers, and serological findings for the period 2015 to 2024.

Laboratory Methods

Serological testing for HBV and HCV markers was carried out using enzyme-linked immunosorbent assay (ELISA). Diagnostic kits approved for use in the laboratory services of the Osh region were applied according to the manufacturers' instructions. The presence of HBV and HCV markers was recorded in line with national laboratory standards. All laboratory results were matched with corresponding epidemiological data.

Analytical Methods

The study applied analytical, statistical, and retrospective methods. Incidence and carriage rates for hepatitis B and C were calculated per 100 thousand population. Extensive indicators and mean intensive values ($M \pm m$) were determined. Data processing was conducted using MS Excel and Epi Info. Statistical reliability was assessed using the Student t test, and significance was determined using the calculated t values and corresponding P values.

Results and Discussion

In the Osh region, the epidemiological situation of the hemocontact mechanism of infection with infectious diseases (viral hepatitis B and C) has remained tense for 10 years (**Table 1**).

Table 1. Morbidity rates of viral hepatitis B and C, intensive acute formosis (per 100,0 thousand population)

Year	Osh region		In Osh City	
	HBV	and HCV	HBV	and HCV
2015	3,8±0,5	0,5±0,22	20,2±2,6	4,6±1,2,2
2016	5,1±0,6	1,4±0,33	12,9±2,00	2,6±0,99
2017	6,3±0,7	0,7±0,2	4,3±1,7	2,2±0,66
2018	4,9±0,6	0,9±0,33	6,5±1,5	0,6±0,44
2019	v 1,9±0,4	1,1±0,33	4,2±1,2	1,8±0,88
2020	2,0±0,4	0,9±0,2	0,4±0,4	1,7±0,88
2021	2,4±0,4	0,4±0,11	1,2±0,6	0,9±0,55
2022	2,7±0,55	1,2±0,33	1,2±0,6,6	0,3±0,2
2023	2,3±0,4	1,9±0,44	1,4±0,6,6	1,4±0,77
2024	2,3±0,4	1,6±0,44	1,3±0,7	0,2±0,77

Table 1 shows that in 2015, acute viral hepatitis B had an indicative incidence of 20.2±2.6 per 100,000 population, which decreased to 4.2±1.2 in 2019 and further to 1.3±0.7 in 2024, representing a decrease of almost 15.5 times ($p < 0.05$). Simultaneously, the Osh region exhibits clearly pronounced periodic decreases or rising incidence. The indicative period related to HBV incidence has been studied, showing a range from 3.8±0.5 per 100,000 population in 2015 to 2.3±0.4 per 100,000 population from 2022 to 2024 (Ağaçkiran *et al.*, 2023; Du *et al.*, 2023; Savva *et al.*, 2023; Alnuwaiser *et al.*, 2024; Goyal *et al.*, 2024; Tagami *et al.*, 2024).

In Osh, the rates of HCV morbidity are significantly higher than those in the surrounding Osh Oblast, according to statistical indicators. In 2012, the incidence of HCV infection decreased to a level of 4.6±1.2% per year. This represents a decrease to approximately 0.2±0.7 cases per 100,000 population, which is nearly 23 times lower than previous rates. In the Osh region, during the analyzed period, the indicative incidence of HCV ± 0.2 in 2015 ranged from 0.5 to 1.6 ± 0.4 per 100 thousand in 2024. In the population, over the past three years (2022-2024), an increase of 2.5–3.5 times has been observed compared to 2015 ($p < 0.05$).

Testing is a crucial aspect of tracking hepatitis B virus markers for monitoring the serological spread of infection among children. One of the earliest laboratory screenings for viral hepatitis was initiated in the Osh region in the late 1980s. Currently, there are ten diagnostic centers operating in the republic, though they do not have laboratories. Serological screening for viral hepatitis B and C is conducted in accordance with the directives outlined in the regulation on population markers, as approved by the Ministry of Health of the Kyrgyz Republic (Orders No. 222 dated July 15, 1999; No. 488 dated July 1, 2008; and No. 524 dated July 20, 2018). Amendments and changes to these regulations have not been specifically made in response to the morbidity situation in the republic. In the Osh region's strategy for testing VH markers, screening is primarily influenced by policies and procedures (whether mandatory, voluntary, or compulsory), the financial capabilities of health care institutions, the accessibility of key population groups for laboratory testing, and the medical engagement of the population regarding VH testing. The volume of testing for HBV and HCV markers in the Osh region from 2015 to 2024 is illustrated in **Figure 1** (Ahmed & Rajasekar, 2025; Drissi *et al.*, 2025; Karkimbayeva *et al.*, 2025).

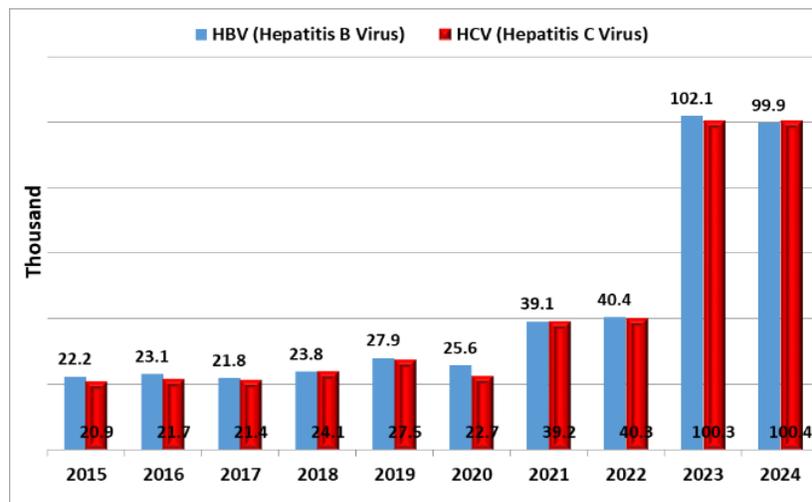


Figure 1. Laboratory screening for HBV and HCV markers in the Osh region in 2015-2024

The figure shows that more than 425 thousand people have been tested for HBV and HCV markers in Osh Oblast over the past 10 years, with Benomila accounting for 26.6% of the region's population. The average annual number of people tested for the marker exceeds 42.5 thousand per year, or 2.7% of the region's population. The analysis showed that the Osh region annually sees an increase of 2.8 times from 22.2 thousand in the HBV survey marker in 2015 to 99.9 thousand in 2024, and by 20.9 thousand with HCV by 2 times, up to 100.4 thousand people, respectively. Viral hepatitis B and C: Over the past 5 years, the maximum number of children examined for the marker has been observed, which is associated with mandatory testing of pregnant women for the introduction of I on VH, I according to the indications of clinical patients and military personnel. During the 10-year study period, among individuals tested for HBV markers, the leading groups were healthcare workers (23.0%), pregnant women (20.3%), blood donors (19.2%), and patients examined based on clinical indications (15.9%). A similar pattern is observed in HCV testing: medical workers (21.2%), pregnant women (20.9%), blood donors (19.4%), and patients examined for clinical indications (13.7%). At the same time, the proportion of the survey group of people who are particularly vulnerable to infection with

hemocontact viral hepatitis (injecting drug users, sex workers, people traveling abroad, patients with STIs, people in prison, etc.) is more than 1.2% (Abdel-Hadi & Abdel-Fattah, 2022; Elshorbagy *et al.*, 2022; Sadeq *et al.*, 2022; Sofiah *et al.*, 2022; Akbari, 2023; Al-Sunbul *et al.*, 2025; Altaie *et al.*, 2026). According to 10 years of data from the Osh region, positive cases were registered among the population groups tested for HBV and HCV, with 6,699 and 17,557 positive cases, respectively. The indicative lesion rate for HBV is 1097.3 ± 8.2 per 100,000 cumulative population, while for HCV it is 418.6 ± 5.1 (< 0.05). Consequently, the statistically significant marker indicating HBV prevalence is 2.6 times higher than that of HCV, which attracts considerable interest. From 2015 to 2022, a total of 588,129 HBV marker cases were detected annually among the surveyed population. Additionally, many cases of HCV showed positive results for markers b, c, and cb. Between 2022 and 2024, up to 4 thousand individuals with HBV were identified. There are up to 4,000 people identified as HBV carriers and approximately 1,400 individuals with HCV per year. **Table 2** provides information on the prevalence of HBV and HCV carriers in the Osh region, per 100,000 population, by year (Çora & Çora, 2022; Kirilmaz, 2022; Üzümlü *et al.*, 2022; Nguyen *et al.*, 2023; Zoubi *et al.*, 2023).

Table 2. Indicative carrier of HBV and HCV markers among the population by years of the Osh region (per 100,0 thousand population).

Years	of HBV	and HCV
2015	77.7±2.4	40.1±1.7
2016	80,5±2,4	28,4±1,4
2017	68,7±2,2	34,4±1,6
2018	74,1±2,3	32,6±1,5
2019	86,4±2,4	41,6±1,7
2020	78,5±2,3	33,8±1,5
2021	107,7±2,7	52,6±1,9
2022	102,3±2,6	42,2±1,7
2023	285,3±4,2	91,3±2,4
2024	215,4±3,7	80,8±2,2
Total	1097.3±8.2	418.6±5.1

From **Table 2**, it follows that during the study period, there was an increase in the prevalence of HBV carriers by 2.8 times in dynamics on markers—from 77.7 ± 2.4 g in 2015 to 215.4 ± 3.7 g in 2024. VG and C increased by 2 times—from 40.1 ± 1.7 to 80.8 ± 2.2 , respectively (< 0.05). Long-term average carrier rates for 2015-2024 are made up of 4.1% for HBV and 1.6% for HCV (Aodh & Al-Marshedi, 2023; Dirican, 2023; Gogoi *et al.*, 2023; Doddapanen *et al.*, 2024; Karthikeyan *et al.*, 2024).

In our opinion, the increase in the carriage rate of viral hepatitis markers is primarily due to laboratory testing and screening in the general population, as well as due to the intensification of the epidemic process of parenteral hepatitis among the population of the region. We analyzed laboratory test results for HBV and HCV across various population categories from 2015 to 2024, focusing on markers and SV (**Table 3**).

Table 3. Results of laboratory testing for HBV and HCV in the markers of various population groups in the Osh region for 2015-2024

N /	Survey contingent	A HBV		and the HCV survey contingent	
		examined Total	of them (+) in %	Total	of them (+) in %
	Citizens, Total, including	426284	4.1±0.01	418558	1.6±0.02
1	Drug	users 137	8.0±2.3	158	43.0±3.9
2	Patients with STI	215	5.1±1.5	177	5.6±1.7
3	Sex workers (SR)	153	7,5±2,1	217	11,7±2,2
4	Persons traveling abroad	3701	2.9±0.3	3686	1.2±0.2
5	Donors, in blood,	82013	4,3±0,07	81494	1,1±0,03
6	Pregnant	86542	3.7±0.6	87695	0.8±0.03

7	Military personnel	6890	4.1±0.2	6766	0.9±0.1
8	Persons in pre-trial detention,	1056	5,2±0,7	1059	7,6±0,8
9.	In Clinical Examined by indications, adults	68024	7.7±0.1	57487	6.0±0.09
10	By examining clinical indications in children	27114	1.0±0.06	23207	0.2±0.03
11	Health workers	98219	2.1±0.05	88931	1.6±0.04

From **Table 3**, it is evident that from 2015 to 2024, the indicative prevalence of the examined benomyl cohorts in the Osh region averaged 4.1%. A small proportion of carriers was observed among the surveyed population groups: injecting drug users at 8.0±2.3%, sex workers at 7.575±2.1%, chronic patients without pathology at 7.777±0.1%, individuals in pre-trial detention at 5.2±0.7%, and patients with STIs at 5.151±1.5%. Below the regional average, lower prevalence rates were found in people traveling abroad (1.2±0.2%), pregnant women (3.7±0.6%), and medical workers (2.1±0.05%).

A similar pattern is observed in the marker for HCV screening, where the average indicative carrier composition of benomilis is

1.6±0.02%. Among injecting drug users, this indicator is significantly higher in the tested groups: 43.3±3.9% for injecting drug users, 11.7±2.2% for sex workers, 7.6±0.8% for individuals in pre-trial detention, 6.0±0.09% for patients with chronic pathologies without adults, and 5.6±1.7% for patients with STIs. HCV was detected among injecting drug users, showcasing the highest indicative lesion rate at 43.0±3.9%. In contrast, a significantly low level of HCV carriers (ranging from 0.2% to 0.9%) was found among healthy population groups, including pregnant women, military personnel, and sick children. The carriage of HBV and HCV markers among specific population groups was analyzed according to the long-term dynamics of these indicators from 2015 to 2024 (**Tables 4 and 5**).

Table 4. Indicators of HBV carrier in the marker in the Osh region (in%)

Contingent	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Total surveyed: including	4,7	4,7	4,4	4,4	4,5	4,4	4,1	3,8	4,3	3,7
donors, in the blood	6,6	6,8	5,8	4,6	3,9	3,9	4,1	3,7	2,5	2,7
Pregnant	11,1	12,5	5,2	16,8	13,0	13,0	6,0	4,9	2,7	2,2
Adult patients.	8,5	9,1	9,5	6,9	6,8	6,8	5,9	5,5	9,4	7,8
Health workers	2,9	2,9	2,5	2,2	2,2	2,1	1,8	1,6	1,8	1,6
Persons exited. abroad	5,2	4,5	3,8	1,8	4,8	4,9	2,7	2,8	1,9	1,8

From **Table 4**, it is evident that during the period of HBV carriage among the tested population groups, the proportion studying the composition of benomyl decreased by 3.7% in 2024, compared to a 4.7% decrease in 2015, resulting in an overall decline of 21.5%. When comparing 2024 to 2015, a statistically significant decrease

(p < 0.05) in the prevalence of HBV was observed across groups: donors (2.4 times), pregnant women (5 times), health workers (1.8 times), and individuals traveling abroad (1.8 times). A similar trend has been noted among HCV-tested carriers in the general population (**Table 5**).

Table 5. Indicative marker b of HCV carriage in the Osh region (in %).

Contingent	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Total Surveyed: including	2,6	2,7	2,6	1,9	2,2	2,2	2,0	1,6	1,3	1,3
donors, in the blood	1,6	1,6	0,2	0,8	0,9	0,9	1,4	0,9	0,6	0,6
Pregnant	4,0	3,2	5,0	4,0	3,2	3,2	1,6	0,8	0,6	0,5
Adult patients.	9,6	9,9	8,3	11,1	6,2	6,1	4,8	4,2	8,9	3,9
Health workers	1,4	1,4	1,2	0,9	1,0	1,0	1,1	1,0	0,8	0,8
Persons exited. Rubezh sv,	4,0	4,5	2,4	1,3	1,2	1,7	1,2	0,9	0,6	0,6

The table illustrates a projected decrease in the level of HCV carriage among the surveyed population groups in 2024, anticipated to be 2.5 times lower compared to levels in 2015. During this time, a significant reduction in the HCV marker has been observed, with decreases ranging from 1.8 to 8 times among health workers and pregnant women. Moreover, fundamentally new approaches have been implemented within the existing system for testing the viral hepatitis B marker, leading to more effective monitoring and heightened sensitivity regarding the laboratory-led risk of carrier infection.

The analysis revealed that none of the population groups can be considered fully representative. For example, individuals from different donors with blood types B and II fall within the same age groups. The heterosexual population primarily consists of pregnant women. The drug user group includes not only those who inject drugs intravenously but also individuals who use drugs orally, as well as those who sniff or smoke them. The study of incarcerated individuals is of epidemiological interest, as it highlights the presence of homosexual drug users among children who use intravenous drugs. The likelihood of detecting carriers of viral hepatitis markers is significantly higher among patients with

sexually transmitted infections and those without chronic liver disease, given that the main routes of transmission for viral hepatitis are sexual and parenteral. It is important to study more specific population groups epidemiologically, such as homosexuals and commercial sex workers, who, according to existing literature, are more susceptible to parenteral infections. Therefore, we believe that examining these populations from various epidemiological perspectives is essential.

Furthermore, in the current population testing strategy, financial costs must be considered when selecting viral hepatitis groups. It is important to note that most cases of viral hepatitis B remain asymptomatic and go unnoticed by health professionals, leading to an underrepresentation of officially registered cases compared to the actual situation. In this context, we conducted a comparative analysis of the incidence and carrier rates of HBV and HCV markers per 100,000 in the Osh region from 2020 to 2024 (**Table 6**).

Table 6. Morbidity and carrier rates of HBV and HCV markers among the population of Osh oblast (per 100,0 thousand population).

Years	Chronic hepatitis divisions				Hepatitis			
	B		C		B		C	
	Carrier Indicator	Indicator $\pm m$	Indicator $\pm m$	$\pm m$	Carrier Indicator	Indicator $\pm m$	Indicator $\pm m$	$\pm m$
Indicator 2020	34,2	$\pm 1,7$	11,0	$\pm 0,9$	78,5	$\pm 2,3$	33,8	$\pm 1,5$
2021	30,2	$\pm 1,6$	10,8	$\pm 0,9$	107,7	$\pm 2,7$	52,6	$\pm 1,9$
2022	33,9	$\pm 1,7$	11,1	$\pm 0,9$	102,3	$\pm 2,6$	42,2	$\pm 1,7$
2023	36,1	$\pm 1,6$	12,6	$\pm 1,0$	285,3	$\pm 4,2$	91,3	$\pm 2,4$
2024	39,4	$\pm 1,8$	14,1	$\pm 1,1$	215,4	$\pm 3,7$	80,8	$\pm 2,2$

Table 6 shows that, compared to the officially registered incidence of viral hepatitis markers, the indicative rate per 100,000 population increased from 2.3 times for HBV in 2020 to 5.5 times in 2024, and from 3.1 times to 5.7 times for HCV ($p < 0.05$). A high level of HBV and HCV serological markers among the population indicates a high carrier rate for the tested undiagnosed asymptomatic forms. This circumstance indicates that there are populations of pathogens of parenteral viral hepatitis among the potential sources studied, which create a real risk of their spread if standard preventive measures are not taken in health care institutions. Therefore, to assess the actual incidence of viral hepatitis, it is necessary to study indicators for effective tracking and the "carriers" of HBV and HCV serological markers, which, as our study shows, are several times higher than those of their officially unregistered counterparts.

The ten-year surveillance in the Osh region reveals a complex and evolving epidemiological picture for hemocontact viral hepatitis B and C. Two divergent trends stand out. First, reported acute HBV incidence has fallen sharply from 20.2 ± 2.6 per 100,000 in 2015 to 1.3 ± 0.7 per 100,000 in 2024 ($p < 0.05$). Second, despite reductions in acute incidence, the measured prevalence of HBV and HCV carriage rose markedly over the same period: HBV carriers increased from 77.7 ± 2.4 to 215.4 ± 3.7 per 100,000 (2.8-fold) and HCV carriers from 40.1 ± 1.7 to 80.8 ± 2.2 per 100,000 (2-fold) ($p < 0.05$). This apparent paradox, declining acute cases alongside growing carrier pools, frames the principal public health challenge in the region (Siddiqui *et al.*, 2023; South Eastern European Journal of Public Health, n.d.). A major driver of the increased carrier detection is intensified laboratory screening. Over 425,000 people (about 26.6% of the region) were screened for HBV and HCV during 2015–2024, with annual testing climbing from roughly 22.2 thousand to nearly 100 thousand persons. Expanded, programmatic testing—including mandatory antenatal screening, donor screening, and targeted testing of clinical and occupational groups—inevitably uncovers previously undiagnosed chronic

infections and asymptomatic carriers. The temporal spikes in carrier prevalence, particularly in 2023, are consistent with intensified screening campaigns rather than a sudden biological surge in transmission alone (Alam *et al.*, 2023; Microorganisms, n.d.).

Nevertheless, the distribution of markers across population subgroups identifies persistent pockets of high transmission risk that warrant urgent action. Injecting drug users recorded the highest carriage rates by far (HBV 8.0% and HCV 43.0%). At the same time, sex workers, persons in pretrial detention, and patients with sexually transmitted infections also show substantially elevated prevalence (Siddiqui, 2021; Degenhardt *et al.*, 2023). Medical personnel and blood donors have lower yet non-negligible carriage rates, underscoring both occupational exposure risks and the importance of blood safety. These subgroup patterns signal ongoing parenteral and sexual transmission chains that testing alone will not interrupt (Ogolla *et al.*, 2025). The substantial reduction in acute HBV incidence likely reflects the positive effects of sustained vaccination and infection-control measures implemented over the study period, especially among infants and pregnant women (Nilyanimit *et al.*, 2025). Declines in donor and pregnant women carriage rates provide further evidence that prevention policies have produced benefits. Yet the persistence and growth of the chronic reservoir suggest that many infections remain undiagnosed for years and that transmission is sustained within high-risk networks. The data therefore indicate partial success: primary prevention reduced new acute disease while secondary prevention and case-finding lag behind (Infectious Disease Reports, n.d.).

Policy and programmatic implications follow directly from these findings. First, intensified case-finding must be matched by robust linkage-to-care pathways. Identifying carriers without ensuring access to confirmatory diagnostics, counseling, antiviral therapy where indicated, and follow-up undermines the value of screening

(Liu *et al.*, 2023). Second, harm reduction services, needle and syringe programs, opioid substitution therapy, and targeted outreach must be scaled up to reduce HCV transmission among people who inject drugs (Diagnostics, n.d.). Third, continued and expanded antenatal screening accompanied by maternal management and neonatal prophylaxis will help sustain reductions in perinatal HBV transmission (Faure-Bardon *et al.*, 2021). Fourth, infection control training and monitoring in health-care facilities remain essential to prevent iatrogenic transmission (Siddiqui *et al.*, 2025).

From a surveillance perspective, the data demonstrate the value of long-term regional monitoring that integrates laboratory and epidemiological indicators. Future work should prioritize population-based serosurveys using probabilistic sampling to estimate true prevalence better and characterize undiagnosed disease. Operational research is also needed to evaluate barriers to care following diagnosis and to test models for integrating hepatitis services into primary care and harm-reduction programs.

Future Recommendations

The research data show that the Osh region successfully reduced acute viral hepatitis cases, but many people with chronic HBV and HCV infections remain undiagnosed and untreated. Organizations need to implement preventive measures that help them identify problems early. The observed data patterns have led to the following recommendations.

Strengthen Targeted Screening for High-Risk Groups

The testing program needs to grow, but researchers should direct their efforts toward drug users who inject, sex workers, people in detention, and patients with sexually transmitted infections. Virus transmission remains most effective through these specific populations, which show the highest marker levels (Price *et al.*, 2025).

Improve Linkage to Clinical Evaluation and Treatment

Screening has limited value if positive individuals are not connected to follow-up care. Programs should establish clear referral pathways, expand antiviral treatment access, and support patient follow-up through counseling and community health workers (Luther *et al.*, 2025).

Scale Up Harm-Reduction Interventions

The solution to decrease parenteral transmission requires increased distribution of needle and syringe programs, opioid substitution therapy, and community outreach programs. The current measurement methods prove successful for regions that have high HCV infection rates (Toma *et al.*, 2025).

Strengthen Infection-Control Practices in Health-Care Settings

The prevention of iatrogenic transmission needs permanent training programs, active monitoring systems, and auditing procedures. Standard precaution breaches need to be the primary focus for facilities with limited resources because these incidents

happen regularly in their operational environments (Soni *et al.*, 2025).

Enhance Surveillance through Periodic Seroprevalence Surveys

The system requires population-based serosurveys to determine actual infection rates, detect hidden transmission patterns, and evaluate vaccination and screening program effectiveness (Bloch *et al.*, 2025).

Conclusion

The mechanism of infection with markers of viral hepatitis C and the situation of the incidence of hemocontact carriers (viral hepatitis B and C) is of concern to the public health system, although the officially registered number of patients with viral hepatitis reflects the objective situation in the main program. The high level of carriage of viral hepatitis markers among the population groups of the region is encouraging. Over the past 10 years, 425 thousand or more people have been tested for HBV and HCV in the marker. People, Benomila will make up 26.6% of the region's population. In the dynamics of the indicator by 100.0 thousand in carriers. a 2.8 - fold increase in the prevalence of HCV benomil markers in the population, from 77.7 \pm 2.4 g in 2015 to 215.4 \pm 3.7 g in 2024. HCV and 2-fold increase- τ from 40.1 \pm 1.7 to 80.8 \pm 2.2, respectively (< 0.05). Indicative interests and attracts many statistically significantly higher markers of HBV infection in the population (2.6 times) than HCV. A small proportion of carriers was noted among the surveyed population groups: drug users, sex workers, non-pathological chronic patients, adults, persons in pre-trial detention, and patients with STIs. This indicator is relatively low for people traveling abroad, medical workers, and pregnant women. Sv of groups of tested markers of parenteral hepatitis among the population tended to decrease for the period of carriage under study. The indicative carriage of viral hepatitis markers in comparison with the officially registered morbidity (100,0 thousand population) exceeds 2.3 times by 2020 for HBV by 5.5 times by 2024, for HCV from 3.1 to 5.7 times, respectively (< 0.05). In this regard, to assess the incidence of viral hepatitis, it is necessary to study the indicators of actual and effective tracking of the "carrier" of HBV and HCV serological markers.

Acknowledgments: The authors would like to express their sincere gratitude to Osh State University for providing the research infrastructure and institutional support essential for the successful completion of this project.

Conflict of interest: None

Financial support: None

Ethics statement: The study protocol was reviewed and approved by the Ethical Committee of Osh State University. All procedures were conducted in accordance with the ethical standards of the institutional research committee and the principles outlined in the Declaration of Helsinki. Written informed consent was obtained from all participants prior to their inclusion in the study. The corresponding author can be contacted for further

information regarding the study protocol, ethical approval, and data availability.

References

- Abdel-Hadi, B., & Abdel-Fattah, S. R. (2022). Clinical pharmacist intervention in appendectomy—Dexametomidine as an adjunct therapy. *Journal of Advanced Pharmacy Education and Research*, *12*(2), 1–5. doi:10.51847/AYOZXtLMrj
- Ağaçkiran, M., Avşaroğullar, O. L., & Şenol, V. (2023). Examining the frequency of violence versus nurses and the factors affecting it in hospitals. *Journal of Integrative Nursing and Palliative Care*, *4*, 11–16. doi:10.51847/0rzZBHvQ2d
- Ahmed, T., & Rajasekar, A. (2025). Clinical and radiographic peri-implant comparison between treated periodontitis on supportive care and healthy controls. *Annals of Dental Specialties*, *13*(4), 1–5. doi:10.51847/X3IdeBjeqE
- Akbari, M. (2023). Topical interferon alpha-2b is a proper alternative for management of adenoviral keratitis: A case report. *Journal of Advanced Pharmacy Education and Research*, *13*(2), 12–15. doi:10.51847/bHZyx16R2Y
- Akmatov, M. K., Beisheeva, N. J., Nurmatov, A. Z., Gulsunai, S. J., Saikal, K. N., Derkenbaeva, A. A., Abdrahmanova, Z. O., Prokein, J., Klopp, N., Illig, T., et al. (2023). The changing epidemiology of viral hepatitis in a post-Soviet country—The case of Kyrgyzstan. *Pathogens*, *12*(8), 989. doi:10.3390/pathogens12080989
- Alam, A., Yildirim, O., Siddiqui, F., Imam, N., & Bay, S. (2023). Network medicine: Methods and applications. In R. Ishrat (Ed.), *Biological Networks in Human Health and Disease* (pp. 75–90). Singapore: Springer Nature Singapore. doi:10.1007/978-981-99-4242-8_5
- Alnuwaiser, M. K., Alqudairy, M. S., Alshehri, F. A., Aleid, A. S., Alkhalaf, A. Z., Mohammadi, M. M. A., & Alkhalaf, A. K. (2024). Recent advancement in anterior teeth esthetics: A narrative review. *Bulletin of Pioneer Research in Medical and Clinical Sciences*, *4*(2), 13–21. doi:10.51847/QIZ7YIMH1R
- Al-Sunbul, A. A., Aldhalaan, R., AlHaddab, M., AlRushoud, S. S., & Alharbi, M. (2025). Multidisciplinary course of action in treating an intricate dental condition: A case report. *Annals of Dental Specialties*, *13*(1), 1–6. doi:10.51847/tMCyHl210C
- Altaie, A. A., Abdulrazzaq, M. M., Alkhalidi, E. F. (2026). Shear bond strength between lithium disilicate and zirconia core after addition of nanoparticles: A comparative study. *Annals of Dental Specialties*, *14*(1), 1–7. doi:10.51847/sOs7rrcUvo
- Aodh, A. M., & Al-Marshedi, A. A. (2023). Williams-Beuren's syndrome: A case report in Prince Sultan Military City, Riyadh, Saudi Arabia 2022. *World Journal of Environmental Biosciences*, *12*(1), 20–23. doi:10.51847/dQxngBeVLQ
- Bloch, E., Baudemont, G., Donnadieu, F., Garcia, L., Pelleau, S., SeroPed Study Consortium, Milieu Intérieur Consortium, Quintana-Murci, L., Duffy, D., Fontanet, A., et al. (2025). Investigation of the sero-epidemiology of vaccine preventable diseases and common viral infections in French populations. *Communications Medicine*, *5*(1), 465. doi:10.1038/s43856-025-01162-5
- Centers for Disease Control and Prevention. (2025, November 27). Hepatitis B basics | Hepatitis B | CDC. <https://www.cdc.gov/hepatitis-b/about/index.html>
- Çora, H., & Çora, A. N. (2022). An international relations study: Turks in the Western world's history perspective and Atatürk's approach. *Journal of Organizational Behavior Research*, *7*(1), 96–107. doi:10.51847/eegeptya4E
- Degenhardt, L., Webb, P., Colledge-Frisby, S., Ireland, J., Wheeler, A., Ottaviano, S., Willing, A., Kairouz, A., Cunningham, E. B., Hajarizadeh, B., et al. (2023). The epidemiology of injecting drug use, prevalence of injecting related harm, and exposure to behavioural and environmental risks among people who inject drugs: A systematic review. *Lancet Global Health*, *11*(5), e659. doi:10.1016/S2214-109X(23)00057-8
- Dirican, S. (2023). Wetland of local importance in Sivas Province (Turkey): Kaz Lake. *World Journal of Environmental Biosciences*, *12*(1), 16–19. doi:10.51847/SAIXockcIlg
- Doddapanen, N., Lakshmegowda, Y. K., Aardhya, S., Rajashekar, R., Doolgindachbaporn, T., & Nagaraju, P. (2024). Environmental education, awareness and environmental ethics among pre-university students of Mysuru city, Karnataka, India. *World Journal of Environmental Biosciences*, *13*(2), 13–20. doi:10.51847/nBbI6XJU0H
- Drissi, A. E. M., Hazzat, W. E., Zaoui, F., & Benyahia, H. (2025). Treatment of growing skeletal class III malocclusion using maxillary expansion and intermaxillary elastics. *Annals of Dental Specialties*, *13*(1), 34–40. doi:10.51847/BEsgm5jm6K
- Du, X., Dong, Q., Sun, L., Chen, X., & Jiang, J. (2023). Studying the relationship between depression and internal stigma in mothers of children with cerebral palsy. *Journal of Integrative Nursing and Palliative Care*, *4*, 17–22. doi:10.51847/9WQmf9zDW1
- Elshorbagy, R. T., Balbaa, A. E. A., Ayad, K. E., Allam, N. M., Eladl, H. M., & Allah, W. R. A. (2022). Cognitive task versus focus of attention on dynamic postural control in recurrent ankle sprains. *Journal of Advanced Pharmacy Education and Research*, *12*(2), 6–10. doi:10.51847/OYUrFadR58
- Faure-Bardon, V. (2021). Maternal infections: Revisiting the need for screening in pregnancy. *BJOG: An International Journal of Obstetrics & Gynaecology*. <https://obgyn.onlinelibrary.wiley.com/doi/10.1111/1471-0528.16509>
- Gerlich, W. H. (2013). Medical virology of Hepatitis B: How it began and where we are now. *Virology Journal*, *10*, 239. doi:10.1186/1743-422X-10-239
- Gogoi, P., Kamle, M., & Kumar, P. (2023). Endophytic bacteria associated with rice: Role in biotic and abiotic stress protection and plant growth promotions. *World Journal of Environmental Biosciences*, *12*(1), 1–9. doi:10.51847/ELxLUdbokK
- Goyal, S., Singh, S., Dalal, K., & Goyal, S. (2024). The impact of vitamin D in ulcerative colitis patients among a tertiary care centre. *Bulletin of Pioneer Research in Medical and Clinical Sciences*, *4*(2), 1–6. doi:10.51847/2oJxwMjShf

- Jumabayeva, A., Nersesov, A., Kulzhanov, M., Nefedova, M., Nuraliyeva, G., Rakhimbekova, G., Tanabayeva, S., & Fakhradiyev, I. (2022). Prevalence of viral hepatitis B, C, and D in Kazakhstan. *The Scientific World Journal*, 2022, 9102565. doi:10.1155/2022/9102565
- Kaewdech, A., Charatcharoenwithaya, P., & Piratvisuth, T. (2024). Asian perspective on hepatitis B virus and hepatitis C virus elimination. *Viruses*, 17(1), 34. doi:10.3390/v17010034
- Karkimbayeva, G., Rysbayeva, Z., Dosberdiyeva, G., Askarova, S., & Uatayeva, A. (2025). Integration of regenerative techniques in the treatment of periodontal conditions: Meta-analysis. *Annals of Dental Specialties*, 13(4), 6–15. doi:10.51847/3IPTVp0u9M
- Karthikeyan, V., Muthupriya, P., Gopikrishna, M., & Sivakumar, K. (2024). Effects of electromagnetic radiation and radio frequency on freshwater calanoid and cyclopoid copepods. *World Journal of Environmental Biosciences*, 13(2), 1–5. doi:10.51847/YYlqFBgHxk
- Kirilmaz, S. K. (2022). Mediating role of positive psychological capital in the effect of perceived organizational support on work engagement. *Journal of Organizational Behavior Research*, 7(1), 72–85. doi:10.51847/xNeqENPv4Y
- Liu, W., Khalid, M., Wahab, S., Faizan Siddiqui, M., Hasan Khan, S., Sadiq, M., & Khatoon, Z. (2024). A multitier virtual screening study of phytoconstituents as Myeloid Cell Leukemias 1 inhibitors. *Journal of Biomolecular Structure & Dynamics*, 42(10), 5219–5228. doi:10.1080/07391102.2023.2226739
- Luther, B. L., Bybee, S. G., Elmore, C. E., Grigorian, E., Wang, C. Y., Butler, J. M., & Wallace, A. S. (2025). From screening to support: Exploring patient engagement with health-related social needs services. *AJPM Focus*, 4(4), 100346. doi:10.1016/j.focus.2025.100346
- Mackesy-Amiti, M. E., Levy, J. A., Bahromov, M., Jonbekov, J., & Luc, C. M. (2023). HIV and hepatitis C risk among Tajik migrant workers who inject drugs in Moscow. *Research Square*, rs.3.rs-2622346. doi:10.21203/rs.3.rs-2622346/v1
- MDPI. (2025, November 27). Hepatitis C diagnosis: Simplified solutions, predictive barriers, and future promises. <https://www.mdpi.com/2075-4418/11/7/1253>
- MDPI. (2025, November 27). Maternal HIV infection and antiretroviral therapy in pregnancy: Implications for vertical transmission, fetal safety, and long-term infant outcomes. <https://www.mdpi.com/2076-0817/14/8/818>
- MDPI. (2025, November 27). Targeted screening with the use of clinical risk factors for detecting congenital cytomegalovirus infection in newborns: A prospective multicenter cohort study. <https://www.mdpi.com/2076-2607/13/9/2197>
- Nguyen, V. T., Tran, D. T. L., Dang, T. T. N., Nguyen, T. K. P., & Ngo, T. X. B. (2023). The impact of logistics services on customer satisfaction: An empirical study in the COVID 19 pandemic. *Journal of Organizational Behavior Research*, 8(1), 12–24. doi:10.51847/MIoTW6LdxZ
- Nilyanimit, P., Wanlapakorn, N., Vichaiwattana, P., Wongsrisang, L., Klinfueng, S., Suntronwong, N., Bhunyakitikorn, W., Angsuwatcharakon, P., Sonthichai, C., Thawinwisan, N., et al. (2025). Significant reduction in Hepatitis B virus infections following 32 years of universal Hepatitis B vaccination as part of EPI, Thailand. *Scientific Reports*, 15(1), 1167. doi:10.1038/s41598-024-84854-7
- Ogolla, C. O., Guya, B., & Maima, A. O. (2025). Impact of donor history on the risk of transfusion-related infections. *Global Health Epidemiology and Genomics*, 2025, 8585241. doi:10.1155/ghe3/8585241
- Peng, J., Su, D., Zhang, Z., & Wang, M. (2020). Identification and management of asymptomatic carriers of coronavirus disease 2019 (COVID-19) in China. *Influenza and Other Respiratory Viruses*, 14(5), 599–600. doi:10.1111/irv.12768
- Price, O., Webb, P., Grebely, J., Peacock, A., Medland, N., Read, P., Cooke, E., Hickman, M., Vickerman, P., & Degenhardt, L. (2025). Sexually transmitted infection prevalence and testing coverage among people who inject drugs: A systematic review. *Drug and Alcohol Dependence*, 273, 112732. doi:10.1016/j.drugalcdep.2025.112732
- Razavi-Shearer, D. M., Kondili, L. A., Hall, S., Buti, M., Gamkrelidze, I., Naveira, M. C. M., Nde, H., Negro, F., Osmani, A., Picchio, C. A., et al. (2025). Estimating the impact of displacement from Ukraine on HBV and HCV prevalence among migrants in the European Union, 2024: A modeling study. *Lancet Regional Health - Europe*, 58, 101452. doi:10.1016/j.lanep.2025.101452
- Sadeq, Z. A., Sabri, L. A., & Al-Kinani, K. K. (2022). Natural polymer effect on gelation and rheology of ketotifen-loaded pH-sensitive in situ ocular gel (Carbapol). *Journal of Advanced Pharmacy Education and Research*, 12(2), 45–50. doi:10.51847/zOf4TcFeKT
- Savva, G., Papastavrou, E., Charalambous, A., Vryonides, S., & Merkouris, A. (2023). Studying the nurses' and nursing students' attitudes towards the phenomenon of elderly. *Journal of Integrative Nursing and Palliative Care*, 4, 6–10. doi:10.51847/DkBR8F3IGx
- Siddiqui, M. F. (2021). IoMT potential impact in COVID-19: Combating a pandemic with innovation. In K. Raza (Ed.), *Computational Intelligence Methods in COVID-19: Surveillance, Prevention, Prediction and Diagnosis* (Vol. 923, pp. 349–361). Singapore: Springer Singapore. doi:10.1007/978-981-15-8534-0_18
- Siddiqui, M. F., Alam, A., Kalamatov, R., Mouna, A., Villela, R., Mitalipova, A., Mrad, Y. N., Rahat, S. A. A., Magarde, B. K., Muhammad, W., et al. (2023). Leveraging healthcare system with nature-inspired computing techniques: An overview and future perspective. In K. Raza (Ed.), *Nature-Inspired Intelligent Computing Techniques in Bioinformatics* (Vol. 1066, pp. 19–42). Singapore: Springer Nature Singapore. doi:10.1007/978-981-19-6379-7_2
- Siddiqui, M. F., Mouna, A., Villela, R., Kalamatov, R., Boueri, M., Bay, S., Babu, P. S., Etry, H., Mitalipova, A., Baig, M. M. I., et al. (2025). Inequality in genetic healthcare: Bridging gaps with deep learning innovations in low-income and middle-income countries. In K. Raza (Ed.), *Deep Learning in Genetics and Genomics* (pp. 397–410). Academic Press. doi:10.1016/B978-0-443-27574-6.00003-5
- Siddiqui, M. F., Nohra, L., Saleh, M., Thakkar, K., Trivedi, R.,

- Moujally, S. N., Deeb, H., Nicolas, G., & Emmanuel, N. (2023). Pediatric oncology, palliative care and low- or middle- income countries: A call for action. *Global Pediatric Health, 10*, 2333794X231188591. doi:10.1177/2333794X231188591
- Sofiah, M., Lestari, K., Barliana, M., Parwati, I., & Halimah, E. (2022). blaSHV-12 gene detection from *Klebsiella pneumoniae* producing extended-spectrum β -lactamase using amplification-refractory mutation system method. *Journal of Advanced Pharmacy Education and Research, 12*(2), 76–83. doi:10.51847/6DchvAGqsJ
- Soni, S., Yarrarapu, S. N. S., & Tobin, E. H. (2025). Infection control. In *StatPearls*. Treasure Island (FL): StatPearls Publishing. <http://www.ncbi.nlm.nih.gov/books/NBK519017/>
- South Eastern European Journal of Public Health. (2025, February 8). Health policy implementation in developing nations: Challenges and solutions. <https://www.seejph.com/index.php/seejph/article/view/447>
- Tagami, J., Satoh, S., & Kano, H. (2024). Simultaneous estimation of gender male and atrial fibrillation as risk factors for adverse outcomes following transcatheter aortic valve implantation. *Bulletin of Pioneer Research in Medical and Clinical Sciences, 4*(2), 69–77. doi:10.51847/yvaz3NOAQu
- Toma, D., Anghel, L., Patraş, D., & Ciubară, A. (2025). Hepatitis C virus: Epidemiological challenges and global strategies for elimination. *Viruses, 17*(8), 1069. doi:10.3390/v17081069
- Üzüm, B., Özkan, O. S., & Çakan, S. (2022). Moral disengagement, organizational broken window, person-organization fit as an antecedent: Machiavellian leadership. *Journal of Organizational Behavior Research, 7*(1), 29–41. doi:10.51847/54QfKceM1p
- World Medical Association. (2013). World Medical Association Declaration of Helsinki: Ethical principles for medical research involving human subjects. *JAMA, 310*(20), 2191–2194. doi:10.1001/jama.2013.281053
- Zoubi, M. K., Jaradat, H. A., Alqamaz, S., Lababneh, H., Kassawneh, F. Y., & Issa, M. M. (2023). The impact of the COVID-19 pandemic on interior design students' performance in Jordanian universities. *Journal of Organizational Behavior Research, 8*(1), 25–38. doi:10.51847/ZDkJP32geh