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MONITORING OF VIRAL HEPATITIS B, C INCIDENCE IN RIVNE REGION FOR THE PERIOD 2013–2023

Topicality. *The article highlights the state of research on the problem of the incidence of viral hepatitis B, C (HB, HC) and newly detected chronic hepatitis B and C (CHB and CHC) in the Rivne region for 2013-2023, and shows the increase in the risks of HBV, HCV diseases during full-scale russian military aggression.*

Purpose of the work*: to analyze the incidence of HB, HC CHB CHC in the Rivne region for 2013-2023, to identify the main risks and trends of HB and HC diseases during full-scale russian military aggression.*

Materials and methods*. The work used analytical techniques of the epidemiological method, descriptive, statistical and graphical methods. A retrospective epidemiological analysis of the structure of diseases of HB, HC CHB CHC for 2013-2023 in the Rivne region was conducted.*

The results. *In the Rivne region, during the second year of Russian military aggression, there was a sharp increase in the incidence of acute hepatitis B by 5.32 times from 0.95 cases per 100 thousand population (2021) to 5.05 cases per 100 thousand population (2023). In 2023, the incidence of chronic hepatitis B in the region increased to 2.35 cases per 100 thousand population, which was 3.41 times higher than the 2021 indicator (0.69).*

During the period 2021-2023, the incidence of acute hepatitis C in the Rivne region increased by 2.84 times from 0.43 cases per 100 thousand population (2021) to 1.22 cases per 100 thousand population (2023). The incidence of chronic hepatitis C for the period 2021-2023 in the Rivne region increased by 2.53 times from 3.2 cases per 100 thousand population (2021) to 8.11 cases per 100 thousand population (2023).

Conclusions*. The incidence of HBV and HCV in the Rivne region remains an urgent problem that requires constant attention from medical professionals and communities. On the path to eliminating viral hepatitis in the Rivne region and Ukraine, certain successes were noted, which were manifested in a decrease in the incidence of acute and chronic hepatitis B and C in 2019-2021. However, the Russian military aggression against our country led to an increase in the risks of hepatitis B and C infection in 2022-2023 in both the Rivne region and Ukraine.*

Key words: *viral hepatitis B, viral hepatitis C, chronic viral hepatitis B, chronic viral hepatitis C.*

Хоронжевська І.С., Юхимчук Ю.М., Терентьєва Ю. М., Рибчук Л. В. Моніторинг захворюваності вірусними гепатитами В, С у Рівненській області за період 2013–2023 роки

Актуальність. *У статті висвітлено стан дослідження проблеми захворюваності вірусними гепатитами В,С (ГВ, ГС) та вперше виявленими хронічними гепатитами В та С (ХГВ та ХГС) в Рівненській області за 2013–2023 роки, показано збільшення ризиків захворювань ГВ, ГС під час повномасштабної російської військової агресії.*

***Мета роботи**: проаналізувати стан захворюваності ГВ, ГС, ХГВ, ХГС в Рівненській області за 2013–2023 роки, з'ясувати основні ризики та тенденції захворювань ГВ та ГС під час повномасштабної російської військової агресії.*

***Матеріали та методи**. У роботі використовувались аналітичні прийоми епідеміологічного методу, описовий, статистичний та графічні методи. Проведений ретроспективний епідеміологічний аналіз структури захворювань ГВ, ГС, ХГВ, ХГС за 2013–2023 роки в Рівненській області.*

***Результати.** У Рівненській області під час другого року російської військової російської агресії спостерігається різке збільшення захворюваності гострим гепатитом В в 5, 32 рази з 0,95 вип. на 100 тис. населення (2021 р.) до 5,05 вип. на 100 тис. населення (2023 р.). У 2023 р. в області показник захворюваності хронічним гепатитом В виріс до 2,35 вип. на 100 тис. населення, що було вище показника 2021 року (0,69) в 3,41 рази.*

За період 2021–2023 рр. захворюваність гострим гепатитом С в Рівненській області зросла в 2,84 рази з 0,43 вип. на 100 тис. населення (2021 р.) до 1,22 вип. на 100 тис. населення (2023 р.). Захворюваність хронічним гепатитом С за період 2021–2023 рр. у Рівненській області зросла в 2,53 рази з 3,2 вип. на 100 тис. населення (2021 р.) до 8,11 вип. на 100 тис. населення (2023 р.).

***Висновки.** Захворюваність на ГВ, ГС у Рівненській області залишається .актуальною проблемою, яке потребує постійної уваги з боку медичних працівників та громад. На шляху до елімінації вірусних гепатитів в Рівненській області та Україні відмічались певні успіхи, що проявлялись в зниженні показників захворюваності гострими та хронічними гепатитами В і С в 2019–2021 рр. Проте російська військова агресія проти нашої країни призвела до підвищення ризиків зараження гепатитами В і С в 2022–2023 рр. як в Рівненській області, так і в Україні.*

***Ключові слова:** вірусний гепатит В, вірусний гепатит С, хронічний вірусний гепатит В, хронічний вірусний гепатит С.*

Relevance. Hepatitis B and C (HB and HC) are a serious global public health problem. Hepatitis B and C viruses (HBV and HCV) affect the liver and can cause both acute and chronic disease, which may progress to cirrhosis and liver cancer, potentially leading to death [1; 2].

In 2016, the World Health Organization (WHO) set a goal to eliminate viral hepatitis as a public health threat by 2030 through the adoption of the First Global Health Sector Strategy on Viral Hepatitis [3].

According to WHO data, in 2022, 254 million people worldwide were living with chronic hepatitis B (CHB), while approximately 1.2 million new infections were registered annually. During this period, hepatitis B (HB) caused nearly 1.1 million deaths, primarily due to cirrhosis and hepatocellular carcinoma (primary liver cancer). WHO emphasizes that HB can be prevented through vaccines**,** which are effective, safe, and accessible [4].

Fifty million people worldwide have chronic hepatitis C (CHC), with about 1.0 million new infections reported annually. In 2022, approximately 242,000 people died from hepatitis C, mostly from cirrhosis and hepatocellular carcinoma. Currently, there is no effective vaccine against hepatitis C, but direct-acting antiviral agents (DAAs) can cure over 95% of individuals with HC infection [5].

In Ukraine, according to estimates, up to 5% of the population is infected with HC and 1–2.5% with HB**.** These figures were reported in 2019 in the Resolution of the Cabinet of Ministers of Ukraine No. 1415-r dated November 27, 2019**,** "On the Approval of the National Strategy for Combating HIV/AIDS, Tuberculosis, and Viral Hepatitis until 2030" [6; 7].

On February 24, 2022, the full-scale Russian military aggression began, resulting in significant casualties, numerous injuries among both military personnel and civilians, and forcing a large number of Ukrainians to leave their homes. Due to damage or destruction of infrastructure, many healthcare facilities were impaired or disrupted, leading to a significant increase in the risk of HB and HC infection because of difficulties in providing necessary medical care [8; 9].

Thus, the war initiated by the Russian Federation against Ukraine has sharply increased the risk of blood-borne hepatitis B and C infections**.**

Objective. To analyze the morbidity of HB, HC, CHB, and CHC in the Rivne region for the period 2013–2023, and to identify the main risks and trends of HB and HC infections during the full-scale Russian military aggression.

Materials and Methods. The study employed analytical approaches of the epidemiological method, as well as descriptive, statistical, and graphical methods. A retrospective epidemiological analysis of the structure of HB, HC, CHB, and CHC cases in the Rivne region for 2013–2023 was conducted.

The study used data from statistical reports, including: state statistical reporting form No 40-zdor. "Report on the Work of the Rivne Regional Sanitary-Epidemiological Station" (State Institution "Rivne Regional Sanitary-Epidemiological Station," currently State Institution "Rivne Regional Center for Disease Control and Prevention, Ministry of Health of Ukraine");State statistical reporting forms No. 1 "Report on Certain Infectious and Parasitic Diseases" (monthly) and No. 2 "Report on Certain

Infectious and Parasitic Diseases" (annual) (State Institution "Rivne Regional Center for Disease Control and Prevention, Ministry of Health of Ukraine").

During the study, descriptive and analytical methods were applied, along with standard methods of medical statistics [10].

Results and Discussion. Monitoring morbidity from HB and HC plays a crucial role on the path toward the elimination of these infections. The First Global Health Sector Strategy on Viral Hepatitis by WHO (2016) outlined the main strategic goal of eliminating viral hepatitis as a public health threat by 2030, in line with the United Nations Sustainable Development Goals , particularly SDG 3: Good Health and Well-being, which aims to ensure healthy lives and promote well-being for all at all ages [11; 12]. Achieving the strategic target for viral hepatitis by 2030 is defined as a 90% reduction in new chronic infections and a 65% reduction in mortality compared to the 2015 baseline.

WHO notes that in highly endemic areas, HB is most commonly transmitted from mother to child at birth (perinatal transmission) or through horizontal transmission, especially from an infected child to an uninfected child during the first five years of life. The development of chronic infection is highly prevalent in infants infected from mothers or during early childhood. HB can also spread through needle sticks, tattoos, piercings, and contact with infected blood and body fluids such as saliva, menstrual, vaginal, and seminal fluids. Transmission can also occur through the reuse of contaminated needles and syringes or sharp instruments in healthcare settings, as well as among people who inject drugs. Sexual transmission is more common among unvaccinated individuals with multiple sexual partners. HB infection acquired in adulthood leads to chronic hepatitis in less than 5% of cases, whereas infection in infancy and early childhood leads to chronic hepatitis in approximately 95% of cases. This underscores the importance of prioritizing vaccination of infants and children [13].

HCV is a blood-borne virus, most often transmitted through contact with infected blood during unsafe injection practices, transfusion of unscreened blood, injection drug use, and sexual activity involving blood contact. There is currently no vaccine for HC, but direct-acting antiviral agents (DAAs) can cure over 95% of infected individuals [14].

With the onset of the full-scale Russian military invasion of Ukraine, the epidemiological situation regarding HB and HC worsened due to prolonged combat, significant casualties, numerous injuries among military personnel and civilians, increased numbers of internally displaced persons, and substantial destruction and closure of healthcare facilities. Under these conditions, the risk of HB and HC infection increased due to the lack of adequate conditions for medical care, insufficient supplies of disposable syringes and dressings, limited ability to properly sterilize and disinfect medical instruments, and other factors [15; 16; 17].

Observational data showed that in the Rivne region, during the period 2013–2023, cases of acute and newly diagnosed chronic HB and HC infections were registered every year.

Incidence data for newly detected acute and newly detected chronic viral hepatitis B (AHB and CHB) among the population of Rivne region and Ukraine for 2013–2023 are presented in Figure 1.

In the baseline year 2015, the overall incidence of acute hepatitis B (AHB) in the Rivne region was 3.45 cases per 100,000 population. Five years later, in 2020, this indicator decreased by 17.4% to 2.85, and in 2021, a further decline in AHB incidence was observed, reaching 0.95 cases per 100,000 population. However, with the onset of the full-scale Russian military aggression in 2022, AHB incidence increased almost 2.9-fold to 2.72 per 100,000, and in 2023, it further rose 1.9-fold to 5.05 per 100,000. Thus, in 2023, the AHB incidence in the Rivne region was 5.05, which is 31.6% higher than the baseline value in 2015 (3.45).

The incidence of newly diagnosed chronic hepatitis B (CHB) in the Rivne region in 2020 was 1.21 per 100,000 population, which was 3.2 times lower than the baseline indicator in 2015 (3.89 per 100,000). In 2021, CHB incidence further decreased to 0.69 cases per 100,000 population.

However, in 2022, the incidence of newly diagnosed chronic hepatitis B (CHB) increased almost 2.1-fold, reaching 1.45 per 100,000 population, and in 2023, it further rose 1.6-fold to 2.35 per 100,000.

During the second year of the Russian military aggression, the Rivne region experienced a sharp increase in acute hepatitis B (AHB) incidence by 5.32 times, from 0.95 per 100,000 in 2021 to 5.05 per 100,000 in 2023. In 2023, the CHB incidence in the region rose to 2.35 per 100,000, which is 3.41 times higher than in 2021 (0.69).

Similar trends were observed across Ukraine. The overall incidence of acute hepatitis B (AHB) in Ukraine in 2015 was 3.15 cases per 100,000 population, which decreased 1.8-fold to 1.74 in 2020, and further declined to 1.22 per 100,000 in 2021. However, in 2022, following the full-scale Russian invasion, AHB incidence increased by nearly 2.5%, reaching 1.25 per 100,000, and in 2023, it rose by 48% to 1.85 per 100,000.

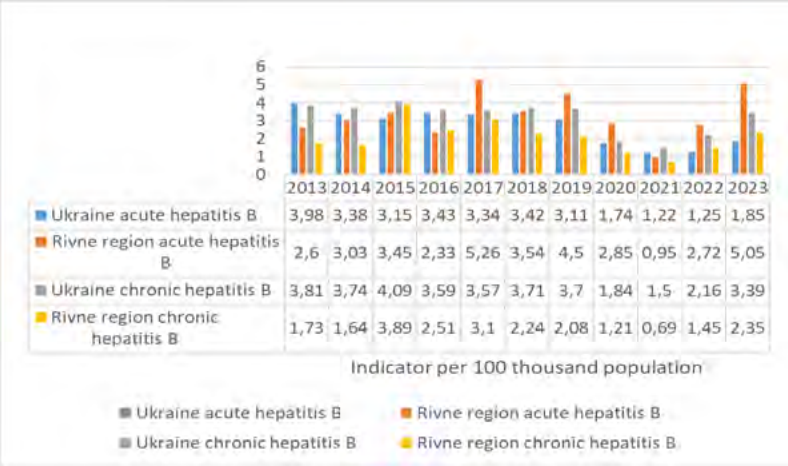

Fig. 1. Incidence of acute hepatitis B (AHB) and newly diagnosed chronic hepatitis B (CHB) among the population of the Rivne region and Ukraine for 2013–2023 (cases per 100,000 population)

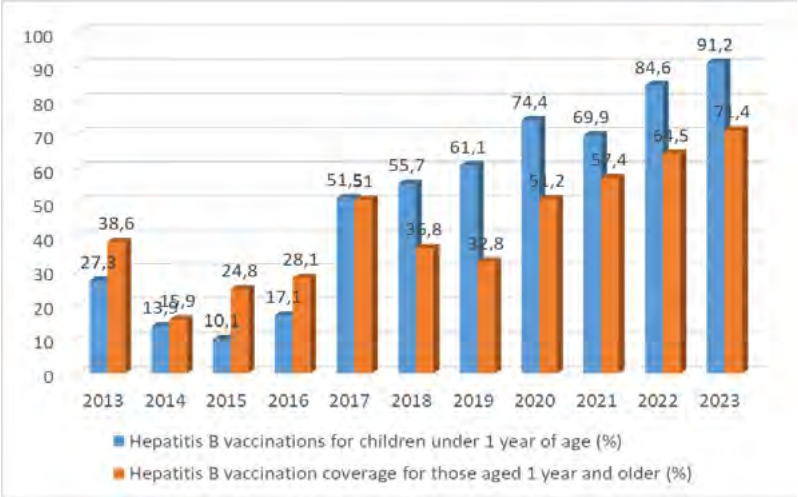

Fig. 2. Coverage of hepatitis B vaccination among children in the Rivne region for 2013–2023

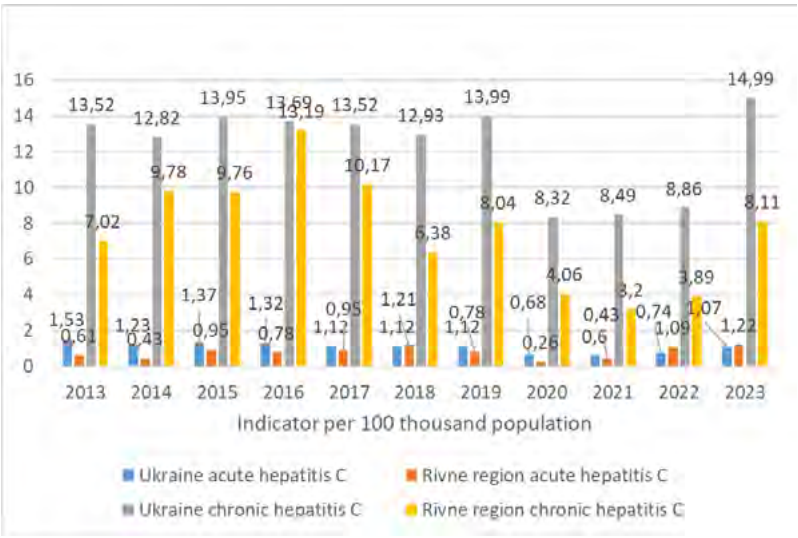

Fig. 3. Incidence of acute hepatitis C (AHC) and newly diagnosed chronic hepatitis C (CHC) among the population of the Rivne region and Ukraine for 2013–2023

The incidence of newly diagnosed chronic hepatitis B (CHB) in Ukraine in 2020 was 1.21 per 100,000, which was 3.2 times lower than the baseline indicator in 2015 (3.89 per 100,000). In 2021, CHB incidence further declined to 0.69 per 100,000. However, after the full-scale Russian invasion, CHB incidence increased almost 2.1-fold in 2022 to 1.45 per 100,000, and in 2023, it further rose 1.6-fold to 2.35 per 100,000.

The coverage of hepatitis B vaccination among children in the Rivne region is presented in Figure 2.

During the observation period, the coverage of hepatitis B vaccination among children improved. Coverage with three doses of hepatitis B vaccine for children under 1 year increased 3.34-fold, from 27.3% in 2013 to 91.2% in 2023. Coverage with three doses among children over 1 year increased 1.85-fold**,** from 38.6% in 2013 to 71.4% in 2023**.**

During the period of the full-scale Russian military invasion, coverage of hepatitis B vaccination among children under 1 year increased by 23.35%, from 69.9% in 2021 to 91.2% in 2023, while among children over 1 year, vaccination coverage rose by 19.61%**,** from 57.4% in 2021 to 71.4% in 2023. This indicates significant efforts by the healthcare system in promoting hepatitis B immunization among children during the martial law period. However, vaccination coverage did not reach 95%**,** as required by Goal 6: Tasks and indicators for achieving the Sustainable Development Goals in Ukraine by 2030 [18].

The morbidity data for acute hepatitis C (AHC) and newly diagnosed chronic hepatitis C (CHC) among the population of the Rivne region and Ukraine for 2013–2023 are presented in Figure 3**.**

The incidence of acute hepatitis C (AHC) in the region decreased by 72.63% during 2015–2020, from 0.95 per 100,000 in 2015 to 0.26 per 100,000 in 2020.

In 2021, AHC incidence increased by 65.4%**,** reaching 0.43 per 100,000, although this level remained 54.74% lower than the baseline indicator in 2015.

During martial law in 2022, there was a further increase in the incidence of acute intestinal infections, rising almost 2.5 times to 1.09 per 100,000 population. In 2023, this rate increased by an additional 11.9%, reaching 1.22 per 100,000 population.

Thus, during martial law, in 2023, the incidence of AHC in the Rivne region was 1.220/0000, which was 28.4% higher than in the base year 2015 (0.950/0000).

In Rivne region, the incidence of newly diagnosed chronic CHB in 2020 was 4.06 0/0000, which

Table 1

Structure of the probable transmission routes of hepatitis B virus (HBV) among patients with acute and newly diagnosed chronic hepatitis B in the Rivne region during 2020–2023

Transmission routes	Years 2020–2021		Years 2022–2023	
	Total	%	Total	%
Injection drug use	1	1,52	2	1,53
Unprotected sex	3	4,54	6	4,58
Mother-to-child transmission	-	-	-	-
Blood transfusion	1	1,52	-	-
Hemodialysis	2	3,03	3	2,29
Nosocomial infection	6	9,09	9	6,87
Other and unidentified transmission routes	53	80,3	111	84,73
Total	66	100	131	100

Table 2

Structure of the probable transmission routes of hepatitis C virus (HCV) among patients with acute and newly diagnosed chronic hepatitis C in the Rivne region during 2020–2023

Transmission routes	Years 2020–2021		Years 2022–2023	
	Total	%	Total	%
Injection drug use	5	5,43	8	4,94
Unprotected sex	11	11,96	9	5,56
Mother-to-child transmission	-	-	-	-
Blood transfusion	-	-	-	-
Hemodialysis	1	1,09	3	1,85
Nosocomial infection	7	7,61	6	3,7
Other and unidentified transmission routes.	68	73,91	136	83,95
Total	92	100	162	100

was 58.4% lower than the initial indicator index (II) in 2015 (9.76 0/0000).

In 2021, a further decline in the incidence of chronic hepatitis C was observed, reaching 3.2 cases per 100,000 population.At the same time, during the war, in 2022, the Rivne region recorded a 21.6% increase in the incidence of chronic hepatitis C, reaching 3.89 cases per 100,000 population. In 2023, this rate increased further – by 2.08 times – reaching 8.11 cases per 100,000 population.

During the period 2021–2023, the incidence of acute hepatitis C in the Rivne region increased 2.84 times – from 0.43 cases per 100,000 population in 2021 to 1.22 cases per 100,000 population in 2023.

The incidence of chronic hepatitis C in the Rivne region during the same period increased 2.53 times – from 3.2 cases per 100,000 population in 2021 to 8.11 cases per 100,000 population in 2023.

The incidence of acute hepatitis C (ACH) in Ukraine for the period 2015-2020 decreased by 2.01 times and amounted to 1.37 0/0000 (2015) and 0.68 0/0000 (2020), respectively.

In 2021, a further decrease in the incidence of acute hepatitis C was observed – by 11.8%, reaching 0.6 cases per 100,000 population. Under martial law conditions in Ukraine, in 2022, the incidence of acute hepatitis C increased by 23.3%, reaching 0.74 cases per 100,000 population. In 2023, this rate rose again by 23.3%, reaching 1.07 cases per 100,000 population.

The incidence of newly detected CHC in Ukraine in 2020 was recorded at 8.32 0/0000, which was 40.35% lower than the initial indicator index (II) of 2015(13.95 0/0000).

In 2021, an increase in the incidence of chronic hepatitis C was observed, reaching 8.49 cases per 100,000 population.After the full-scale invasion of Ukraine by the Russian Federation, in 2022, the incidence of chronic hepatitis C in Ukraine continued to rise by 4.4%, reaching 8.86 cases per 100,000 population. In 2023, this rate increased further by 69.2%, reaching 14.99 cases per 100,000 population.

Thus, in 2023, the incidence of newly detected CHC in Ukraine was 14.99 0/0000, which was 7.5% higher than in the base year 2015 (13.95 0/0000).

The analysis of the structure of probable transmission routes of hepatitis B virus (HBV) among patients with acute and newly diagnosed chronic hepatitis B in the Rivne region during 2020–2023 showed that infection occurred through injection drug use in 1.52%–1.53% of cases and through unprotected sexual contact in 4.54%–4.58% of cases.

Transmission of HBV through blood transfusion was recorded in 1 patient (1.52%) during 2020–2021. Infection through hemodialysis was reported in 2 patients (3.03%) during 2020–2021 and in 3 patients (2.29%) during 2022–2023.

In addition, nosocomial (healthcare-associated) HBV infection was noted in 6 patients (9.09%) during 2020–2021 and in 9 patients (6.87%) during 2022–2023. A significant proportion of patients (80.3%–84.73%) had other or unidentified routes of transmission (Table 1).

The analysis of the structure of probable transmission routes of hepatitis C virus (HCV) among patients with acute and newly diagnosed chronic hepatitis C in the Rivne region during 2020–2023 showed that infection occurred through injection drug use in 5.43%–4.94% of cases, and through unprotected sexual contact in 11.96% of cases (2020–2021) and 5.56% of cases (2022–2023) (Table 2).

Infection with HC through hemodialysis was recorded in 1 patient (1.09%) during 2020–2021 and in 3 patients (1.85%) during 2022–2023. In addition, nosocomial HC infection was identified in 7 patients (7.61%) during 2020–2021 and in 6 patients (3.7%) during 2022–2023. Notably, a significant proportion of patients (73.91%–83.95%) had other or unidentified routes of transmission.

The analysis of the age structure of patients with HB and HC in the Rivne region during 2020–2023 showed that the highest incidence of acute and newly diagnosed chronic HB and HC was observed in individuals aged 25–49 years: 18 patients (54.54%) with acute HB in 2020 and 24 patients (41.38%) in 2023; 4 patients (28.58%) with chronic HB in 2020 and 11 patients (40.74%) in 2023.

Among patients with acute HC, adults aged 25–49 accounted for 41.3%–50% of cases, and for chronic HC, 55.91%–76.59% of cases. Among children under 14 years, 1 case of acute and chronic HB was recorded in 2020, while no cases of acute or chronic HC were reported. In the 15–24 age group, acute HB was registered in 4 patients (12.13%) in 2020 and 6 patients (10.34%) in 2023.

Conclusions. The incidence of acute and chronic hepatitis B and C in the Rivne region remains a significant public health issue, requiring ongoing attention from healthcare professionals and communities. On the path toward the elimination of viral hepatitis in the Rivne region and Ukraine, compared to the baseline indicator levels of 2015, certain successes were observed, reflected in the reduction of incidence rates of acute and chronic hepatitis B and C in 2020–2021.

However, the full-scale Russian military invasion of Ukraine on February 24, 2022, led to increased risks of hepatitis B and C infection in the Rivne region and

across Ukraine, resulting in a rise in the incidence of acute and chronic hepatitis B and C in 2022–2023.

In the Rivne region, during the second year of Russian military aggression, a sharp increase in acute hepatitis B incidence was observed – 5.32 times higher, rising from 0.95 cases per 100,000 population in 2021 to 5.05 cases per 100,000 population in 2023. In 2023, the incidence of chronic hepatitis B in the region increased to 2.35 cases per 100,000 population, 3.41 times higher than the 2021 level (0.69).

During the period 2021–2023, the incidence of acute hepatitis C in the Rivne region increased 2.84 times, from 0.43 cases per 100,000 population in 2021 to 1.22 cases per 100,000 population in 2023. The incidence of chronic hepatitis C during the same period increased 2.53 times, from 3.2 cases per 100,000 population in 2021 to 8.11 cases per 100,000 population in 2023.

Achieving the goal of viral hepatitis elimination and reducing the incidence of hepatitis B and C requires implementing measures to prevent HB and HC infection, expanding access to diagnosis and treatment, preventing mother-to-child transmission, and increasing coverage of children with hepatitis B immunoprophylaxis services to 95%. It is also necessary to ensure the safety of injections (including in home settings and among risk groups), surgical and dental procedures, as well as cosmetic and hairdressing services. Strengthening epidemiological investigations in HB and HC outbreaks to identify probable routes of infection is also essential.

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