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Research Article

Incidence of infectious diseases in Bulgaria and Pleven region for a 20-year period (2004–2023)

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Summary

Introduction: The incidence of infectious diseases directly reflects the realities in all spheres of public life. **Objective:** to describe and analyse the dynamics of infectious morbidity in the country and the Pleven region against the background of fundamental changes in the general socio-economic plan and specific changes in the health sector over 20 years (2004–2023). **Material and methods:** A retrospective study on the incidence of infectious diseases in Bulgaria and the Pleven region for a 20-year period (2004–2023) was conducted. We used the following sources of information: official population statistics from the National Statistical Institute; official statistics from the National Center for Public Health and Analysis (NCPHA); analysis of the incidence of infectious diseases in the National Center for Infectious and Parasitic Diseases (NCCPD), annual reports of Regional Health Inspectorate – Pleven. **Results:** Significant changes were found in the incidence of specific infectious diseases related to changes in the immunisation strategy, the entry into force of the health reform at the beginning of the 21st century, and the admission of Bulgaria to the European Union. The impact of the COVID-19 pandemic on the actual reporting of infectious (and not only) morbidity is also evident. **Conclusion:** There is a permanent trend of decrease in the incidence of infectious diseases in the country and the Pleven region, most pronounced in diseases with mass vaccine prophylaxis. Follow-up in the dynamics of infectious diseases is a sensitive indicator of public health at the national and regional levels.

Key words: Bulgaria, immunisation calendar, infectious diseases incidence, Pleven region

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Introduction

Good health and well-being are fundamental human rights and key indicators for the sustainable development of the society. Efforts to improve the health of the nation are aimed at achieving integrated health promotion and health prevention, an effective health system oriented to meet health needs, high trust of the population towards it, as well as at engaging all citizens and interested institutions (Ministry of Health 2023). The health of the population or groups is assessed comprehensively with the following three groups of indicators: 1) Demographic indicators, 2) Indicators of physical development of the population, and 3) Morbidity indicators. Another indicator is the population self-assessment (Yordanova et al. 2023). Infectious disease directly reflects the realities in all spheres of state public life.

The **present study aimed** to describe and analyse the dynamics of infectious disease incidence in the country and the Pleven region against the background of fundamental changes in the general socio-economic plan and specific changes in the health sector over 20 years (2004–2023).

Materials and methods

We retrospectively studied the incidence of infectious diseases in Bulgaria and the Pleven region over 20 years (2004–2023). The leading epidemiological indicators (number of patients and incidence) characterising the spread of acute infectious diseases (excluding tuberculosis, AIDS and sexually transmitted infections) during the study period were presented. Due to the huge array of data, we presented the indicators in interval scales in 5-year periods.

For passive extraction of data, we used the following sources of information: the official population statistics from annual reports of the National Statistical Institute (NSI); the official statistics from the National Center for Public Health and Analysis (NCPHA); annual analyses of infectious morbidity in Bulgaria by the National Center for Infectious and Parasitic Diseases (NCIPD); annual reports of the Regional Health Inspectorate – Pleven. Regarding COVID-19, the data were obtained from the Unified Information Portal – COVID-19 |coronavirus.bg; Graphical analysis of data from the National Information System for COVID-19, Bulgaria (site of the National Center for Infectious and Parasitic Diseases); the annual reports of the National Statistical Institute and the annual epidemiological analyses of the Regional Health Inspectorate – Pleven.

Results and discussion

The structures of infectious diseases in Bulgaria (Fig. 1A) and the Pleven region (Fig. 1B) (2004–2023) are presented below.

Respiratory infections dominate the structure of infectious diseases in Bulgaria and the Pleven region – total relative share for a 20-year period – 56.96% and 62.98%, respectively. A drastic reduction in the incidence of respiratory infections with mass immunoprophylaxis (diphtheria, whooping cough, mumps, measles, and rubella) is visible (Table 1).

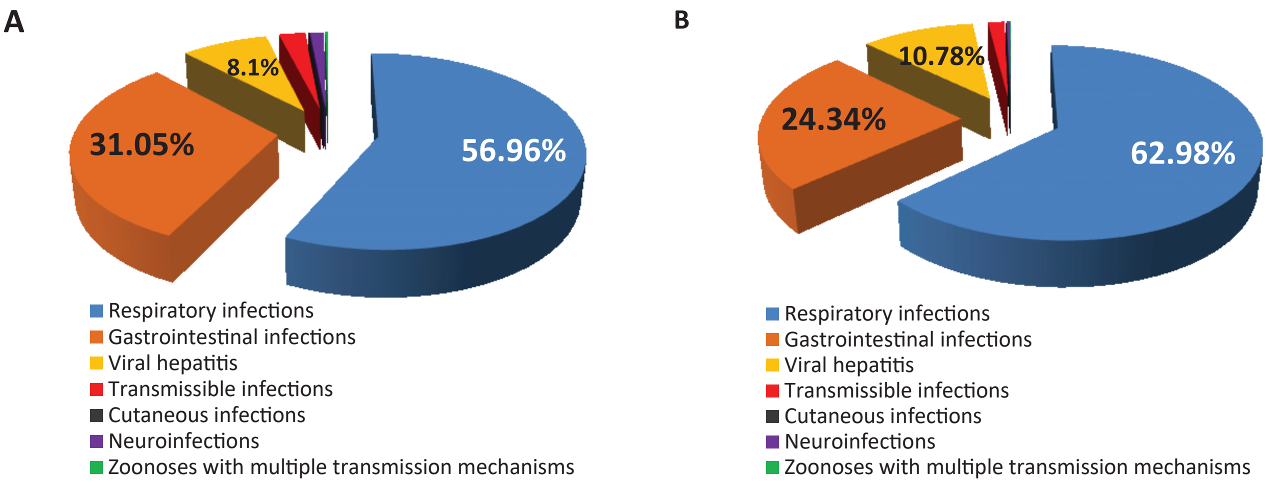

Figure 1. Structures of infectious diseases in Bulgaria (**A**) and the Pleven region (**B**) (2004–2023).

The progress in **diphtheria** was the most significant. There were no recorded cases of diphtheria during the study period. The high immunisation coverage was essential for its prevention. In Bulgaria, the immunisation coverage with the diphtheria vaccine was steady: over 90% per year over the last 30 years (Gancheva and Karcheva 2024; Vladimirova et al. 2024).

The downward trend in **rubella** is clear: for the period 2004–2008, 2,835 patients were registered in Bulgaria; for the period 2009–2013 – 152 patients; for 2014–2018 – 15 patients, and in the last 5-year period (2019–2023) there were no registered cases of rubella. In the Pleven region, 56 patients were registered from 2004 to 2008; the last four rubella cases were in 2009–2013 (Table 1). The National Verification Committee for the Elimination of Measles and Rubella and the Regional Verification Commission of the World Health Organization declared an end to the endemic spread of rubella in Bulgaria in 2017. During the entire study period, no cases of congenital rubella were registered in Bulgaria.

The incidence of **measles** decreased significantly. After the sharp drop to six patients for the country during the period 2004–2008 (incidence $0.014\%_{000}$) and the absence of cases in the Pleven region, during an epidemic that broke out in 2010 in Bulgaria, 22,004 patients were registered, with an incidence of $290.92\%_{000}$ (22,425 cases for the period 2009–2013), and in the Pleven region – 473 cases (incidence $162.43\%_{000}$). In 2022, only one case of measles was registered in Bulgaria (incidence $0.01\%_{000}$). Measles elimination necessitates the maintenance of immunisation coverage ≥ 95% with the measles-mumps-rubella (MMR) vaccine (Graham et al. 2019; Tsekov et al. 2023). The spread of measles and the lower immunisation coverage in 2020 may lead to the loss of Bulgaria's status as a country with an interrupted measles endemic spread in the last three years. In 2020–2023, the immunisation coverage with measles-mumps-rubella vaccine first and second intake was unsatisfactory. In 2023, the immunisation coverage for the first intake was 91.6%, but it did not reach the requirements for vaccine coverage of ≥ 95%, which would prevent the spread of measles and rubella viruses in the community. With a second vaccination, the immunisation coverage was 87.4% and remained the same compared to 2021 (87.2%) (Vladimirova et al. 2024).

The largest number of patients with **pertussis** in Bulgaria (0.37% of respiratory infections for 2004–2023) was registered in 2004–2008 – 1,332 (Table 1). The incidence during this period was $3.45\%_{000}$, decreasing to $0.398\%_{000}$ (2019–2023). In 2023, twenty cases of pertussis were registered in Bulgaria (incidence $0.31\%_{000}$). The incidence of pertussis in Bulgaria increased compared to the previous year (2022 – $0.25\%_{000}$; 2021 – $0.04\%_{000}$; 2020 – $0.39\%_{000}$; 2019 – $1\%_{000}$; 2018 – $1.62\%_{000}$; 2017 – $1.63\%_{000}$). The vaccination coverage for pertussis during this period ranged from 92.8% to 92.4% of children to one year of age (Vladimirova et al. 2024). In the Pleven region, there were 37 pertussis cases (2004–2023), and the incidence decreased from $1.182\%_{000}$ to $0.21\%_{000}$ at the end of the study period. Unfortunately, the situation regarding pertussis worsened. During the pertussis epidemic in 2024, there were 2731 registered cases in Bulgaria. The alarming trend culminated in infant deaths in 2024, which necessitated emergent measures regarding the immunisation of at-risk contingents. Implementing several measures, such as a recommendation for pregnant women to get immunisation during 27–36 weeks of gestation and changing the time of the first vaccine dose in infancy (at 6 weeks old instead of 2 months), discontinued this unfavourable process.

Mumps (2.23% of respiratory infections for 2004–2023) is another important vaccine-preventable disease, given its possible complications (central nervous system, CNS involvement, sterility, damage to pancreatic functions, etc.). The most significant number of patients with mumps was registered in 2004–2008: 12,421 (Table 1), with a peak in 2008 of 5,582 patients. The range of incidence for the country was from 0.19 to 73.06$\%_{000}$ (in 2008), and for the Pleven region – from 0 to 44.64$\%_{000}$ (also in 2008). In 2023, eleven patients with mumps were registered in Bulgaria (incidence 0.17$\%_{000}$), and no cases of mumps were registered in the Pleven region.

Table 1. Respiratory infectious diseases with mass immunoprophylaxis in Bulgaria and the Pleven region – number of registered patients and incidence ($\%_{000}$).

Disease	Indicator / Years	Region	2004–2008	2009–2013	2014–2018	2019–2023
Pertussis	Cases	Bulgaria	1332	542	415	137
		Pleven region	*18*	*6*	*11*	*2*
	Incidence	Bulgaria	3.45	1.45	1.17	0.398
		Pleven region	*1.182*	*0.43*	*0.864*	*0.21*
Mumps	Cases	Bulgaria	12491	1650	110	177
		Pleven region	*327*	*75*	*2*	*0*
	Incidence	Bulgaria	32.57	4.36	0.31	0.30
		Pleven region	*21.45*	5.182	*0.152*	*0*
Measles	Cases	Bulgaria	6	22425	179	1489
		Pleven region	*0*	*473*	*0*	*0*
	Incidence	Bulgaria	0.014	64.56	0.502	4.26
		Pleven region	*0*	*32.554*	*0*	*0*
Rubella	Cases	Bulgaria	2835	152	15	0
		Pleven region	*56*	*4*	*0*	*0*
	Incidence	Bulgaria	7.31	0.41	0.042	0
		Pleven region	*3.604*	*0.278*	*0*	*0*

The incidence of respiratory infections without mass immunoprophylaxis (Table 2) contrasted with the incidence of vaccine-preventable infections. **Chickenpox** had the highest relative share in the structure of respiratory infections (without acute respiratory infections and influenza, COVID-19) with an 81.03% relative share for the entire 20-year period, and for 2023 – 72.79% of all respiratory infections. In 2023, 31,216 cases were registered, with an incidence rate of 484.14$\%_{000}$ (2022 – 26,591 cases, incidence rate 388.82$\%_{000}$; 2021 – 6,615 cases, incidence rate 94.19$\%_{000}$; 2020 – 12,266 cases, incidence rate 176.45$\%_{000}$; 2019 – 30,628 cases, morbidity 437.54$\%_{000}$). In the Pleven region, for the period 2004–2023, 17,348 cases of chickenpox were registered, and the incidence ranged from 109$\%_{000}$ to 846$\%_{000}$, while for Bulgaria, the incidence was from 94$\%_{000}$ to 529$\%_{000}$.

Scarlet fever was the second respiratory infectious disease without vaccine prophylaxis (11.87% of all respiratory infections within 20 years), with high morbidity, which increased after the end of the COVID-19 pandemic. For Bulgaria, the incidence was from 2.66$\%_{000}$ to 69.7$\%_{000}$, and for the Pleven region – from 1.71$\%_{000}$ to 82.62$\%_{000}$. In 2023, there was a significant increase in registered cases in the country – 11,634, with an incidence of 180.44$\%_{000}$. The upward trend in the incidence of chickenpox and scarlet fever after the end of the COVID-19 pandemic is attributable to the preventive measures imposed during

Table 2. Respiratory infectious diseases without mass immunoprophylaxis in Bulgaria and the Pleven region – number of registered patients and incidence ($\%_{000}$).

Disease	Indicator / Years	Region	2004–2008	2009–2013	2014–2018	2019–2023
Chickenpox	Cases	Bulgaria	146893	142251	128969	107216
		Pleven region	*4784*	*6016*	*4192*	*2356*
	Incidence	Bulgaria	380.33	384.0	360.8	316.23
		Pleven region	*312.14*	*434.69*	*331.94*	*251.76*
Scarlet fever	Cases	Bulgaria	21273	17476	21216	16993
		Pleven region	*669*	*358*	*571*	*223*
	Incidence	Bulgaria	55.07	46.95	39.31	51.5
		Pleven region	*43.63*	*25.69*	*45.3*	*23.44*

the pandemic, limited contacts, but the possibility of distortion of the actual picture due to non-registered cases of respiratory infections other than COVID-19.

Another respiratory infectious disease without immunoprophylaxis is legionellosis. Only sporadic cases were registered in Bulgaria during the studied periods – six, eight, sixteen, and twenty, respectively- and no one of these cases was registered in the Pleven region. The incidence of legionellosis was $0.014\%_{000}$, $0.02\%_{000}$, $0.046\%_{000}$ and $0.058\%_{000}$, respectively.

The peak of respiratory incidence was the emergence of the COVID-19 pandemic. This global health catastrophe had a significant impact on the capacity of health systems to deliver health services. While health systems were challenged by the increasing demand for care for patients with COVID-19, it was critical to maintain preventive and curative services, especially for vulnerable populations. Globally, by March 29, 2023, there were 761,402,282 confirmed cases of COVID-19, of which 6,887,000 were fatal, according to WHO data. During the same period, 274,567,136 cases were registered in Europe, 1,299,702 confirmed cases in Bulgaria, and 36,308 in the Pleven region. Four waves with the highest incidence of COVID-19 were registered (November 2020, March 2021, October 2021 and January 2022) (Figs 2, 3). There were 45,135 deaths in Bulgaria during the 3-year pandemic period (78.11% over the age of 65), and in the Pleven re-

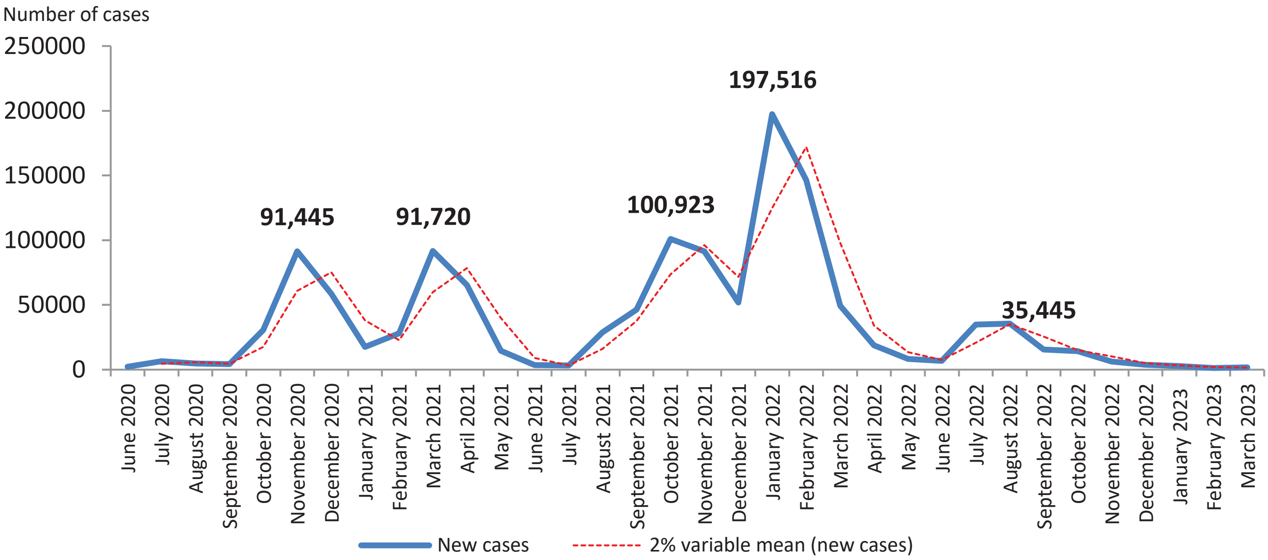

Figure 2. Registered and confirmed cases of COVID-19 in Bulgaria (June 2020 – March 2022).

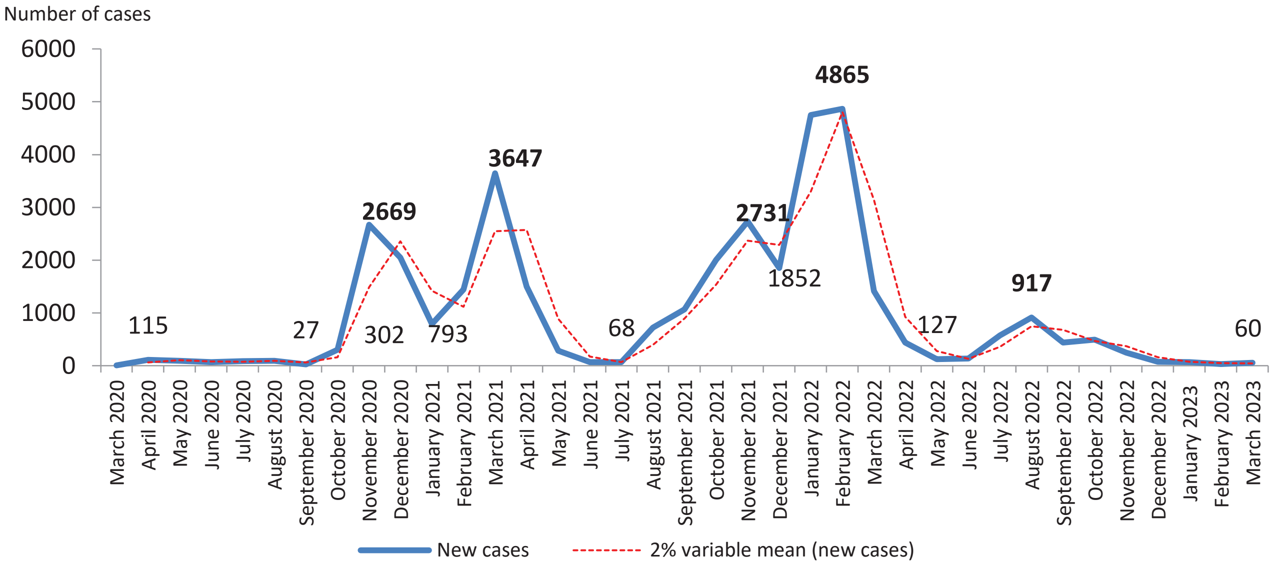

Figure 3. Registered and confirmed cases of COVID-19 in the Pleven region (June 2020 – March 2022).

Table 3. Mortality from COVID-19 in Bulgaria (2020–2022).

Years	Region	Number of deaths			Mortality $\%_{000}$			Relative shares of deaths with COVID-19		
		Total	Males	Females	Total	Males	Females	Total	Males	Females
2020	Bulgaria	8554	5284	3270	123.4	157.3	91.5	6.9	8.0	5.6
	Pleven region	*243*	*151*	*92*	*103.5*	*132.6*	*76.1*	*4.8*	*5.6*	*3.8*
2021	Bulgaria	27588	14731	12857	401.1	442.3	362.5	18.5	19.1	17.9
	Pleven region	*948*	*510*	*438*	*410.6*	*456.5*	*367.6*	*15.4*	*16.0*	*14.8*
2022	Bulgaria	8993	4967	4026	139.1	159.8	120.0	7.6	8.1	7.0
	Pleven region	*298*	*164*	*134*	*134.3*	*153.4*	*116.5*	*6.1*	*6.4*	*5.8*

gion – 1,489 cases (80.66% over the age of 65). The highest mortality from COVID-19 (18.5% of all fatalities) was recorded in 2021 – 401.1$\%_{000}$ (77.53% of the deceased were over 65 years of age) (Table 3) (Gancheva et al. 2024).

Gastrointestinal infections (Table 4) occupy the second position in the structure of infectious diseases in Bulgaria and the Pleven region – total relative share for a 20-year period – 31.05% and 24.34%, respectively. Shigellosis had the highest incidence rate (for Bulgaria – 15.87$\%_{000}$ in 2004, falling to 0.77$\%_{000}$ in 2022 and 1.24$\%_{000}$ in 2024). The Pleven region's incidence was from 0 to 12.05$\%_{000}$ (2004). It was followed by salmonellosis with the highest incidence in 2008 (21.02$\%_{000}$ for the country), after which there was a downward trend to 8$\%_{000}$ in 2023. The incidence for the Pleven region ranged from 12.37$\%_{000}$ (2012) to 3.47$\%_{000}$ (2021). Rotavirus gastroenteritis, which was officially registered in 2012, mainly affected early childhood (Pitzer et al. 2009) and had a range of morbidity from 4.31$\%_{000}$ to 40.52$\%_{000}$ for the country, and for the Pleven region – from 1.29$\%_{000}$ to 52.39$\%_{000}$. The picture was similar in escherichiosis, although with a lower incidence. However, the risk of invasive infections caused by *E. coli* should be considered. In 2004, registration of campylobacteriosis (incidence from 0.42 to 13.44$\%_{000}$) and yersiniosis (incidence from 0.07 to 0.192$\%_{000}$) was introduced, to which improved laboratory diagnostics had contributed. Botulism presented as sporadic cases (for 2004–2023, 44 registered cases in Bulgaria). In 2023, nine cases were registered (incidence 0.14$\%_{000}$)

Table 4. Gastrointestinal infections in Bulgaria and the Pleven region – number of registered patients and incidence ($\%_{000}$).

Disease	Indicator / Years	Region	2004–2008	2009–2013	2014–2018	2019–2023
Shigellosis	Cases	Bulgaria	5921	3412	1757	430
		Pleven region	*115*	*41*	*12*	*3*
	Incidence	Bulgaria	15.53	9.182	4.902	1.252
		Pleven region	*7.52*	*2.86*	*0.92*	*0.42*
Salmonellosis	Cases	Bulgaria	5669	5116	3939	1984
		Pleven region	*154*	*122*	*101*	*49*
	Incidence	Bulgaria	14.71	13.73	11.0	5.83
		Pleven region	*10.06*	*8.7*	*7.93*	*5.22*
Escherichiosis	Cases	Bulgaria	4239	2708	1657	1453
		Pleven region	*96*	*23*	*9*	*1*
	Incidence	Bulgaria	11.01	7.26	4.63	4.27
		Pleven region	*6.21*	*1.62*	*0.71*	*0.105*
Rotavirus gastroenteritis	Cases	Bulgaria	–	4370	11173	3548
		Pleven region	–	*51*	*392*	*140*
	Incidence	Bulgaria	–	29.92	31.248	10.362
		Pleven region	–	*9.68*	*31.06*	*14.84*
Campylobacteriosis	Cases	Bulgaria	164	326	961	789
		Pleven region	–	–	–	–
	Incidence	Bulgaria	0.42	0.89	13.44	2.32
		Pleven region	–	–	–	–
Yersiniosis	Cases	Bulgaria	27	51	68	44
		Pleven region	*2*	*5*	*1*	*2*
	Incidence	Bulgaria	0.07	0.138	0.192	0.13
		Pleven region	*0.33*	*0.36*	*0*	*0.22*
Botulism	Cases	Bulgaria	15	10	9	10
		Pleven region	–	–	–	–
	Incidence	Bulgaria	0.038	0.026	0.024	0.03
		Pleven region	–	–	–	–
Enterocolitis	Cases	Bulgaria	84630	89321	79884	33449
		Pleven region	*1895*	*1246*	*1017*	*476*
	Incidence	Bulgaria	219.38	240.51	223.26	97.86
		Pleven region	*123.93*	*88.39*	*79.66*	*50.48*

– six were suspicious, three were confirmed, and the incidence was higher than the usual incidence in the previous ten years (Vladimirova et al. 2024). The relative share of etiologically unproven enterocolitis cases was high – 82.73% of all intestinal infections for the 20-year period.

The relative shares of cases with **acute viral hepatitis** (Table 5) for Bulgaria and the Pleven region were 8.07% and 10.78% of infectious diseases, respectively (2004–2023). The registration of viral hepatitis A and viral hepatitis B started in 1993, of hepatitis C – in 1997 and thus gave more explicit information on the internal structure of the group. Hepatitis type A had the highest prevalence (82.23% of type-proven hepatitis in Bulgaria), with an incidence range for the country ranging from 11.64$\%_{000}$ (2019–2023) to 52.19$\%_{000}$ (2004–2008) and for the Pleven region – from 4.73 to (2014–2018) to 52.43$\%_{000}$ (2004–2008). There was an undulating trend over 5-year periods with a gradually decreasing incidence. Viral hepatitis type B (13.79% of proven viral hepatitis) had a reduced incidence after the introduction of mandatory vaccination in newborns in 1992. The incidence for Bulgaria ranged from 2.36 (2019–2023) to 10.34$\%_{000}$ (2004–2008), and for the Pleven region – from 2.56 to 9.34$\%_{000}$ for the same periods. Sources of infection were the carriers of the B virus and non-immunised individuals. The importance of viral hepatitis C was increased (2.91% of type-proven viral hepatitis), with the incidence for Bulgaria of 0.85 (2019–2023) to 1.45$\%_{000}$ (2004–2008), and for the Pleven region – from 0.625 (2019–2023) to 8.08$\%_{000}$ (2014–2018) (due to a nosocomial outbreak in 2014). Hepatitis D was 0.14% of proven hepatitis with an incidence of 0.018 to 0.076$\%_{000}$. Since 2019, registration of cases of viral hepatitis type E has been required by law, and the average incidence for the 5-year period was 1.55$\%_{000}$ (from 0.67 in 2021 to 3.1$\%_{000}$ in 2019). Type-unspecified cases of viral hepatitis accounted for 7.31% of all cases registered from 2004 to 2023.

Table 5. Acute viral hepatitis in Bulgaria and the Pleven region – number of registered patients and incidence ($\%_{000}$).

Disease	Indicator / Years	Region	2004–2008	2009–2013	2014–2018	2019–2023
Acute viral hepatitis A	Cases	Bulgaria	20189	15746	7147	4032
		Pleven region	*806*	*398*	*59*	*219*
	Incidence	Bulgaria	52.19	42.63	20.045	11.64
		Pleven region	*52.43*	*28.41*	*4.73*	*32.24*
Acute viral hepatitis B	Cases	Bulgaria	4059	1859	1181	800
		Pleven region	*144*	*77*	*40*	*24*
	Incidence	Bulgaria	10.34	4.99	3.30	2.36
		Pleven region	*9.34*	*5.47*	*3.13*	*2.56*
Viral hepatitis C	Cases	Bulgaria	560	398	423	288
		Pleven region	*28*	*34*	*7*	*3*
	Incidence	Bulgaria	1.45	1.07	1.18	0.85
		Pleven region	*1.81*	*2.098*	*8.08*	*0.625*
Viral hepatitis D	Cases	Bulgaria	30	22	23	7
		Pleven region	*4*	–	–	–
	Incidence	Bulgaria	0.076	0.06	0.064	0.018
		Pleven region	*1.33*	–	–	–
Viral hepatitis E	Cases	Bulgaria	–	–	–	530
		Pleven region	–	–	–	*12*
	Incidence	Bulgaria	–	–	–	1.55
		Pleven region	–	–	–	*1.275*
Acute viral hepatitis, unspecified	Cases	Bulgaria	1342	1191	1365	623
		Pleven region	*20*	*42*	*39*	*5*
	Incidence	Bulgaria	3.474	3.212	3.82	1.822
		Pleven region	*1.106*	*2.99*	*3.06*	*0.525*

Transmissible infections (Table 6) amounted to 2.44% of all infectious cases. In this group, the relative share of Lyme borreliosis was the highest (56.08% of transmissible infections), followed by Boutoneuse fever (43.02%) and Crimean-Congo haemorrhagic fever (CCHF) (0.62%). Eight cases of neuroborreliosis and tick-borne encephalitis were registered. Since 2012, cases of West Nile fever have been registered: a total of 34 to date (incidence from 0.026 to 0.058$\%_{000}$). With global climate changes, the importance of transmissible infections (especially those with mosquito-vector species) will increase due to changes in the geographic distribution of these vectors (Kilpatrick 2011; Rose et al. 2020).

Table 6. Transmissible infections in Bulgaria and the Pleven region – number of registered patients and incidence ($\%_{000}$).

Disease	Indicator / Years	Region	2004–2008	2009–2013	2014–2018	2019–2023
Crimean-Congo hemorrhagic fever	Cases	Bulgaria	54	24	24	8
		Pleven region	–	–	–	–
	Incidence	Bulgaria	0.14	0.074	0.504	0.024
		Pleven region	–	–	–	–
Lyme borreliosis	Cases	Bulgaria	4079	2861	2164	863
		Pleven region	*138*	*131*	*127*	*18*
	Incidence	Bulgaria	10.56	7.652	6.06	2.524
		Pleven region	*8.996*	*9.398*	*9.996*	*1.89*
Boutoneous fever	Cases	Bulgaria	3790	22.61	11.84	410
		Pleven region	*5*	*8*	*14*	*4*
	Incidence	Bulgaria	9.798	6.066	3.304	1.196
		Pleven region	*0.44*	*0.556*	*1.074*	*0.432*
West Nile fever	Cases	Bulgaria	–	4	21	9
		Pleven region	–	–	–	–
	Incidence	Bulgaria	–	0.05	0.058	0.026
		Pleven region	–	–	–	–

Infections of the outer coverings (tetanus, rabies) occupied an insignificant share of infectious cases – a total of 26 cases of tetanus (2004–2023), without cases of rabies (the last one was in 1994, with a lethal outcome). The importance of post-exposure prophylaxis with anti-rabies vaccine and epizootic control among animals was enormous (Baker et al. 2022). The incidence of tetanus had decreased dramatically due to mandatory vaccination and post-exposure prophylaxis. No cases of tetanus and rabies were registered during the study period in the Pleven region.

Infections of the central nervous system (CNS) from 2004 to 2023 in Bulgaria and the Pleven region (Table 7) were 0.18% and 0.50% of all infectious cases, respectively. Cases of non-bacterial meningitis for the country and Pleven region accounted for 51.48% and 48.57%, respectively, of all infections of CNS. Regarding bacterial meningitis, the cases of pneumococcal meningitis had the highest relative share (4.94%), followed by cases of meningococcal infection (2.89%), streptococcal meningitis (1.54%), meningitis caused by *H. influenzae* (1.09%). Cases of CNS infections with other aetiology were 8.64%, and 7.06% had unproven aetiology. There were no cases of poliomyelitis (the last three cases were in 2001). The morbidity of pneumococcal and *H. influenzae* meningitis decreased due to mandatory immunoprophylaxis (Mahmud et al. 2020; Li et al. 2021; Tsekov et al. 2023).

Zoonoses with multiple mechanisms of transmission (0.10% and 0.089% of the infectious cases for Bulgaria and Pleven region, respectively) – the highest relative share was for Q-fever (51.85% of the cases in the group), followed by leptospirosis (16.52%), brucellosis (10.64%), listeriosis (7.82%), haemorrhagic fever with renal syndrome (6.23%), tularaemia (5.35%), anthrax (1.24%), ornithosis (0.35%). The incidence of zoonoses decreased (Table 8), possibly due to a change in the structure of economic branches in the country and, more specifically – a decrease in animal husbandry.

Table 7. Infections of CNS in Bulgaria and the Pleven region – number of patients and incidence (‱).

Disease	Indicator / Years	Region	2004–2008	2009–2013	2014–2018	2019–2023
Meningococcal disease	Cases	Bulgaria	176	84	52	23
		Pleven region	*6*	*3*	*6*	*1*
	Incidence	Bulgaria	0.456	0.224	0.146	0.068
		Pleven region	*0.394*	*0.218*	*0.456*	*0.105*
Pneumococcal meningitis	Cases	Bulgaria	205	147	146	75
		Pleven region	*5*	*4*	*12*	*10*
	Incidence	Bulgaria	0.53	0.39	0.42	0.22
		Pleven region	*0.876*	*0.208*	*0.944*	*0.34*
Streptococcal meningitis	Cases	Bulgaria	83	51	25	19
		Pleven region	–	–	*1*	–
	Incidence	Bulgaria	0.216	0.138	0.068	0.056
		Pleven region	–	–	*0.076*	–
H. influenzae-meningitis	Cases	Bulgaria	79	31	11	6
		Pleven region	–	*2*	–	–
	Incidence	Bulgaria	0.204	0.082	0.03	0.016
		Pleven region	–	*0.18*	–	–
Othersbacterial meningitis	Cases	Bulgaria	135	293	375	199
		Pleven region	–	*2*	*8*	*7*
	Incidence	Bulgaria	0.35	0.794	1.04	0.586
		Pleven region	–	*0.144*	*0.624*	*0.845*
Bacterial meningitis of unspecified aetiology	Cases	Bulgaria	600	218	–	–
		Pleven region	*11*	*7*	–	–
	Incidence	Bulgaria	1.554	0.97	–	–
		Pleven region	*0.65*	*0.478*	–	–
Viral meningitis	Cases	Bulgaria	2227	1516	953	455
		Pleven region	*8*	*34*	*22*	*4*
	Incidence	Bulgaria	5.76	4.092	2.604	1.328
		Pleven region	*0.508*	*2.442*	*1.748*	*0.425*

Conclusions

There is a permanent trend for decreasing general infectious morbidity in the country and the Pleven region, most evident in diseases with mass vaccine prophylaxis. After a period of decline in the relative share of respiratory infections until 2019 (mainly due to the reduced incidence of vaccine-preventable diseases) followed stagnation. However, during the last 5 years, the incidence of respiratory infections has increased in both the country and the Pleven region.

At the same time, the relative share of intestinal infections is the opposite – from 2004 to 2018, they increased and then decreased.

In viral hepatitis, the trend was upward until 2004, after which it decreased.

Transmissible infections have variable dynamics, but one should think in the direction of an increase in the incidence of diseases whose vectors would change their geographical distribution areas due to climate changes. Imported cases due to increased human migration would also change the incidence of these infectious diseases.

Infections of CNS have a reduced incidence, especially those with mandatory vaccine prophylaxis.

Table 8. Zoonoses with multiple mechanisms of transmission in Bulgaria and the Pleven region – number of patients and incidence ($\%_{000}$).

Disease	Indicator / Years	Region	2004–2008	2009–2013	2014–2018	2019–2023
Listeriosis	Cases	Bulgaria	24	26	42	41
		Pleven region	*3*	*3*	–	–
	Incidence	Bulgaria	0.074	0.07	0.118	0.12
		Pleven region	*0.132*	*0.144*	–	–
Leptospirosis	Cases	Bulgaria	116	49	95	21
		Pleven region	4	4	2	0
	Incidence	Bulgaria	0.3	0.132	0.264	0.062
		Pleven region	*0.39*	*0.288*	*0.162*	*0*
Q-fever	Cases	Bulgaria	396	106	131	249
		Pleven region	*1*	–	*1*	*1*
	Incidence	Bulgaria	1.018	0.288	0.368	0.728
		Pleven region	*0.066*	–	*0.08*	*0.11*
Hemorrhagic fever with renal syndrome	Cases	Bulgaria	17	29	35	–
		Pleven region	–	–	–	–
	Incidence	Bulgaria	0.044	0.08	0.094	0.072
		Pleven region	–	–	–	–
Anthrax	Cases	Bulgaria	5	9	5	2
		Pleven region	–	*1*	*1*	–
	Incidence	Bulgaria	0.01	0.28	0.012	0.02
		Pleven region	–	*0.185*	*0.152*	–
Brucellosis	Cases	Bulgaria	124	10	43	4
		Pleven region	–	–	*2*	–
	Incidence	Bulgaria	0.322	0.026	0.12	0.012
		Pleven region	–	–	*0.264*	–
Tularaemia	Cases	Bulgaria	48	11	28	4
		Pleven region	–	–	*1*	–
	Incidence	Bulgaria	0.126	0.028	0.076	0.01
		Pleven region	–	–	*0.152*	–
Ornithosis	Cases	Bulgaria	4	–	1	1
		Pleven region	*2*	–	–	–
	Incidence	Bulgaria	0.012	–	0.002	0.002
		Pleven region	*0.264*	–	–	–

In all zoonoses, there is a trend towards a decrease, one of the possible reasons being a decrease in animal husbandry.

Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statements

The authors declared that no clinical trials were used in the present study.

The authors declared that no experiments on humans or human tissues were performed for the present study.

The authors declared that no informed consent was obtained from the humans, donors or donors' representatives participating in the study.

The authors declared that no experiments on animals were performed for the present study.

The authors declared that no commercially available immortalised human and animal cell lines were used in the present study.

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Author contributions

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Data availability

All of the data that support the findings of this study are available in the main text.

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