ARTYKUŁ ORYGINALNY

Regional differences in the hepatitis C morbidity indicator in Poland in the years 2008-2013

Regionalne zróżnicowanie wskaźnika zachorowalności na wirusowe zapalenie wątroby typu C w Polsce w latach 2008–2013

Andrzej Śliwczyński[1] iD, Melania Brzozowska[1] iD, Adam Wierzba[1] iD, Waldemar Wierzba[1] iD

[1] Wydział Nauk o Zdrowiu, Akademia Humanistyczno-Ekonomiczna w Łodzi, Polska

Autor korespondencyjny:	Andrzej Śliwczyński
	Wydział Nauk o Zdrowiu, Akademia Humanistyczno-Ekonomiczna
	Doktora Seweryna Sterlinga 26
	90-212 Łódź, Polska
Finansowanie:	Brak
Konflikt interesów:	Nie zgłoszono

Abstract

Key words:	*HCV, Hepatitis C, epidemiology, regional variability, morbidity HCV*
Introduction and objective:	The goal of the article is to estimate the population of people suffering from hepatitis C in Poland in the years 2008–2013 as well as to analyze regional differences in the morbidity indicator.
Material and methods:	The database of the National Health Fund was used to create a set of hepatitis C patients based on ICD-10 codes. B17.1 - acute hepatitis C and B18.2 - chronic viral hepatitis C. It was assumed that patients with listed codes are people with indicated anti-HCV antibodies, not necessarily with specific viraemia. Based on the aforementioned ICD-10 codes and patient's identifier, the number of sufferers (annual morbidity) was established along with territorial indicators. Regional incidence and morbidity indicators per 10,000 inhabitants of a given voivodeship were calculated based on demographic data for each year separately. Annual incidence was established as the number of patients which were not present in the data sets for the previous year. Due to a short period of analysis repeated infections were not analysed.
Results:	In Poland most hepatitis C patients are aged 52–58 years. The voivodeship with the highest morbidity indicator per 10,000 inhabitants is the Dolnośląskie (4.28) and Mazowieckie (3.95). The lowest morbidity indicators per 10,000 inhabitants are present in Podkarpackie (1.19) and Wielkopolskie (1.75) voivodeships. The highest hepatitis C morbidity indicator is observed in Mazowieckie (15.22) and Kujawsko-Pomorskie (11.81) voivodeships.
Conclusions:	The number of Polish patients with established anti-HCV antibodies is relatively constant, and the number of new cases fluctuates at around 6% annually. There are clear differences in incidence and morbidity indicator values in Poland between various voivodeships, which additionally change over time.

Streszczenie

Słowa kluczowe:	*HCV, Hepatitis C, chorobowość WZW C, różnice regionalne WZW C, epidemiologia*
Wprowadzenie i cel:	Celem artykułu jest oszacowanie populacji osób chorych na wirusowe zapalenie wątroby typu C w Polsce w latach 2008–2013 oraz analiza regionalnych różnic we wskaźniku zachorowalności.
Materiał i metody:	Bazę danych Narodowego Funduszu Zdrowia wykorzystano do stworzenia zbioru pacjentów z WZW typu C w oparciu o kody ICD-10. B17.1 – ostre wirusowe zapalenie wątroby typu C i B18.2 – przewlekłe wirusowe zapalenie wątroby typu C. Przyjęto, że pacjenci z wymienionymi kodami to osoby ze wskazanymi przeciwciałami anty-HCV, niekoniecznie ze swoistą wiremią. Na podstawie w/w kodów ICD-10 oraz identyfikatora pacjenta ustalono liczbę chorych (roczna zachorowalność) wraz ze wskaźnikami terytorialnymi. Regionalne wskaźniki zachorowalności i zachorowalności na 10 000 mieszkańców danego województwa obliczono na podstawie danych demograficznych w każdym roku osobno. Zapadalność roczną ustalono jako liczbę chorych, których nie było w zbiorach danych za rok poprzedni. Ze względu na krótki okres analizy nie analizowano powtarzających się infekcji.
Wyniki:	W Polsce większość pacjentów z wirusowym zapaleniem wątroby typu C jest w wieku 52–58 lat. Województwo o najwyższym wskaźniku zachorowalności na 10 tys. mieszkańców to dolnośląskie (4,28) i mazowieckie (3,95). Najniższe wskaźniki zachorowalności na 10 tys. mieszkańców występują w województwach podkarpackim (1,19) i wielkopolskim (1,75). Najwyższy wskaźnik zachorowalności na wirusowe zapalenie wątroby typu C występuje w województwie mazowieckim (15,22) i kujawsko-pomorskim (11,81).
Wnioski:	Liczba pacjentów w Polsce z ustalonymi przeciwciałami anty-HCV jest stosunkowo stała, a liczba nowych przypadków oscyluje na poziomie około 6% rocznie. Liczba podejrzanych przypadków, które nie zostały potwierdzone dalszą diagnostyką jako faktyczne zachorowanie, wynosi ok. 3 tys. 11% wszystkich zgłoszonych przypadków. W Polsce istnieją wyraźne różnice w wartościach wskaźników zachorowalności i zachorowalności pomiędzy różnymi województwami, które dodatkowo zmieniają się w czasie.

Praktyka Kliniczna

A. Śliwczyński et al.:
Regional differences in the hepatitis C morbidity
indicator in Poland in the years 2008-2013
Zeszyty Naukowe CSK MSWiA; 2/2022

Introduction

The assessment of the number of people infected with the HCV virus is an analytical problem in most countries worldwide [1]. The recommendations of Associations (Polish Society Of Epidemiologists And Doctors Of Contagious Diseases) which suggest the restriction of screening to high risk groups [2] result in up to 50–75% of infected not knowing their own health issues. At the same time the registering of patients worldwide and in Europe is conducted using various different systems, which results in specific problems with data consolidation and analysis [2]. It is established that there are approx. 80 to 170 million people infected with HCV virus worldwide, the most frequent genotype is (46%) genotype 1, genotypes 2 and 3 are on the second place (22%), and genotype 4 is present in 13% of the infected [3,4]. The isolation of the HCV virus structure in 1989 and introduction of its laboratory diagnostics (in Poland since 1990 [5]) allowed the precise diagnostics of HCV cases, as well as epidemiological studies of the population. In Poland the establish of population of HCV infected is the task of the National Institute of Public Health – National Institute of Hygiene (NIZP-PZH) of the National Institute of Public Health (NIZP), operating on the basis of infection registries kept by the Chief Sanitary Inspector (GIS). So far there were no studies and analyses which would use the National Health Fund (NFZ) database, which contains full information on medical treatments provided in Poland. The first Polish estimates of the infected population and of anti-HCV antibody spread were provided at the beginning of 90s in the 20th century, based on testing first time blood donors. The assumed study methodology (healthy men in a single age bracket, from entire Poland, randomly arriving to donate blood) enabled the obtaining of results representative for the given sex and age. Since 1997 the collection and analysis of HCV data is obligatory registration of HCV (according ICD-10) is the task of epidemiological supervision units (Chief Sanitary Inspectorate - GIS), and the requirement to notify and register applies to HCV and mixed HBV and HCV infection. This registration is the basis for all epidemiological analyses intended to estimate the population of HCV infected.

The data published by the Polish HCV Expert Group in 2015 show that in Poland approx. 730 thousand people have anti-HCV antibodies, and in approx. 230 thousand of them (0.6%) active viral replication occurs. The results provided by experts are based on 2011 [6] and 2012 [7] studies which were conducted on a representative sample (with a sample number of respectively 26 thousand and 4.8 thousand). The percentage of people with anti-HCV antibodies established by the experts ("0.9–1.9% of inhabitants of Poland depending on the studied population and research methodology", that is from 342 thousand to approx. 722 thousand people) [2,8,9]. Detection rate of the true number of HCV case is estimation as 15% [7,9,10]. Whereas the authors of the official annual NIZP-PZH report state that "prevalence of anti-HCV antibodies in the general population of Poland amounts to 0.95% (320 thousand people) and the number of actively infected is approx. 230 thousand people (0.6%)" [10]. All the attempts to estimate the HCV population in Poland are based on:

1. Routine testing for the presence of anti-HCV antibodies, using subsequent generations of tests, performed in accordance with the guidelines [11].

2. Detection of HCV RNA presence using the PCR on serum, in the small (estimated by the Polish HCV Expert Group to be 30 thousand) group of anti-HCV positive people, where the confirmation of active viral replication forms the basis to begin and monitor the antiviral therapy [12].

All the reported cases are provided in accordance with the HCV case definitions accepted in 2005 and 2009.

The National Health Fund in Poland is the only public payer which finances medical treatment pursuant to the provisions of the Act [13]. It has a full database of medical events (for the entire population of Poland) reported by medical institutions and paid by public funds. The data are reported to the Fund Branches of the corresponding area in accordance with the Regulation of the Minister of Health [14] after the medical procedure is performed on the patient, the payment made pursuant to the report requires the validation and verification of data. The goal of the article is to estimate the population of people suffering from hepatitis C in Poland in the years 2008–2013 as well as to analyze regional differences in the morbidity indicator.

Material and methods

The NFZ databases were analysed in order to select a set of patients with an indicated ICD-10 diagnosis of: B17.1 — acute hepatitis C and B18.2 — chronic viral hepatitis C. Afterwards a set of information about HCV patients was created based on the selected data. To simplify the studies and taking into account the available databases it was assumed that the persons shown in the reports with the listed codes are people with indicated anti-HCV antibodies, not necessarily with specific viremia. Based on the aforementioned ICD-10 codes and provided patient's identifier (PESEL number) the indicated patient population (annual morbidity) was established along with territorial indicators. Morbidity indicator per 10,000 inhabitants of a given voivodeship were calculated based on demographic data obtained from the Chief Statistical Office (GUS) website for each year separately. SAS Enterprise Guide 5.1 was used to perform analyses. This study was carried out following the principles expressed in the Declaration of Helsinki. Patient consent was waived due to the fact, that this study is a retrospective analysis, and datasets used in this study were anonymous.

Praktyka Kliniczna

A. Śliwczyński et al.:
Regional differences in the hepatitis C morbidity
indicator in Poland in the years 2008-2013
Zeszyty Naukowe CSK MSWiA; 2/2022

Results

In Poland for patients older than 18 (adults) three maximums can be found (the chart is trimodal), the largest number of patients is present for the age of approx. 55 years, approx. 900 annually, but the first increase of average annual number of patients occurs for the age of approx. 30 years, and moreover another small increase can be observed for patients at an age of approx. 75 years. Looking at the total number of patients in Poland demonstrated in the NFZ IT systems depending on their age in individual years (Figure 1) the maximum amount of patients can be found at the age of approx. 52–58 years.

The number of patients with HCV diagnosis registered in the NFZ IT system during the 2008–2013 period increased by, on the average, 6.7%, to stabilise in 2011 on a level of approx. 36 thousand patients (SD=3092). The reports on the services provided to the patients indicate migration between voivodeships on the annual mean level of approx. 500 persons (approx. 1.4%) — table 1. On the average approx. 2000 people are being treated per voivodeship. Until 2010 a more dynamic increase of the number of patients could be observed, and then their number stabilised. This situation could be related to the introduction of the JGP Diagnosis Related Group system in 2008, modelled on the English HRG, and with strong connection between the reported data and the ICD-10 diagnosis.

The amount of cases of patients listed in the IT systems with the HCV diagnosis fluctuates at a level of approx. 11 thousand annually (SD=+/-1750) showing a decreasing tendency ANNUALLY (2010=-4%; 2011=+2.3%; 2012=-19.22%; 2013= -10.2%). The voivodeships with the highest average number of patients (for the 2009–2014 period) are: Mazowieckie, Dolnośląskie and Śląskie voivodeships. The lowest number of patients can be observed in Opolskie, Podkarpackie and Podlaskie voivodeships: Standardising the data using the population of a given voivodeship (table 2) shows a small change in the order of voivodeships. The voivodeship with the highest average morbidity indicator (for the 2009–2013 period) is the Dolnośląskie voivodeship (4.28/10 thousand inhabitants), and the next ones are Mazowieckie (3.95/10 thousand inhabitants) and Zachodniopomorskie (3.07/10 thousand inhabitants) voivodeships. The lowest average periodical morbidity indicators per 10,000 inhabitants are present in Podkarpackie (1.19), Wielkopolskie (1.75) and Podlaskie (2.12) voivodeships. Over the examined period the participation of men and women was equal, the average participation of men was approx. 49.9%. There were no statistically significant differences over the examined period within the same voivodeship, whereas there were statistically significant differences in the HCV occurrence frequency when various voivodeships were compared.

Standardising the data based on the population size of the given voivodeship (table 2) has shown statistically significant difference in the HCV occurrence frequency (morbidity) between voivodeships: Mazowieckie (15.22±0.7593), Kujawsko-Pomorskie (11.81±0.3162), Dolnośląskie (10.96±1.6226) and Śląskie (10.74+/-0.3948). The highest variability of morbidity indicator in individual years has occurred in the Warmińsko-Mazurskie, Zachodniopomorskie and Pomorskie voivodeships (SD>2), average morbidity indicator value variance (1<SD<2) occurred in the Dolnośląskie, Lubuskie and Opolskie voivodeship. The difference in the average HCV occurrence frequency in the years 2008–2013 between the 8 voivodeships with the lowest and the 8 voivodeships with the highest morbidity indicators was statistically significant (5.71±1.6441 vs 10.43±2.3402; p=0.005).

The treatment of patients with specific viraemia is conducted through a drug treatment programme financed from the public funds [15], which has strict parameters of patient participation in the therapy (in particular patient inclusion and exclusion criteria, the treatment method). The share of patients undergoing therapy within the programme annually averages approx. 20% of all demonstrated cases (after correcting the total number of patients and excluding the therapies which were not started (suspicion) the share of treated patients to the general number of patients averages
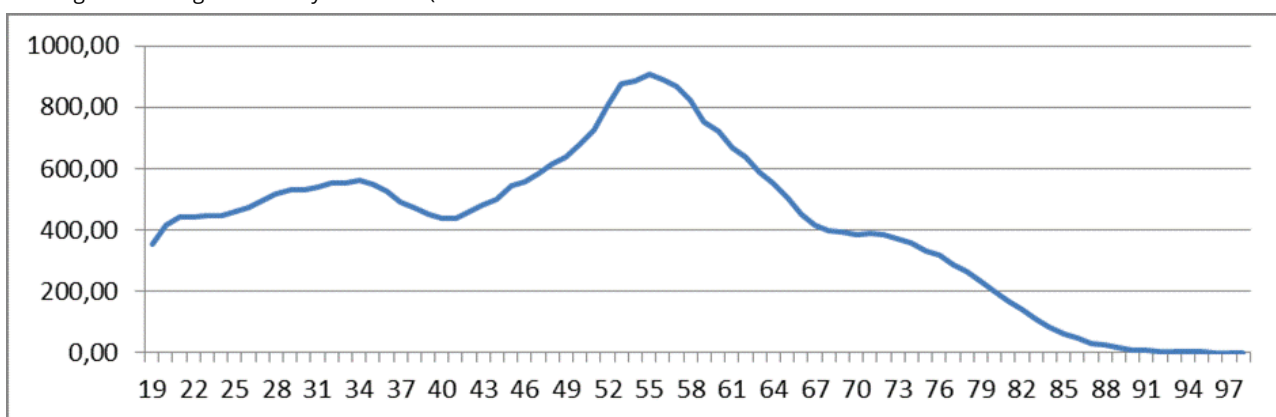

Figure 1 *Relationship between the average number of patients and the age of the patient the moment services were provided.*

Praktyka Kliniczna

A. Śliwczyński et al.:
Regional differences in the hepatitis C morbidity
indicator in Poland in the years 2008-2013
Zeszyty Naukowe CSK MSWiA; 2/2022

Voivodeship	Morbidity**					
	2008	2009	2010	2011	2012	2013
Dolnośląskie	2 597	3 066	3 670	3 821	2 899	2 990
Kujawsko-pomorskie	2 528	2 468	2 383	2 389	2 471	2 522
Lubelskie	1 781	1 734	1 640	1 731	1 962	1 856
Lubuskie	686	613	642	619	927	945
Łódzkie	1 477	1 781	1 878	1 848	1 853	2 144
Małopolskie	2 668	2 799	2 924	2 933	2 975	2 987
Mazowieckie	7 230	7 901	8 376	8 310	8 267	7 907
Opolskie	495	520	712	805	528	509
Podkarpackie	677	684	700	711	758	776
Podlaskie	625	706	705	705	774	721
Pomorskie	1 066	1 096	1 710	2 401	2 510	2 559
Śląskie	4 838	4 829	4 914	5 275	5 092	4 892
Świętokrzyskie	1 218	1 197	1 171	1 217	1 220	1 223
Warmińsko-mazurskie	329	366	391	830	1 026	1 026
Wielkopolskie	1 099	1 203	1 156	1 983	1 180	1 238
Zachodniopomorskie	834	905	1 086	1 711	1 649	1 718
Total	30 148	31 868	34 058	37 289	36 091	36 013
Total adjusted for migration***	29 858	31 428	33 106	36 252	35 747	35 632
Migration from region****	290	440	952	1 037	344	381
Average of regions	1 884.25	1 991.75	2 128.63	2 330.56	2 255.69	2 250.81

Table 1 *Hepatitis C. Morbidity in every province in Poland in 2008-2013.*
**Morbidity - the number of patients (with ICD-10 B17.1; B18.2) listed in the reports for a given year;
The actual number of detected cases calculated by subtracting the number of patients which were listed twice due to travel between voivodeships (their numbers were provided in the row marked *).

Praktyka Kliniczna

A. Śliwczyński et al.:
Regional differences in the hepatitis C morbidity
indicator in Poland in the years 2008-2013
Zeszyty Naukowe CSK MSWiA; 2/2022

Voivodeship	2008	2009	2010	2011	2012	2013
Dolnośląskie	9.03	10.66	12.76	13.10	9.94	10.26
Kujawsko-pomorskie	12.22	11.93	11.51	11.39	11.78	12.02
Lubelskie	8.24	8.04	7.61	7.97	9.05	8.56
Lubuskie	6.80	6.07	6.35	6.05	9.06	9.24
Łódzkie	5.79	7.01	7.40	7.29	7.33	8.48
Małopolskie	8.12	8.49	8.85	8.76	8.88	8.92
Mazowieckie	13.89	15.13	16.01	15.72	15.62	14.94
Opolskie	4.79	5.04	6.91	7.94	5.22	5.03
Podkarpackie	3.22	3.25	3.33	3.34	3.56	3.65
Podlaskie	5.25	5.93	5.93	5.87	6.45	6.01
Pomorskie	4.80	4.91	7.65	10.51	10.98	11.19
Śląskie	10.41	10.41	10.59	11.40	11.02	10.59
Świętokrzyskie	9.57	9.42	9.23	9.52	9.56	9.59
Warmińsko-mazurskie	2.31	2.56	2.74	5.71	7.07	7.07
Wielkopolskie	3.23	3.53	3.39	5.74	3.41	3.58
Zachodniopomorskie	4.93	5.34	6.41	9.94	9.58	9.98
P O L A N D	7.83	8.23	8.67	9.41	9.28	9.25

Table 2 *Relationship between the average number of patients and the age of the patient the moment services were provided.*

annually 25.5% (SD ±2.3%)), during the year patients are rotated within the programme. The treatment of patients is also possible within the settlement of DRG group services in the hospital, even if the hospital has no contract for the drug programme. At the same time there's a significant differentiation of the number of patients in the programme between regions, voivodeships such as Lubelskie, Podlaskie demonstrate a share of patients within the programme which exceeds 50%, in the Mazowieckie, Podkarpackie and Lubuskie voivodeships the participation fluctuates around 20% to 50%, and the smallest share is demonstrated by Śląskie and Pomorskie voivodeships.

Discussion

The estimates of HCV patients indicated in the available analyses show significant discrepancies [3,4], at the same time significant variability related to the analysed country was indicated, as well as significant spread of HCV burden indicators (from 1% do to 10% of the population) [16]. The modern electronic data communication and collection systems seem to be more helpful for this type of works, with higher data credibility even compared to other paid sources [17], as indicated in the analysis of data provided to the CDC (Center for Disease Control and Prevention). The use of elec-

Praktyka Kliniczna

A. Śliwczyński et al.:
Regional differences in the hepatitis C morbidity
indicator in Poland in the years 2008-2013
Zeszyty Naukowe CSK MSWiA; 2/2022

-tronic databases of the National Health Fund enabled the estimation of the number of patients with anti-HCV antibodies (the number of patients with indicated ICD-10 B17.1 and B18.2 diagnosis), the number of patients with acute form of the illness is approx. 0.5% of the entire estimated number of patients, which is in accordance with the known course of the illness. The number of patients in Poland with observed presence of anti-HCV antibodies (and also for some percentage of them HCV-RNA) is relatively constant. The therapy of the patients is conducted mainly within the framework of hospital health care, that is, treatment within the health insurance system based on medical procedures settled using the DRG groups (based on the English HRG system) and within the framework of the drug treatment programme. Taking into account the fact that the IT systems include in their databases each observed case, algorithms verifying whether underwent antiviral therapy were applied; over the studied period approximately 11.7% of cases of suspected illness which did not end with therapy were observed. Underestimation, underregistration and underdiagnosing of HCV patients is a significant hindrance to the correct calculation of the patient population. The natural history of HCV infection, which is asymptomatic or with few symptoms, marked by ambiguous non-hepatic symptoms and taking many years, indicates that it's more sensible to use methods appropriate to the epidemiology of chronic illnesses [18], not entirely specified for chronic infectious illnesses [19].

The analysis has also demonstrated regional differences in the morbidity indicators present within Poland, which indicate the separation of at least two macroregions with high and low values (voivodeships with a low average value of indicators over the studied period: Podkarpackie, Wielkopolskie, Podlaskie, Małopolskie, Warmińsko-Mazurskie, Lubelskie, Kujawsko-Pomorskie, Łódzkie, high values are present in: Opolskie, Świętokrzyskie, Lubuskie, Śląskie, Zachodniopomorskie, Pomorskie, Mazowieckie, Dolnośląskie). Unlike other existing analyses which indicate regional conditions [20] within the macroregions additional fluctuations of voivodeships occurs, which indicates a small significance of correlations acc. to the Pearson correlation coefficient (value of 0.25). Its occurrence in each of the macroregions of highly industrialised voivodeships (Wielkopolskie, Małopolskie — group 1; Śląskie, Mazowieckie — group 2) and of voivodeships with a worse infrastructure (Podkarpackie, Podlaskie — group 1; Świętokrzyskie, Opolskie — group 2) indicates a different cause for the differences than medical infrastructure or physician availability. A further, more detailed analysis will be required, taking into account demographic data, but also given voivodeship's outgoing tourist traffic (in particular its directions). The limitation of this study is the use of data for the settlement of health services with the public payer. The selected database contains a lot of necessary information used for the analyzes performed, but is not a clinical registry. Future studies are also necessary to verify the hypothesis that the population of so-called risk groups is responsible for the differences in the incidence and morbidity between regions [21].

Conclusions

1. There are clear differences in morbidity indicator values in Poland between various voivodeships, which additionally change over time.

2. The number of patients in Poland with established anti-HCV antibodies is relatively constant, and the number of new cases fluctuates at around 6% annually.

3. The number of suspected cases which are not confirmed as actual illness by further diagnostics amounts to approx. 11% of all reported cases.

4. Taking into account data from NFZ databases enables the reliable establishing of actual number of people infected with HCV in Poland, including patients with active hepatitis C, with the HCV virus replication, infectious (frequently unaware of the fact), and requiring the treatment.

5. Correct diagnosis of the HCV virus infection prevalence in the population of Poland has significant importance for full effectiveness of antiviral therapy, which may — in a more long-term, but possible perspective — result in the eradication of hepatitis C.

References

1. Muhlberger N, Schwarzer R, Lettmeier B, Sroczynski G, Zeuzem S, Siebert U. HCV-related burden of disease in Europe: a systematic assessment of incidence, prevalence, morbidity, and mortality. BMC Public Health, 2009; 22: 9-34. DOI: 10.1186/1471-2458-9-34.

2. Coffin PO, Scott JD, Golden MR, Sullivan SD. 2012). Cost-effectiveness and population outcomes of general population screening for hepatitis C. Clin Infect Dis, 2012; 54(9): 1259-71. DOI: 10.1093/cid/cis011.

3. Christensen PB, Hay G, Jepsen P et al. Hepatitis C prevalence in Denmark - an estimate based on multiple national registers. BMC Infect Dis, 2012; 12: 178.

4. McDougall NI, McCluggage WG, Coyle PV, Sloan JM, Callender ME. Early experience with chronic hepatitis C in Northern Ireland: epidemiology and response to monotherapy. Ulster Med J, 2004; 73(1): 25-31.

5. Laskus T. Zakażenia wirusami hepatotropowymi i uszkodzenie wątroby u osób nadużywających alkoholu i narkomanów. Hepatotropic virus infections and liver damage in alcohol and drug addicts. Habilitation thesis. Medical Academy in Warsaw, Poland, 1991.

Praktyka Kliniczna

A. Śliwczyński et al.:
Regional differences in the hepatitis C morbidity
indicator in Poland in the years 2008-2013
Zeszyty Naukowe CSK MSWiA; 2/2022

6. Flisiak R, Halota W, Horban A, et al. Prevalence and risk factors of HCV infection in Poland. Europ J Gastroenterol Hepatol, 2011; 23: 1213-1217.

7. Godzik P, Kołakowska A, Madaliński K, Stępień M, et al. Rozpowszechnienie przeciwciał anty-HCV wśród osób dorosłych w Polsce – wyniki badania przekrojowego w populacji ogólnej. (Proliferation of anti-HCV antibodies among adults in Poland - the results of a cross-sectional study in the general population). Przegl Epidemiol, 2012; 66: 575–580.

8. Cornberg M, Razavi HA, Alberti A et al. A systematic review of hepatitis C virus epidemiology in Europe, Canada and Israel. Liver Intern, 2011; suppl. 2(31): 30-60.

9. Panasiuk A, Flisiak R, Mozer-Lisewska I et al. Distribution of HCV genotypes in Poland. Przegl Epidemiol, 2013; 67:11-16.

10. Parda N, Henszeł Ł, Stępień M. Hepatitis C in Poland. Przegl. Epidemiol, 2014; 68 (2): 265-269.

11. Madaliński K, Flisiak R, Halota W, et al. Diagnostyka laborato-ryjna zakażeń wirusem zapalenia wątroby typu C. Rek-omendacja Polskiej Grupy Roboczej 2012/2013. (Laboratory diagnostics of hepatitis C virus infections. Recommendation by Polish Working Group) Diagnostyka Laboratoryjna, 2013; 49(1): 65-70.

12. Rosińska M, Parda N, Stępień M. Hepatitis C in Poland in 2011. Przegl Epidemiol, 2013; 67(2): 247-251.

13. Act on health care services financed from public funds (Dz. U. of 2015, poz. 581 consolidated text).

14. Regulation of the Minister of Health on the scope of necessary information collected by service providers detailed method of recording such information and its provision to entities re-quired to finance the services from public funds (Dz.U. of 2013, poz. 1447)

15. Programy lekowe. http://www.mz.gov.pl/leki/refundacja/pro-gramy-lekowe, accessed on 13 August 2019.

16. Averhoff FM, Glass N, Holtzman D. Global burden of hepatitis C: considerations for healthcare providers in the United States. Clin Infect Dis, 2016; 55 Suppl 1: 10-5. DOI: 10.1093/cid/cis361.

17. Iqbal K, Klevens RM, Jiles R. Comparison of acute viral hepatitis data quality using two methodologies, 2005-2007. Public Health Rep, 2012; 127(6): 591-7.

18. Remington PL, Brownson RC, Wegner MV (eds.). Chronic Disease Epidemiology and Control. APHA. Washington DC, 2008.

19. Knap JP. Uwagi o epidemiologii przewlekłych chorób in-fekcyjnych. (Notes on epidemiology of chronic infectious diseas-es) (in): Knap J.P. (ed.): Epidemiologia w klinice. Ed. WUM. War-saw 2013: 128–162.

20. Ciccozzi M, Lo Presti A, Ciccaglione AR, Zehender G, Ciotti M. Phylogeny and phylodinamic of Hepatitis C in Italy. BMC Infect Dis, 2012; 12 Suppl 2:S5. DOI: 10.1186/1471-2334-12-S2-S5.

21. Rosińska M, Sierosławski J, Wiessing L. High regional variability of HIV, HCV and injecting risks among people who inject drugs in Poland: comparing a cross-sectional bio-behavioural study with case-based surveillance. BMC Infect Dis, 2015;15: 83. DOI: 10.1186/s12879-015-0828-9.