

Viral hepatitis C in Poland in the Silesian Province between 2005–2014

Bogumiła Braczkowska¹, Małgorzata Kowalska¹, Kamil Barański¹, Urszula Mendera-Bożek²

¹ Department of Epidemiology, School of Medicine, SUM Katowice, Poland

² State Provincial Sanitary Inspector, Katowice

Braczkowska B, Kowalska M, Barański K, Mendera-Bożek U. Viral hepatitis C in Poland in the Silesian Province between 2005–2014. *Ann Agric Environ Med*. doi: 10.26444/aaem/75928

Abstract

Introduction and objective. Viral hepatitis C remains one of the major health and social problems related to infectious diseases in Poland. The aim of the study was assessment of the registered changes in the incidence of HCV in the Silesian Province of western Poland during the last 10 years, including age, gender and place of residence.

Materials and method. A retrospective analysis was performed of the HCV incidence between 2005–2014 in the Silesian Province. The crude and standardized incidence rates were calculated for males and females in each year. Subsequently, the territorial diversity of the epidemiological situation in the districts was assessed by calculating the average incidence rate over the entire study period.

Results. Incidence rates calculated according to the case definition of 2005 ranged between 5.95/100000 in 2005 to 10.36/100000 in 2014. Analysis of the structure of the incidence showed that during the analyzed period, the majority of hepatitis C cases were related to males (52.5%) rather than females (47.5%), and hepatitis C was more prevalent in younger males (aged 20–49) and older females (aged over 50). After excluding the effect of age, the standardized rates were twice as low, compared to the crude incidence rates.

Conclusions. An increase in the HCV incidence rate was observed in males and females. It is obvious that the detection of additional cases will entail the need to provide funding for the treatment of more patients, which should be included in the map of regional health needs in the coming years. Our study demonstrates the temporal and spatial variability of HCV incidence in the Silesian Province of Poland. The observed increase in the crude and standardized rates suggests that the current registry system of HCV in Poland is more effective now. The current situation is comparable with the data in other EU countries.

Abbreviations

ZLK-1 (Polish abbreviation for 'Reporting of suspicious cases or diagnosis of cases of infections or infectious diseases'); B17.1 (acute viral hepatitis C – code by ICD-10); B18.2 (chronic viral hepatitis C – code by ICD-10)

Key words

Silesia, hepatitis C, epidemiology, Poland

INTRODUCTION

Viral hepatitis C remains one of the major health and social problems related to infectious diseases in Poland. Direct costs associated with the treatment of hepatitis C and complications are very high. Such costs accounted for ~ PLN 234 mln in 2013. Indirect costs related to the incapacity to work, deaths, absenteeism and presenteeism were twice as high and estimated at ~ PLN 585 mln in relation to patients treated at that time [1]. The current data indicate that in Poland the number of people with chronic hepatitis C who required treatment was ~ 200,000 in 2015 [2]. Moreover, according to the data of 2013, infection with HCV was the main reason (27.7%) for liver transplantations in Poland [3].

Monitoring the incidence of hepatitis C is routinely conducted by the Sanitary Inspection in accordance with the provision in the Polish Act on the Prevention and Combating of Infections and Infectious Human Diseases. Consequently, physicians, feldshers health care professionals and hospital administrators are obliged to report diagnosed or suspicious cases of hepatitis C, using then appropriate form (ZLK-1). In

recent years, the criteria for the case definition of contracting hepatitis C used as part of the epidemiological surveillance of infectious diseases have been changed in the European Union. This situation resulted in the improvement in the level of recorded detection of HCV infections. Cases registered in accordance with the definition of 2005 were related to the cases with clinical symptoms and/or elevated transaminases, as well as to those confirmed by positive test results for specific anti-HCV antibodies. From the beginning of 2009, the registration of cases of hepatitis C was based on all the cases confirmed by laboratory tests, irrespective of the clinical picture. It was sufficient to demonstrate the presence of specific anti-HCV antibodies and to confirm them using another test for the presence of antibodies (e.g. the Recombinant ImmunoBlot Assay Test), or using the test for the detection of HCV nucleic acid in blood serum. In 2014, new criteria were implemented. The registration of cases of hepatitis C is only related to those confirmed by laboratory tests based on one of the following three criteria: detection of HCV nucleic acid in the blood serum, detection of the HCV core antigen or confirmation of the presence of specific anti-HCV antibodies, additionally confirmed by another test for the presence of antibodies [4–6].

It should be recognized that the use of the above case definition of disease/diagnosis in the epidemiological surveillance is related to the standardization of reportability

Address for correspondence: Kamil Barański, School of Medicine, Medical University of Silesia, Medyków 18, 40-752 Katowice, Poland
e-mail: baranski@sum.edu.pl

Received: 14 December 2016; accepted: 23 May 2017; first published on July, 10 2017

and ensures the comparability of data in the epidemiological surveillance in Poland and in the European Community.

In recent years, an increase in the number of detected infections has been observed in Poland. Planning and implementation of effective preventive measures related to hepatitis C should be preceded by a thorough analysis of the epidemiological situation in the given region (also limited to an administrative dimension of the district or province). Without the above, a successful realization of actions which are to be followed in accordance with the provisions in the 4th operational objective of the new National Health Programme will not be possible [7].

OBJECTIVE

The aim of the study was assessment of the registered changes in the incidence of viral hepatitis C in the Silesian Province over the last 10 years, including age, gender and place of residence of individuals with hepatitis C. Additionally, standardization of the incidence rates was performed and their territorial variability in the districts assessed, including case definition used in epidemiological surveillance which was discussed in the Introduction.

MATERIALS AND METHOD

A retrospective analysis was performed of the data collected as part of a routine registration of the cases of hepatitis C in the area of activity of District Sanitary Inspectorates in the Silesian Province between 2005–2014. Reports of the diagnosis of hepatitis C (B17.1; B18.2) constituted the source of data, registered in accordance with the current case definition of hepatitis C in the given year, and according to the criteria used in the epidemiological surveillance and approved by the European Commission. It should be noted that until 2013 a previously used case definition of 2005 had been used to ensure the continuity of the criterion for the case in Poland. Data from the last year were reported according to the case definition of 2014.

Data regarding the total population, males and females, and people in different age groups for each year, which were necessary for the calculation of incidence rates, were obtained from the database of the Central Statistical Office of Poland – the Local Data Bank [8].

Analysis of the collected data was performed in accordance with the descriptive epidemiological study. The total and specific (considering the districts) crude incidence rates (n/100,000 of population) were calculated for the entire observation period (2005–2014). The average incidence rate (\bar{X} avg) of all the given years, standard deviation (SD) and the coefficient of variation (V) were used for assessing the stability of the registry system in the districts. Subsequently, the crude incidence rates in the groups of males and females from the Silesian Province (n/100,000) were calculated. The procedure of standardization was performed using the direct method with the use of the world population as a reference [9]. Description of the data was performed with the Microsoft Office 2013 package (MS Excel 2013). ArcGIS 9.2, the geographic information system, was used for visualization of the average incidence rates in the analyzed period stratified by districts [10].

RESULTS

In the analyzed period (2005–2014), a total of 4,039 cases of both acute and chronic hepatitis C (ICD-10 – B17.1, B18.2) were reported to the Sanitary Inspection in the Silesian Province. The crude incidence rates calculated according to the case definition of 2005 ranged between 5.95/100,000 in 2005 and 10.36/100,000 in 2014. Considering the criterion of 2014, the incidence rates ranged between 0.58/100,000 and 12.91/100,000 for the initial and final observation period, respectively (Fig. 1). It should be noted that in the last year of the analysis (2014) a considerable 2–3-fold increase in the incidence rate of hepatitis C was reported.

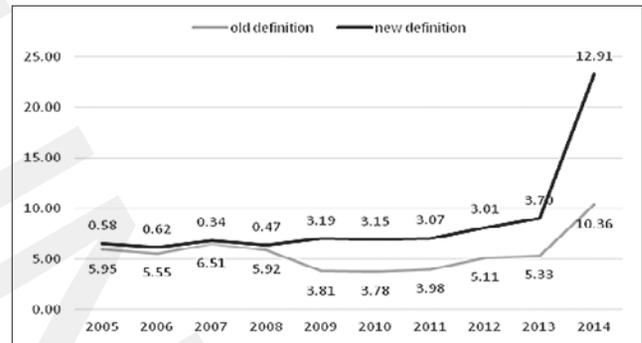


Figure 1. The incidence of hepatitis C in the Silesian Province between 2005 and 2014, (crude incidence rate n/100 000), considering the case definition used in the epidemiological surveillance

Analysis of the structure of incidence showed that during the analyzed period, the majority of cases of hepatitis C were related to males (52.5%) rather than females (47.5%). Figure 2 presents the average incidence rates in the entire analyzed period for males and females, including age groups. It is important to note some regularity, i.e. increased rates were related to younger males in the 20–49 age group, than in older females aged over 50). The highest incidence rate (14.24/100,000) was noted in the group of males aged 45–49 and females aged 50–54 (14.40/100,000).

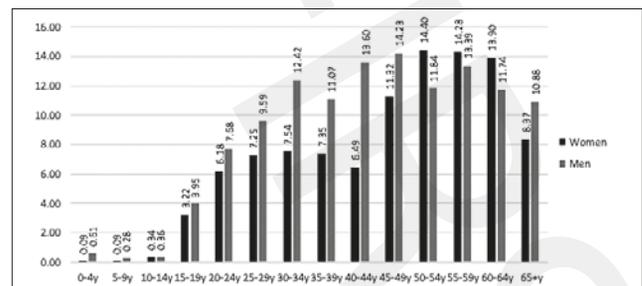


Figure 2. The average crude incidence rate of hepatitis C between 2005 and 2010 (n/100000), depending on the age in the groups of women and men

Table 1 presents the values of crude and standardized incidence rates for males and females in the individual reporting years. The data show an increase in both rates. After excluding the impact of age, the standardized rates were twice as low as the crude values.

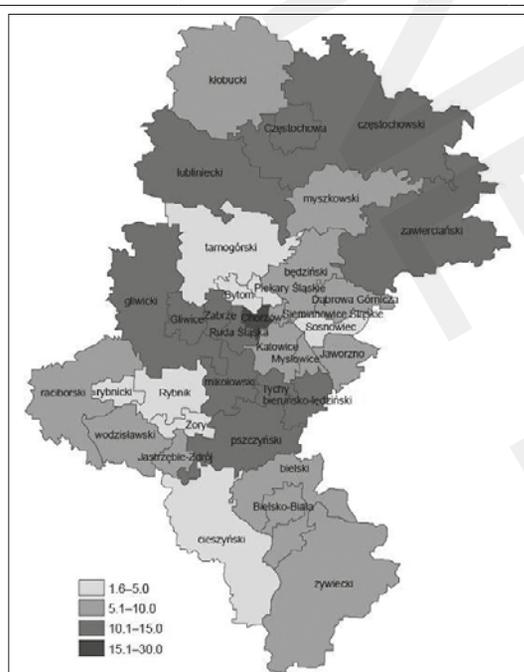
A significant variation in the incidence was observed in districts and cities with district rights in the Silesian Province. The highest value of the crude incidence rate in the last year of observation (2014) was reported in Katowice

Table 1. The incidence of hepatitis C in the Silesian Province between 2005 and 2014 (n/100 000), crude and standardized incidence rates for the world population in the groups of women and men

Sex	Incidence rate n/100 000	Year									
		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Women	Crude	4.95	5.01	6.39	5.82	7.03	6.01	5.98	7.25	7.77	23.39
	Standardized	2.37	2.09	2.63	2.42	2.98	2.61	2.37	2.71	3.33	9.34
Men	Crude	7.86	7.45	7.31	7.01	6.97	7.91	8.15	9.11	9.55	23.09
	Standardized	3.60	3.67	3.34	3.21	3.08	3.65	3.95	4.33	4.49	10.03

Table 2. The incidence of hepatitis C in the districts of the Silesian Province between 2005 and 2014 (crude incidence rate n/100000), average value (X avg), coefficient of variation (V), standard deviation (SD)

District	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	X avg	V	SD
Bielsko Biąła	6.7	3.0	0.3	0.3	2.1	0.9	2.1	8.7	7.2	47.6	7.9	180.6	14.3
Bytom	0.8	1.0	1.3	1.1	2.1	3.5	6.4	4.6	6.8	12.8	4.0	94.2	3.8
Chorzów	2.9	34.3	39.7	26.8	17.4	33.9	29.2	20.2	27.7	35.2	26.7	40.5	10.8
Cieszyn	13.5	4.7	1.2	2.9	1.2	1.1	0.0	0.0	6.8	6.8	3.8	111.7	4.2
Częstochowa	1.3	2.6	10.4	13.6	20.1	15.6	15.3	18.7	21.2	26.8	14.6	55.1	8.0
Dąbrowa Górnicza	1.1	1.4	8.2	6.8	18.7	4.3	6.5	4.7	4.7	25.2	8.2	94.8	7.7
Gliwice	16.4	15.3	6.2	8.2	14.1	18.8	12.6	16.0	11.9	22.7	14.2	33.9	4.8
Jaworzno	2.1	1.0	5.2	5.3	11.6	6.3	9.5	13.8	10.7	27.9	9.3	82.5	7.7
Katowice	0.9	1.0	1.0	0.3	0.3	1.0	0.0	0.3	0.0	45.7	5.1	283.0	14.3
Kłobuck	0.0	2.4	0.0	0.0	2.4	7.0	7.0	11.7	12.9	28.1	7.1	122.9	8.8
Lubliniec	3.9	1.3	1.3	3.9	7.8	9.1	10.3	10.3	11.7	46.8	10.6	124.5	13.3
Myszków	0.0	0.0	2.8	4.2	8.4	20.8	11.1	18.1	11.1	8.3	8.5	83.6	7.1
Racibórz	6.2	9.9	7.2	3.6	10.0	0.9	9.1	4.5	8.2	10.1	7.0	44.7	3.1
Ruda Śląska	2.0	6.2	9.0	16.7	14.6	23.7	15.4	11.9	20.5	29.1	14.9	54.7	8.2
Rybnik	2.2	1.1	1.1	0.7	0.0	0.0	0.4	0.0	0.4	10.0	1.6	192.8	3.0
Sosnowiec	1.8	0.4	0.4	0.9	0.5	0.0	0.0	0.0	0.0	33.4	3.7	278.9	10.5
Tychy	33.2	11.2	20.6	12.0	2.1	0.5	2.6	4.9	6.9	17.1	11.1	92.0	10.2
Wodzisław Śląski	2.4	7.6	5.2	7.6	2.4	2.0	6.8	14.8	8.4	6.4	6.4	59.8	3.8
Zawiercie	4.8	7.3	3.2	11.4	7.3	5.7	15.5	12.3	19.7	18.2	10.5	54.9	5.8
Żywiec	0.7	10.7	12.0	5.3	0.0	0.0	0.0	0.0	7.8	20.2	5.7	122.6	7.0

**Figure 3.** Average incidence rates of hepatitis C (n/100 000 of population) in the districts of the Silesian Province between 2005 and 2014

(45.7/100,000), Lubliniec (46.8/100,000) and Bielsko Biąła (47.6/100,000) in the studied period (2005–2014). The lowest coefficient of variation indicating the stability of the registry was found in Gliwice ($V=33.9\%$), Chorzów ($V=40.5\%$) and Racibórz ($V=44.7\%$) (Tab. 2). Finally, the average incidence rates of hepatitis C for the entire analyzed period (2005–2014) were charted on a map of the Silesian Province (Fig. 3). The presented view confirms a significant variation of the epidemiological surveillance in the districts. The highest value of average hepatitis C incidence in the studied period concerned Chorzów (26.7/100,000), Ruda Śląska (14.9/100,000) and Gliwice (14.2/100,000).

DISCUSSION

Epidemiological monitoring for hepatitis C in Poland conducted as part of the primary activity of the Sanitary Inspection does not reflect the actual prevalence of infections in the population. Among other things, it is associated with the specificity of a prolonged asymptomatic course of the infection, which results in the fact that ~ 80% of infections remain undetected [11].

Another aspect related to under-registration of the disease is probably a relatively low level of awareness of the population

regarding the need for HCV testing. It is known that only 10–40% of the surveyed individuals in 17 European countries were aware of the HCV infection [12]. On the other hand, the cause of probable underestimation of the epidemiological situation of hepatitis C was associated with sensitivity and stability of the surveillance by the State Sanitary Inspection. In Poland between 2011 and 2013, ~ 2,000–3,000 cases of acute and chronic hepatitis C were reported annually. In subsequent years, a significant increase in the number of registered cases was observed, i.e. 3,551 and 4,284 cases in 2014 and 2015, respectively [13].

The results of the presented study provide detailed information on the incidence of hepatitis C in the Silesian Province, considering the temporal and territorial variability. In the last year (2014), an almost two-fold increase in the incidence was observed compared to the value recorded according to the case definition for the purpose of the epidemiological surveillance which has been used since 2005. However, the recorded incidence according to the case definition of 2009 (2009–2013) showed insignificant changes, but a more than three-fold increase in the incidence was reported in 2014. A significant increase in the incidence in the last two years (2013 and 2014) was a result of the introduction of the obligation imposed on the supervisors of analytical laboratories to report positive results of tests for biological pathogens, including HCV [14]. It is likely that most of the registered cases between 2013 and 2014 were chronic infections that had not been detected by that time. Such reasoning is supported by the opinions of experts indicating the low detection of HCV in Poland in relation to other European countries [1, 15]. It may be concluded that the obligation to report positive anti-HCV tests, which was imposed on laboratories, significantly improved the sensitivity of surveillance thus reduced the discussed underestimation of hepatitis C in Poland. On the other hand, it cannot be excluded that the increase in the incidence in the Silesian Province is a result of better access to relevant diagnostic tests and information campaigns conducted by both the State Sanitary Inspection and foundations acting for the benefit of patients with hepatitis C. A significant problem is related to registration and reporting for surveillance the cases and the suspicion of the disease by physicians. Despite appropriate legal regulations, the level of reportability is still highly unsatisfactory in Poland [16, 17].

The obtained results confirm significant differences in the incidence, depending on the gender and age of patients with hepatitis C. The highest rates were related to older groups, aged 45–64. A similar situation was observed in Poland, in accordance with the data of 2014 of the National Institute of Public Health – National Institute of Hygiene, the highest incidence rate was reported in the 55–59 age group, with a higher value related to females. Interestingly, males predominated among younger persons (up to 49 years of age) with the diagnosis of hepatitis C. However, females predominated in the older age group (50–64 years of age). This observation is consistent with the data published by other authors [18], and with previously conducted studies in the Silesian Province (1997–2002) [19].

Three profiles are observed when describing the relationship between HCV transmission pathways in the population and the age of infected individuals. The dominating pathway transmission in the population among people aged 30–49 in Western Europe, the United States, and Australia, are drugs which were intravenously injected. However, the high

prevalence of HCV infections in older people is most likely associated with a higher frequency of medical services (e.g. Japan). Finally, high prevalence of infections noticed in all group ages (e.g. Egypt) is the effect of not following the standards in medical procedures, among others, cutting of tissue continuity [20].

The epidemiological situation of hepatitis C is formed mainly by virus transmission pathways and has undergone significant modifications over the years. The main route of HCV transmission in the population, iatrogenic transmission, due to medical procedures and blood transfusion was significantly reduced in developed countries. This was achieved by the implementation of routine testing of blood donors and improvement in safety in healthcare. Currently in developed countries, the main pathway of infection is related to intravenous drug use [12]. The estimated data suggest that almost half of the people (44%) who use drugs in the European WHO region are infected with HCV-RNA [21]. In Poland, transmission of HCV through blood has been practically eliminated due to diagnostic procedures used in recruiting blood donors [22].

In the presented study, differences in the incidence of hepatitis C with the predominance of younger males may be the effect of diagnostic procedures among donors. Younger men aged 25–44 are the most frequent blood donors in Poland [23]. On the other hand, this study shows a higher incidence in the group of females aged over 50, which may be related to long-term health problems which are more often observed in this group [24].

It is known that multimorbidity and chronicity of diseases are related to numerous hospitalizations and result in the use of multiple medical procedures with the breakdown of tissue integrity. Current data from the epidemiological surveillance presented by the National Institute of Public Health – National Institute of Hygiene in Warsaw demonstrate that of six epidemiological outbreaks of hepatitis C in Poland, as many as five were related to the procedures carried out in healthcare centres [25]. Over 100 infections were observed and the common cause was negligence or ignorance of the medical personnel, e.g. re-use of disposable gloves. Similarly, among 59 epidemiological outbreaks of hepatitis C in the United States, as many as 48 were related to medical procedures in dialysis centres, long-term healthcare and outpatient clinics [26].

The obtained results demonstrate significant changes in the incidence of hepatitis C in the Silesian Province due to legislative changes in the case definition for the purpose of conducting epidemiological surveillance. An increase in the incidence rate is observed among both males and females. It is obvious that detecting additional cases will entail the need to provide funding for the treatment for more patients, which should be considered in the regional map of health needs in the coming years.

The values of standardized rates were twice as low compared to crude rates. Males were predominant among younger infected individuals (aged up to 49 years) and females predominated among older infected individuals (50–64 years of age). Significant differences in the incidence were reported in the districts of the Silesian Province, and the greatest stability of the registry was noted for Chorzów, Gliwice and Racibórz.

Territorial variability of the incidence rate in the examined region has already been demonstrated in an earlier publication

(19). It should be noted that the highest incidence rates of HCV in period 1998–2002 concerned Chorzów and Gliwice. Similar results were obtained in the current observation, which may indicate that the observed variation in the Silesian province is related to the sensitivity of the surveillance system. The epidemiological surveillance introduced in the definition of cases of HCV has not fundamentally changed the image of territorial variability.

CONCLUSIONS

The conducted study allowed the formulation of the following conclusions:

1. In the analyzed period in the Silesian Province, the incidence of HVC increased.
2. The incidence rates of HCV expressed in the standardized rate were higher in males than in the female population.
3. HCV incidence showed territorial variability with the most stable in the period registry for Gliwice, Chorzów and Racibórz.

Acknowledgement

This study was supported by Medical University Grant No. KNW-1-069/K/6/0

REFERENCES

1. Hepatitis C. System report. The need of changes in the organization of health care system. HTA consulting, Krakow 2014; 8.
2. Warunek W, Janczewska E, Pisula A. Interferon-free 3D therapy in a patient after liver transplantation with the reactivation of infection with genotype 1b HCV. *Case Report. Lekarz POZ*, 2015; 1(1): 71–74.
3. Krawczyk M, Grąt M, Kornasiewicz O, et al. Results of liver transplantation in The Department of General, Transplant and Liver Surgery at The Medical University of Warsaw in patients with chronic hepatitis B and C viruses infection, *Przegl Epidemiol*. 2013; 67(1): 5–10.
4. Definitions of cases of infectious diseases for the purposes of epidemiological surveillance, NIPH – NIH Warsaw 2004; 52, http://wwwold.pzh.gov.pl/oldpage/epimeld/inne/Def_PL1_3.pdf [cited 28.10.2016].
5. Definitions of cases of infectious diseases for the purposes of epidemiological surveillance, NIPH – NIH Warsaw 2011; 62, http://wwwold.pzh.gov.pl/oldpage/epimeld/inne/Def_PL2_1h.pdf [cited 28.10.2016].
6. Definitions of cases of infectious diseases for the purposes of epidemiological surveillance, NIPH – NIH Warsaw 2014; 58, http://wwwold.pzh.gov.pl/oldpage/epimeld/inne/Def_PL2_3.pdf [cited 28.10.2016].
7. National Health Programme for 2016–2020. *Journal of Laws of 16th September 2016; (1492)*, Warsaw 2016; <http://www.mz.gov.pl/zdrowie-i-profilaktyka/narodowy-program-zdrowia/npz-2016-2020/cele-operacyjne-npz/> [cited 28.10.2016].
8. Central Statistical Office of Poland, Bank of local data, 2016; <https://bdl.stat.gov.pl/BDLS/> [cited 28.10.2016].
9. Ahmad OB, Boschi-Pinto C, Lopez AD, Murray ChJL, Lozano R, InoueM. Age standardization of rates: a new WHO standard. *GPE Discussion Paper Series 31, EIP/GPE/EBD. WHO 2001*; <http://www.who.int/healthinfo/paper31.pdf> [cited 30.05.2016]
10. ESRI: Mapping platform for your institution, 2016; <http://www.arcgis.com/about> [cited 03.06.2016].
11. World hepatitis C day 28th July 2015, NIPH – NIH, Warsaw 2015, http://gis.gov.pl/images/aktualnosci/150728_dzie%C5%84_wzw_sytuacja_epidemiologiczna_hcv_w_polsce.pdf [cited 03.06.2016].
12. Merkinaitis S, Lazarus JV, Gore C. Addressing HCV infection in Europe: reported, estimated and undiagnosed cases. *Cent Eur J Public Health*. 2008; 16 (3): 106–10.
13. Infectious diseases and poisoning in Poland (annual newsletters), Available from: http://wwwold.pzh.gov.pl/oldpage/epimeld/inne/Def_PL1_3.pdf [cited 28.10.2016].
14. Regulation of the Minister of Health of 25th March 2014 on biological pathogens which are subject to reporting, forms of reports of positive test results of biological pathogens and the circumstances of reporting such cases (*Journal of Laws of 2014, item 459, Warsaw, 08.04.2014*); <http://isap.sejm.gov.pl/DetailsServlet?id=WDU20140000459> [cited 28.10.2016].
15. Kobierski J, Hałdaś M, Władysiek M. Hepatitis C – the implications and the need for change in the health care system in Poland. *J Health Policy Outcomes Res*. 2014; 2: 26–34. http://www.jhpor.com/index/artykul/pokaz/hepatitis_c_the_implications_and_the_need_for_change_in_the_health_care_system_in_poland, [cited 28.10.2016].
16. The Act on the Prevention and Combating of Infections and Infectious Human Diseases, (*Journal of Laws no 234, item 1570, 30.12.2008*), [cited 28.10.2016].
17. Godala M, Szatko F. Reportability of infectious diseases. Part I. The assessment of the awareness of physicians related to reporting infectious diseases to the sanitary inspection. *Probl Hig Epidemiol*. 2010; 91(2): 198–205.
18. Infectious diseases and poisoning in Poland (2014, annual newsletter), 2014; http://wwwold.pzh.gov.pl/oldpage/epimeld/2014/Ch_2014.pdf [cited 28.10.2016].
19. Kowalska M, Zejda J.E. Cases of hepatitis C virus (HCV) in the Silesian Province between 1997 and 2002. *Przegl Epidemiol*. 2004; 58(3): 435–444.
20. Bruno Pozzetto, Meriam Memmi, Olivier Garraud, Xavier Roblin, and Philippe Berthelot. Health care-associated hepatitis C virus infection, *World J Gastroenterol*. 2014; 14, 20(46): 17265–17278.
21. Negro F. Epidemiology of hepatitis C in Europe. *Digestive and Liver Disease* 2014; 46, (1): 58–164, [cited 10.10.2016].
22. Raciborski F, Gujski M, Kłak A, Gierczyński J. HCV in Poland. The strategy to solve the health problem and actions in the perspective of 2015 and 2016 Report, Institute for Health Protection, Warsaw 2015; 16 [cited 28.10.2016].
23. Health and health care in 2014. Central Statistical Office of Poland, Warsaw 2015; 127. http://stat.gov.pl/cps/rde/xbcr/gus/zo_zdrowie_i_ochrona_zdrowia_w_2014.pdf [cited 28.10.2016].
24. Health and health care in 2011, Central Statistical Office of Poland, Warsaw 2012; 175. http://stat.gov.pl/cps/rde/xbcr/gus/zo_zdrowie_i_ochrona_zdrowia_w_2011.pdf [cited 28.10.2016].
25. Stępień M, Rosińska M. Hepatitis c outbreaks in Poland in 2003–2013. Medical procedures as a dominant route of HCV transmission. *Przegl Epidemiol*. 2015; 69(3): 465–472.
26. Healthcare-Associated Hepatitis B and C Outbreaks Reported to the Centers for Disease Control and Prevention (CDC) USA 2008–2015; 1–29. <http://www.cdc.gov/hepatitis/outbreaks/pdfs/healthcareinvestigationtable>. [cited 10.10.2016].