

# The micro-elimination approach - a new way of tackling hepatitis C in paediatric population

---

## Type

Review paper (After Acceptance of EIC)

---

## Keywords

HCV, DAA, novel strategies, micro-elimination, HCV cascade of care

---

## Abstract

Recent advances in antiviral drug development towards HCV have revolutionized the therapy and paved the way towards the elimination of chronic hepatitis C (CHC). Difficulties in achieving time-bound elimination targets of the World Health Organization's Global Strategy on viral hepatitis might be overcome through a novel micro-elimination approach. A new, emerging strategy assumes to focus elimination efforts on high-risk and left behind populations, and therefore allows for quick, efficient targeting of treatment and prevention services. So far, gaps in antenatal and/or paediatric care, lack of reimbursement and approval of direct-acting antivirals (DAA) in the paediatric population have been a barrier to access treatment leading to marginalization of children and adolescents. Only recently approved DAAs for use in children aged  $\geq 3$  years seem to be the cornerstone of HCV elimination by reducing the risk of future horizontal and vertical transmission, firstly on a national, and ultimately on a global level.

Preprint

## Introduction

According to the World Health Organization's (WHO) Global Strategy, viral hepatitis should be eliminated as a serious public health threat by 2030. An estimated 90% decrease in the number of new chronic hepatitis C (CHC) cases, a 65% decrease in hepatitis C virus (HCV)-associated mortality, and the treatment coverage of 80% of all eligible patients are assumed [1]. Many countries will need to substantially intensify their HCV control efforts to meet aforesaid targets. These ambitious goals might be achieved by the implementation or enhancement of HCV cascade of care. It consists of HCV prevalence estimation, identification of individuals with CHC and linking them to care, assessment of liver disease, introduction of antiviral treatment, achievement of clinical cure (defined as sustained viral response - SVR), and post-SVR follow-up (screening for cirrhosis, hepatocellular carcinoma (HCC), and other HCV-related liver diseases) [2–4]. HCV cascade of care varies across regions. It reflects the disparities in the burden of hepatitis C and dynamics of public health response, and leads to an identification of gaps in care (e.g. those lost to follow-up- LTFU) and foci for improvement [2,5]. There are many challenges across the care cascade. Significant economic burden results mainly from diagnosis- and medication-related costs. Unfortunately, HCV infection often remains undiagnosed. Although there are highly effective direct-acting antivirals (DAA) available, the rates of treatment initiation continue to be low. According to the WHO, in 2015, only 20% of HCV-infected individuals worldwide were aware of their health status and treatment was started by less than 10% of them [6]. Such results are unsatisfactory and pose a challenge for the time-bound goals of mass-screening approach of the Global Strategy.

## **Micro-elimination - a novel emerging strategy and a target subpopulation**

HCV elimination progress varies even across European countries. To overcome all formidable obstacles, micro-elimination strategy is suggested. Micro-elimination is defined as a pragmatic approach which allows for the identification of realistic goals of HCV elimination, distribution of resources and assistance for local specialists in the process of intervention modification, delivery and enhancement [3,7]. Compared to the comprehensive, country-level actions undertaken to eliminate HCV, this approach is less costly [8]. Provided that elimination efforts are focused on smaller affected populations, tailored treatment and prevention services would be introduced quickly and effectively [9].

Micro-elimination is a novel concept of HCV elimination in a defined group of people (e.g. HIV-infected individuals, people who inject drugs, prisoners, people affected by haemophilia, and children), settings (e.g. hospitals, addiction treatment centers), age cohorts (e.g. baby-boomers) or geographic areas (e.g. city or region). This strategy substantially increases the chances for success as it supports actions undertaken towards national elimination [3,8,10]. In line with the micro-elimination concept, specific models of patient-oriented services should be determined throughout the HCV cascade of care, especially for high-risk groups and marginalized populations. Children and adolescents also belong to this group as DAA regimens could not have been used in persons below the age of 18 years until 2017. Furthermore, high costs related to the production of paediatric formulations could have impeded the access to treatment in those groups [3,11]. Additionally, adolescents are prone to HCV infections. It is reflected by the increase in the number of young individuals who inject drugs, teenage pregnancies, migration, and populations displaced from conflict zones with no access to

health care or support [11]. Irrespective of the high socioeconomic and long-term benefits resulting from investing in child and adolescent health, only few national viral hepatitis policies address these vulnerable populations, including testing, treatment, and preventive strategies.

### **Epidemiology of CHC in children**

Therefore, the availability of reliable, national data on HCV epidemiology is crucial for accurate assessment of potential subpopulations for micro-elimination and understanding when the target population may drop out of the continuum of care [10]. Compared to adults, the prevalence of HCV infection is lower in children. In 2018, the global prevalence of HCV infection in the group of individuals aged 0–18 years was 0.13% (95% uncertainty interval 0.08–0.16) which corresponds to 3.26 million (2.07–3.90) viremic paediatric patients [12]. Egypt (with an estimated prevalence 2%-9% depending on the region), Sub-Saharan Africa, the Amazon Basin, and Mongolia are the most affected regions. The average prevalence is reported in developing countries (1.8%-5.8%) while the lowest prevalence is reported in the United States and Europe (0.05%-0.36%) [11,13–17].

HCV prevalence in the European paediatric population varies largely between countries due to different past and current risk factors and standards of care. Eastern Europe has the highest HCV prevalence in the paediatric population among Global Burden of Disease regions estimated at 0.4% in comparison with the Western and Central Europe (0.04% and 0.09%, respectively) [12]. The countries with the highest HCV prevalence are: Ukraine (0.54%), Moldavia (0.44%), Belarus (0.41%), Romania (0.21%) and Bulgaria (0.1%) [12]. The lowest prevalence is reported in the Netherlands and Norway

(0.02%), a slightly higher prevalence of 0.03% is observed in Austria, Belgium, France, Germany, Hungary and Spain [12].

In Poland, epidemiological data on hepatitis C is available since 1997, when this disease was included in routine epidemiological surveillance. Recently, a significant reduction in the number of newly detected HCV infections in the group of children and adolescents is observed (Table I).

### **Mother-to-child transmission of HCV and probable gaps in the screening strategy**

Mother-to-child transmission (MTCT) is the main mode of HCV transmission in paediatric population. Moreover, it may still substantially increase the burden of hepatitis C [8,10,18–24]. An estimated risk of vertical transmission is about 5% in a group of women with detectable HCV-RNA. The risk of transmission is much higher (10.8%–25%) in HIV/HCV-coinfected women if HIV coinfection is not adequately controlled [25–27]. The following modes of transmission are the most common in teenagers: injecting drug use, high-risk sexual practices, mainly among men who have sex with men, and tattooing in unregulated settings. In developing countries HCV is still transmitted through iatrogenic mode in the youngest population [16,27,28]. In Poland, about 4000-8000 children annually are born to mothers infected with HCV [29,30]. The average risk of vertical transmission is estimated at 8.2% [31,32]. HCV transmission occurs mainly in the perinatal period and during delivery [22,33,34]. Although, MTCT is the main mode of HCV transmission in paediatric population, especially in high-income countries, the identification of HCV-exposed children is hampered. Some researchers report, that even up to 70% of children born to HCV-infected mothers might

not have been subject to screening or follow-up adequately. Therefore, they are not included in observation (LTFU) [35].

Although HCV RNA testing is reliable in children aged two months, HCV antibody test results in children below the age of 18 months are inaccurate as antibodies may come from the infected mother (maternal antibodies). Therefore, this test cannot be used to confirm HCV infection [36]. It is a common phenomenon that the levels of HCV RNA fluctuate in infants, mainly during the first 2-4 years of life, which could lead to misdiagnosis. Spontaneous clearance of HCV infection is reported in approximately 25%-40% of infected children (loss of HCV RNA that was detectable earlier), while the remaining percentage of children would develop CHC (viral replication is detectable for at least six months) [18,24,27,37-40]. The absence of adequate screening strategy in children may lead to the situation in which children being at risk for perinatal transmission may not be diagnosed until hepatitis C symptoms would appear or abnormal levels of liver enzymes would be detected incidentally. However, detection is challenging as the progress of HCV infection appears to be slower in children than adults. Thus, the majority of children remain asymptomatic during childhood [27]. Consequently, delayed diagnosis could contribute to delayed referrals and treatment which may result in irreversible liver disease (e.g. cirrhosis or hepatocellular carcinoma) and broad spectrum of extrahepatic manifestations [35,41].

Although, histopathological changes in liver tissue are characterized by low inflammatory activity and low stages of fibrosis (unlike in adults), they progress over the time. In case of 2-5% of infected children, they may lead to serious liver damage, including cirrhosis (1.8%) and hepatocellular carcinoma (HCC; rarely encountered, a few case reports) [13,14,19,27,39,42].

Universal screening for hepatitis C in pregnant women is a rapidly evolving area. It could improve the health of mothers and identification of children at risk. However, it is associated with logistic and political considerations. Based on the cost-effectiveness analysis, the WHO does not recommend universal/antenatal screening in populations with the prevalence of anti-HCV below 2% [43,44]. In Poland, the prevalence of anti-HCV antibodies is estimated at 0.86%-1.9% (depending on the population tested and the sampling methodology used), while the percentage of people with detectable replication of HCV is about 0.47-0.6% [45–47]. The prevalence of anti-HCV antibodies in pregnant women is estimated at 0.8% [47]. From a pilot study carried out in pregnant women living in the Mazowieckie Province transpires that anti-HCV antibodies were detected in 2.02% of all women tested [31,32]. Act on Pregnant Woman Care introduced in 2010 in Poland recommended routine anti-HCV screening in all pregnant women. It resulted in the increase of the percentage of HCV infections diagnosed in women who did not report any risk factors during interview (9.9% vs 46.1% before and after 2010, respectively). Significant involvement of obstetricians contributed to the increase in the percentage of HCV-infections detected in pregnant women (21.5% vs 30.8% before and after 2010, respectively) [48]. A recent report revealed that the peak of HCV infection diagnoses is observed in women aged 25-29 years [49]. This increase results from legal requirements for prenatal standard of care throughout pregnancy, with compulsory HCV testing for pregnant women from 2012 onwards [47]. **Maternity** care settings are one of the dominant reasons for anti-HCV antibodies testing in women at the age of 30-39 years.

### **The role of early diagnosis and access to treatment**

Detection of hepatitis C in mothers promotes testing for HCV in their children [50].

Early diagnosis in children enables prompt linkage to care and assessment of liver disease. There are several diagnostic procedures used to assess the grades and stages of liver disease. Previously, liver biopsy was performed as a standard procedure.

Currently, noninvasive methods are mainly selected. Although they would allow for the stratification of disease severity, further validation is required in paediatric population.

So far, the access to treatment has been impeded by high cost, non-reimbursement and lack of approval of new DAA regimens in the younger age groups. Consequently, it generates difficulties in achieving ambitious WHO's targets for HCV elimination [51,52]. Fortunately, a number of significant changes were introduced to DAA registration recently in Europe which revolutionized the therapy of hepatitis C.

In 2017, the Food and Drug Administration and European Medicines Agency (EMA) registered first DAA-based regimens (fixed-dose combination of ledipasvir/sofosbuvir and the combination of sofosbuvir and ribavirin) for adolescents with CHC aged 12–17 years or weighing >35 kg.

Since July 2020, a combination of ledipasvir and sofosbuvir is approved by the EMA to be used in children who are at least 3 years of age. Moreover, in September, a pangenotypic combination regimen (sofosbuvir/velpatasvir) was authorized to be used in children who are at least 6 years of age or weigh at least 17 kg. It is not feasible to predict the critical time of disease progression in early adulthood, thus, early introduction of treatment is considered to be of high cost-effectiveness [53]. Moreover, treatment of HCV-infected children is of utmost importance since early eradication of HCV is essential for preventing high-risk teenager behaviours contributing to the transmission of infection. Oral treatment options characterized by high effectiveness,

safety profile, and simplicity of use are needed to improve treatment coverage in HCV-infected paediatric population [11]. Irrespective of the high cure rates of DAA (> 95%), the access to this treatment for children and adolescents still remains a major concern in Poland as it is not reimbursed by the National Health Found (NHF) [54]. Therefore, it is not included in the national therapeutic programmes for hepatitis C. Such treatment is used as a part of enrollment into clinical trials. So far, marginalized paediatric population, has finally an opportunity to be cured. **Since July 2019, a non-commercial POLAC Project (Treatment of Polish Adolescents with Chronic Hepatitis C using Direct Acting Antivirals) is offering sofosbuvir/ledispavir for adolescents (aged over 12 years) with HCV genotype 1 and 4.**

Moreover, ongoing study in Warsaw financed by the Medical Research Agency will offer treatment with a newly approved regimen of sofosbuvir/velpatasvir for children over 6 years of age in 2021 **(regardless of the disease severity and HCV genotype).**

Broad access to DAA regimens would allow for HCV elimination in population by decreasing the risk of future horizontal and vertical transmission. Furthermore, HCV-infected children would have a chance to live without potential stigma and psychological consequences associated with living with chronic contagious disease [55].

## **Conclusion**

Having considered the absence of an effective vaccine for HCV, treatment with the new DAAs seems to be the cornerstone of HCV elimination (treatment is also a potent method of prevention) [56]. Since there were revolutionary changes in the pharmacological management of HCV infection in children with cure rates reaching

>95%, it is of utmost importance to reach this population. Engagement of this group would be essential for success in HCV elimination on the national, and ultimately on the global level.

Preprint



## References

1. World Health Organization (WHO). Global Health Sector Strategy on Viral Hepatitis 2016-2021. Toward Ending Viral Hepatitis. Geneva; 2016.
2. van Dijk M, Drenth JPH, Arends JE, et al. Loss to follow-up in the hepatitis C care cascade: A substantial problem but opportunity for micro-elimination. *J Viral Hepat.* 2020; 27(12):1270-1283.
3. Matičič M, Lombardi A, Mondelli MU, Colombo M. Elimination of hepatitis C in Europe: can WHO targets be achieved? *Clin Microbiol Infect.* 2020;26(7):818-823.
4. Safreed-Harmon K, Blach S, Aleman S, Kielland K, Bollerup S. The Consensus Hepatitis C Cascade of Care: standardized reporting to monitor progress toward elimination. *Clin Infect Dis.* 2019;69(12):2218-2227.
5. Thomas DL. State of the Hepatitis C Virus Care Cascade. *Clin Liver Dis.* 2020;16(1):8-11.
6. World Health Organization (WHO). Global Hepatitis Report 2017. Geneva; 2017.
7. Busschots D, Toghanian S, Bielen R, et al. Eliminating viral hepatitis C in Belgium: The micro-elimination approach. *BMC Infect Dis.* 2020;20(1):1-12.
8. Lazarus J V., Safreed-Harmon K, Thursz MR, et al. The Micro-Elimination Approach to Eliminating Hepatitis C: Strategic and Operational Considerations. *Semin Liver Dis.* 2018;38(3):181-192.
9. The Lancet HIV. Microelimination could be a big deal for HCV and HIV services. *Lancet HIV.* 2018;5(11):e605.
10. Lazarus J V., Wiktor S, Colombo M, Thursz M. Micro-elimination – A path to

- global elimination of hepatitis C. *J Hepatol.* 2017;67(4):665-666.
11. El-Sayed MH, Indolfi G. Hepatitis C Virus Treatment in Children: A Challenge for Hepatitis C Virus Elimination. *Semin Liver Dis.* 2020; 40(3):213-224.
  12. Schmelzer J, Dugan E, Blach S, et al. Global prevalence of hepatitis C virus in children in 2018: a modelling study. *Lancet Gastroenterol Hepatol.* 2020;5(4):374-392.
  13. Abd-Elgawad MM, Baddour NM, Salem MAE. Chronic hepatitis C in children: Clinical spectrum and histopathological study. *Alexandria J Med.* 2013;49(4):363-368.
  14. Baker RD, Baker SS. Hepatitis C in children in times of change. *Curr Opin Pediatr.* 2015;27(5):614-618.
  15. Gower E, Estes C, Blach S, Razavi-Shearer K, Razavi H. Global epidemiology and genotype distribution of the hepatitis C virus infection. *J Hepatol.* 2014;61(1):45-57.
  16. Jonas MM. Children With Hepatitis C. *Hepatology.* 2002;36:S173-S178.
  17. Spearman CW, Dusheiko GM, Hellard M, Sonderup M. Hepatitis C. *Lancet.* 2019;394(10207):1451-1466.
  18. Abdel-Hady M, Bunn SK, Sira J, et al. Chronic hepatitis C in children - review of natural history at a National Centre. *J Viral Hepat.* 2011;18:e535-e540.
  19. Bortolotti F, Verucchi G, Cammà C, et al. Long-Term Course of Chronic Hepatitis C in Children: From Viral Clearance to End-Stage Liver Disease. *Gastroenterology.* 2008;134(7):1900-1907.
  20. Westbrook RH, Dusheiko G. Natural history of hepatitis C. *J Hepatol.* 2014;61(1):58-68.

21. England K, Thorne C, Harris H, Ramsay M, Newell ML. The impact of mode of acquisition on biological markers of paediatric hepatitis C virus infection. *J Viral Hepat.* 2011;18(8):533-541.
22. Indolfi G, Azzari C, Resti M. Perinatal transmission of hepatitis C virus. *J Pediatr.* 2013;163(6):1549-1552.
23. Negro F. Epidemiology of hepatitis C in Europe. *Dig Liver Dis.* 2014;46 (5):158-164.
24. The European Paediatric Hepatitis C Virus Network. Three broad modalities in the natural history of vertically acquired hepatitis C virus infection. *Clin Infect Dis.* 2005;41(1):45-51.
25. Benova L, Mohamoud YA, Calvert C, Abu-Raddad LJ. Vertical transmission of hepatitis C virus: systematic review and meta-analysis. *Clin Infect Dis.* 2014;59(6):765-773.
26. Cornberg M, Razavi HA, Alberti A, et al. A systematic review of hepatitis C virus epidemiology in Europe, Canada and Israel. *Liver Int.* 2011;31:30-60.
27. Indolfi G, Easterbrook P, Dusheiko G, et al. Hepatitis C virus infection in children and adolescents. *Lancet Gastroenterol Hepatol.* 2019;4(6):477-487.
28. Cesaro S, Bortolotti F, Petris MG, Brugiolo A, Guido M, Carli M. An Updated Follow-Up of Chronic Hepatitis C After Three Decades of Observation in Pediatric Patients Cured of Malignancy. *Pediatr Blood Cancer.* 2010;55:108-112.
29. Aniszewska M, Kowalik-Mikołajewska B, Pluta M, Pokorska-Śpiewak M, Marczyńska M. Matka zakażona HCV i jej dziecko. *Zakażenia.* 2014;2:2-8.
30. Aniszewska M, Kowalik-Mikołajewska B, Pluta M, Marczyńska M. Zakażenie wertykalne HCV. *Stand Med.* 2013;4:481-486.

31. Aniszewska M, Kowalik-Mikołajewska B, Pokorska-Lis M, Kalinowska M, Cianciara J, Marczyńska M. Częstość występowania przeciwciał anti-HCV i kobiet ciężarnych. Analiza czynników ryzyka zakażenia HCV. *Przeegl Epidemiol.* 2009;63(2):293-298.
32. Aniszewska M, Kowalik-Mikołajewska B, Pokorska-Lis M, Kalinowska M, Marczyńska M. Zakażenie odmatczyne HCV- czy możemy mieć wpływ na częstość zakażenia i jego przebieg? *Przeegl Lek.* 2010;67(1):9-12.
33. Mast EE, Hwang L-Y, Seto DSY, et al. Risk factors for perinatal transmission of hepatitis C virus (HCV) and the natural history of HCV infection acquired in infancy. *J Infect Dis.* 2005;192:1880-1889.
34. Mok J. When does mother to child transmission of hepatitis C virus occur? *Arch Dis Child Fetal Neonatal Ed.* 2005;90(2):F156-F160.
35. Chappell CA, Hillier SL, Crowe D, Meyn LA, Bogen DL, Krans EE. Hepatitis C virus screening among children exposed during pregnancy. *Pediatrics.* 2018;141(6).
36. Polywka S, Pembrey L, Tovo P-A, Newell M-L. Accuracy of HCV-RNA PCR Test. *Anticancer Res.* 2010;30(12):4799-4804.
37. Garazzino S, Calitri C, Versace A, et al. Natural history of vertically acquired HCV infection and associated autoimmune phenomena. *Eur J Pediatr.* 2014; 173(8):1025-1031.
38. Indolfi G. Chronic hepatitis C virus infection in children and adolescents: Epidemiology, natural history, and assessment of the safety and efficacy of combination therapy. *Adolesc Health Med Ther.* 2010;1:115-128.
39. Khaderi S, Shepherd R, Goss JA, Leung DH. Hepatitis C in the pediatric

- population: Transmission, natural history, treatment and liver transplantation. *World J Gastroenterol.* 2014;20(32):11281-11286.
40. Yeung L. Mother-to-infant transmission of hepatitis C virus. *Hepatology.* 2001;34(2):223-229.
41. Poliwczak AR, Białkowska J, Woźny J, et al. Cardiovascular risk assessment by electrocardiographic Holter monitoring in patients with chronic hepatitis C. *Arch Med Sci* 2020; 16: 1031–1039
42. Pokorska-Śpiewak M, Dobrzeniecka A, Lipińska M, Tomasik A, Aniszewska M, Marczyńska M. Liver Fibrosis Evaluated With Transient Elastography in 35 Children With Chronic Hepatitis C Virus Infection. *Pediatr Infect Dis J.* 2020; doi: 10.1097/INF.0000000000002913. Epub ahead of print. PMID: 33021594.
43. Urbanus AT, van Keep M, Matser AA, et al. Is Adding HCV Screening to the Antenatal National Screening Program in Amsterdam, The Netherlands, Cost-Effective? *PLoS One.* 2013;8(8):1-9.
44. World Health Organization. WHO Guidelines on Hepatitis B and C Testing 2017. Vol 66. Geneva; 2017.
45. Rosińska M, Parda N, Kołakowska A, et al. Factors associated with hepatitis C prevalence differ by the stage of liver fibrosis: A cross-sectional study in the general population in Poland 2012-2016. *PLoS One.* 2017;12(9):e0185055.
46. Flisiak R, Halota W, Horban A, Juszczak J, Pawłowska M, Simon K. Prevalence and risk factors of HCV infection in Poland. *Eur J Gastroenterol Hepatol.* 2011;23(12):1213-1217.
47. Walewska-Zielecka B, Religioni U, Juszczak G, et al. Anti-hepatitis C virus seroprevalence in the working age population in Poland, 2004 to 2014. *Euro*

- Surveill. 2017;22(2):1-9.
48. Aniszewska M, Pokorska-Śpiewak M, Kowalik-Mikołajewska B, Pluta M, Marczyńska M. Hepatitis C infection among pregnant women in central Poland: Significance of epidemiological anamnesis and impact of screening tests to detect infection. *Adv Clin Exp Med.* 2019;28(3):313-318.
  49. Zakrzewska K, Stępień M, Rosińska M. Hepatitis C in Poland in 2018 / Wirusowe zapalenie wątroby typu C w Polsce w 2018 roku. *Przeegl Epidemiol.* 2020;74(2):209-222.
  50. El-Shabrawi M, Kamal N, Mogahed E, Elhousseini M, Aljabri M. Perinatal transmission of hepatitis C virus: an update. *Arch. Med. Sci.* 2020;16(6):1360–1369.
  51. Leblebicioglu H, Arends JE, Ozaras R, et al. Availability of hepatitis C diagnostics and therapeutics in European and Eurasia countries. *Antiviral Res.* 2018;150:9-14.
  52. Myers S, Khosa G, Kuo IF, Janzen D, Alessi-Severini S. Moving towards universal coverage of direct-acting antiviral therapies for hepatitis c infection in canada: An environmental scan of canadian provinces and international jurisdictions. *J Pharm Pharm Sci.* 2018;21(1S):271s-308s.
  53. Nguyen J, Barritt A, Jhaveri RR. Cost effectiveness of early treatment with direct-acting antiviral therapy in adolescent patients with hepatitis C infection. *J Pediatr.* 2019;107:90-96.
  54. Zarębska-Michaluk D, Piekarska A, Jaroszewicz J, et al. Efficacy of 8- versus 12-week treatment with ledipasvir/sofosbuvir in chronic hepatitis C patients eligible for 8 week regimen in a real-world setting. *Arch Med Sci* 2019; 1-7. DOI:

[10.5114/aoms.2019.86569](https://doi.org/10.5114/aoms.2019.86569)

55. Indolfi G, Bailey H, Serranti D, et al. Treatment and monitoring of children with chronic hepatitis C in the Pre-DAA era: A European survey of 38 paediatric specialists. *J Viral Hepat.* 2019;26(8):961-968.
  56. Hollande C, Parlati L, Pol S. Micro-elimination of hepatitis C virus. *Liver Int.* 2020;40(S1):67-71.
- 

Preprint

Table I. Hepatitis C reported in Poland in 2005-2018. Number of cases (n) and rate per 100,000 population by age groups and all reported cases (children + adolescents + adults).

Year	Age groups								Total	
	0-4		5-9		10-14		15-19			
	n	rate	n	rate	n	rate	n	rate	n	rate
2018	9	0,47	5	0,25	3	0,16	10	0,54	3442	8,96
2017	11	0,58	10	0,48	5	0,27	23	1,22	4010	10,44
2016	15	0,80	7	0,34	4	0,22	23	1,18	4261	11,09
2015	14	0,73	8	0,39	10	0,55	32	1,59	4285	11,14
2014	3	0,15	5	0,25	3	0,16	27	1,30	3076	7,99
2013	7	0,35	1	0,05	5	0,27	32	1,47	2705	7,03
2012	9	0,44	5	0,27	2	0,11	58	2,56	2359	6,12
2011	10	0,48	4	0,22	11	0,56	55	2,32	2151	5,58
2010	2	0,10	1	0,11	4	0,20	85	3,44	2111	5,53
2009	6	0,31	2	0,11	11	0,53	95	3,69	1939	5,08
2008	10	0,54	5	0,27	8	0,37	159	5,97	2353	6,17
2007	4	0,22	5	0,26	19	0,84	178	6,48	2753	7,22
2006	7	0,39	4	0,21	37	1,59	178	6,29	2949	7,73
2005	8	0,45	5	0,25	49	1,97	179	6,12	2997	7,85

Note. Data from annual reports of NIZP-PZH and Chief Sanitary Inspectorate "Infectious diseases and poisonings in Poland" retrieved from [http://wwwold.pzh.gov.pl/oldpage/epimeld/index\\_p.html#01](http://wwwold.pzh.gov.pl/oldpage/epimeld/index_p.html#01)