

Hepatitis D double reflex testing of all hepatitis B carriers in low-HBV- and high-HBV/HDV-prevalence countries

Homie A. Razavi^{1,*}, Maria Buti², Norah A. Terrault³, Stefan Zeuzem⁴, Cihan Yurdaydin⁵, Junko Tanaka⁶, Alessio Aghemo^{7,8}, Ulus S. Akarca⁹, Nasser M. Al Masri¹⁰, Abduljaleel M. Alalwan¹¹, Soo Aleman¹², Abdullah S. Alghamdi¹³, Saad Alghamdi¹⁴, Waleed K. Al-Hamoudi¹⁵, Abdulrahman A. Aljumah¹⁶, Ibrahim H. Altraif¹⁷, Tarik Asselah¹⁸, Ziv Ben-Ari^{19,20}, Thomas Berg²¹, Mia J. Biondi²², Sarah Blach²³, Wornei S.M. Braga²⁴, Carlos E. Brandão-Mello^{25,26}, Maurizia R. Brunetto^{27,28}, Joaquin Cabezas^{29,30}, Hugo Cheinquer³¹, Pei-Jer Chen³², Myeong-Eun Cheon³³, Wan-Long Chuang³⁴, Carla S. Coffin³⁵, Nicola Coppola³⁶, Antonio Craxi³⁷, Javier Crespo^{38,39}, Victor De Ledinghen⁴⁰, Ann-Sofi Duberg⁴¹, Ohad Etzion^{42,43}, Maria Lucia G. Ferraz⁴⁴, Paulo R.A. Ferreira⁴⁵, Xavier Forns⁴⁶, Graham R. Foster⁴⁷, Giovanni B. Gaeta⁴⁸, Ivane Gamkrelidze¹, Javier García-Samaniego⁴⁹, Liliana S. Gheorghe^{50,51}, Pierre M. Gholam⁵², Robert G. Gish⁵³, Jeffrey Glenn⁵⁴, Julian Hercun⁵⁵, Yao-Chun Hsu⁵⁶, Ching-Chih Hu⁵⁷, Jee-Fu Huang⁵⁸, Naveed Janjua⁵⁹, Jidong Jia⁶⁰, Martin Kåberg⁶¹, Kelly D.E. Kaita⁶², Habiba Kamal¹², Jia-Hong Kao⁶³, Loreta A. Kondili⁶⁴, Martin Lagging^{65,66}, Pablo Lázaro⁶⁷, Jeffrey V. Lazarus⁶⁸, Mei-Hsuan Lee⁶⁹, Young-Suk Lim⁷⁰, Paul J. Marotta⁷¹, Maria-Cristina Navas⁷², Marcelo C.M. Naveira¹, Mauricio Orrego^{73,74}, Carla Osioy⁷⁵, Calvin Q. Pan⁷⁶, Mário G. Pessoa⁷⁷, Giovanni Raimondo⁷⁸, Alnoor Ramji⁷⁹, Devin M. Razavi-Shearer¹, Kathryn Razavi-Shearer¹, Cielo Y. Ríos-Hincapié⁸⁰, Manuel Rodríguez⁸¹, William M.C. Rosenberg⁸², Dominique M. Roulot⁸³, Stephen D. Ryder⁸⁴, Rifaat Safadi⁸⁵, Faisal M. Sanai⁸⁶, Teresa A. Santantonio⁸⁷, Christoph Sarrazin^{88,89}, Daniel Shouval⁸⁵, Frank Tacke⁹⁰, Tammo L. Tergast⁹¹, Juan Miguel Villalobos-Salcedo⁹², Alexis S. Voeller¹, Hwai-I Yang^{69,93,94,95}, Ming-Lung Yu^{96,97,98}, Eli Zuckerman⁹⁹, on behalf of the Polaris Observatory

Summary

Hepatitis D virus (HDV) infection occurs as a coinfection with hepatitis B and increases the risk of hepatocellular carcinoma, decompensated cirrhosis, and mortality compared to hepatitis B virus (HBV) mono-infection. Reliable estimates of the prevalence of HDV infection and disease burden are essential to formulate strategies to find coinfecting individuals more effectively and efficiently. The global prevalence of HBV infections was estimated to be 262,240,000 in 2021. Only 1,994,000 of the HBV infections were newly diagnosed in 2021, with more than half of the new diagnoses made in China. Our initial estimates indicated a much lower prevalence of HDV antibody (anti-HDV) and HDV RNA positivity than previously reported in published studies. Accurate estimates of HDV prevalence are needed. The most effective method to generate estimates of the prevalence of anti-HDV and HDV RNA positivity and to find undiagnosed individuals at the national level is to implement double reflex testing. This requires anti-HDV testing of all hepatitis B surface antigen-positive individuals and HDV RNA testing of all anti-HDV-positive individuals. This strategy is manageable for healthcare systems since the number of newly diagnosed HBV cases is low. At the global level, a comprehensive HDV screening strategy would require only 1,994,000 HDV antibody tests and less than 89,000 HDV PCR tests. Double reflex testing is the preferred strategy in countries with a low prevalence of HBV and those with a high prevalence of both HBV and HDV. For example, in the European Union and North America only 35,000 and 22,000 cases, respectively, will require anti-HDV testing annually.

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Background

Hepatitis D virus (HDV) infection, which occurs as a coinfection with hepatitis B, increases the risk of hepatocellular carcinoma (HCC), decompensated cirrhosis, and mortality 3.2- (95% CI 1.0–10.0), 2.2- (95% CI 0.8–5.7), and 2.0- (95% CI 0.7–5.7) fold, respectively, compared to hepatitis B virus (HBV) mono-infections.^{1–5} Therefore, reliable estimates of the prevalence of

HDV infection and disease burden are essential to formulate strategies to find coinfecting individuals more effectively and efficiently. Early diagnosis of HDV will also allow for more appropriate counselling (e.g., reduce alcohol consumption, lose weight) to reduce the risk of disease progression and prevent HDV transmission, interventions including antiviral treatment, and follow-up (ultrasound and HCC surveillance). In

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* Corresponding author. Address: Center for Disease Analysis Foundation, 1120 W. South Boulder Rd. Suite 102, Lafayette, CO, 80026, United States. Tel.: (720) 890 4848.

E-mail address: hrazavi@cdafound.org (H.A. Razavi).

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Key points

- Accurate estimates of the prevalence of anti-HDV and HDV RNA positivity are needed to assess the national, regional and global disease burden.
- We recommend double reflex testing of all HBV-infected individuals for anti-HDV and HDV RNA.
- The burden of double reflex testing (anti-HDV and PCR) will be small as only newly diagnosed HBV cases will require testing.
- Globally, less than 2 million people will require anti-HDV testing and less than 90,000 will require PCR testing.
- This recommendation makes the most sense in countries with a low prevalence of HBV and those with a high prevalence of HBV and HDV (*i.e.* most countries).

addition, early detection of complications will save lives by enabling appropriate interventions (*e.g.*, liver transplantation or HCC treatment). Knowledge of HDV infection will raise awareness of the infection among healthcare professionals with potential access to therapy and may empower patients to take action.

Methods

The Polaris Observatory started the task of quantifying the global prevalence of HDV infection. A comprehensive literature review was conducted to determine the prevalence of anti-HDV and HDV-RNA positivity for individual countries/territories. Virtual meetings were held with experts from each setting to discuss the literature search findings and collect unpublished data/reports. The crude reported prevalence was adjusted for patient segments and regional heterogeneity to estimate the adjusted HDV prevalence in the HBV-infected population. The findings were then combined with the Polaris Observatory HBV data (6) to estimate the overall prevalence of anti-HDV and HDV-RNA positivity in each country/territory at the population level.

The number of newly diagnosed HBV infections in each country was updated annually using the following methodologies: In countries where HBV surface antigen (HBsAg) was a notifiable infection, the annual reported data was collected. In countries where the number of newly diagnosed cases was not available, expert panel input was used. Lastly, the secant method was used to solve for the proportion of diagnosed HBsAg-infected population to match the reported number of diagnosed cases to modelled in a given year.⁷ This method assumed that at base, those in later stages of the disease are more likely to be diagnosed than those in earlier stages. Details of the data sources for each country were described previously in Table 6 of Appendix.⁶

For countries where no data was available, the weighted average of countries within the same region, as defined by the Global Burden of Diseases, was applied. The regional estimates (income group, continent, and the European Union) were calculated by summing data from countries in each region. The World Bank data list of all countries in each income group was used.⁸

Results

We found a much lower prevalence of anti-HDV and HDV RNA positivity than that reported in published studies.^{9–12} Key drivers of this discrepancy were the lack of nationally

representative studies and the use of crude or pooled prevalence in meta-analyses, rather than adjusted prevalence (*i.e.*, HDV prevalence of a study adjusted for age, sex, population, or geography of the country). Most data on prevalence estimates relied on studies within smaller regions and subpopulations, which can lead to overestimation of the actual disease prevalence in the general population. As an example, most studies in Brazil report a high prevalence of anti-HDV positivity in the Amazon region. However, the Amazon region also has a small population. After adjusting for the population, HBV prevalence, and HDV infection prevalence in different regions of Brazil, the prevalence of anti-HDV positivity dropped by half, from 3.2% to 1.6%, among HBV-positive individuals in the same study.¹³ Previous studies have also shown a 5- to 10-fold difference in the prevalence of anti-HDV positivity among blood donors and patients with cirrhosis in Italy, Turkey, and Uzbekistan.^{14,15}

The total HBsAg-positive infections and the number of newly diagnosed HBsAg-positive infections from the Polaris Observatory are provided in Table 1.

Discussion

The most effective method to develop accurate estimates of the prevalence of anti-HDV and HDV RNA positivity and find undiagnosed individuals at the national level is to implement double reflex testing. This requires anti-HDV testing of all HBsAg-positive individuals and HDV RNA testing of all anti-HDV-positive individuals.

Table 1. Total HBsAg infections and newly diagnosed HBsAg infections.

Regions	Total HBsAg-positive infections, 2021	Newly diagnosed HBsAg infections, 2021
Global	262,240,000	1,994,000
Regions by income groups		
High income	11,375,000	114,000
Upper middle income	98,193,000	1,128,000
Lower middle income	116,585,000	631,000
Low income	35,636,000	119,000
Geographical regions		
Africa	69,512,000	187,000
Asia	178,978,000	1,694,000
Australia	316,000	6,000
Europe	7,502,000	66,000
North America	2,710,000	22,000
Oceania	788,000	1,000
South America	2,433,000	19,000
European Union	2,828,000	35,000
China, Mainland	80,952,000	1,000,000

A study in Spain showed that implementation of reflex anti-HDV testing resulted in an increased diagnosis of anti-HDV-positive individuals.¹⁶ Without reflex testing, national registries will report a greater HDV prevalence because of selection bias; patients suspected of having hepatitis D, most of them with advanced liver disease, are referred for testing and recorded in the national registry.¹⁷

The current European Association for the Study of the Liver and the Asian Pacific Association for the Study of the Liver guidelines already recommend HDV screening of all HBsAg-positive individuals, whereas the American Association for the Study of Liver Diseases guidelines only recommend screening populations at greater risk for this infection.^{18–20} HDV reflex testing is already performed at specific hospitals or in specific regions within a limited set of countries (e.g., Spain, France, Brazil, Sweden, Canada), but not at the national level.^{21–23} In most cases, only individuals suspected of HDV infection (elevated alanine transaminase level, early-age cirrhosis, or HCC) are screened, leading to high prevalence estimates as a result of selection bias. This screening strategy also has the limitation that it is often too late to implement any preventive measures in individuals suspected of having advanced liver disease.

On the surface, double reflex testing may appear to put an undue burden on healthcare systems, but analysis of the hepatitis B cascade of care provides a different story, because only individuals diagnosed with HBsAg will have to be tested for anti-HDV.²⁴

As shown in Table 1, an estimated 2 million HBsAg-positive people worldwide are diagnosed annually, with half of them residing in mainland China. In all of Europe, an estimated 65,800 patients with HBV would require reflex testing for anti-HDV (only 34,500 in the European Union). Therefore, at the national level, the numbers that require anti-HDV testing will be even fewer. The estimated number of patients requiring testing would be less in North America, South America, and Australia. The total annual number that should be tested for anti-HDV in all of Africa is also less than 180,000. The overall cost could be managed further by not testing for HDV if patients have the same diagnosis already noted in their medical record.

The prevalence of HDV among HBsAg-positive individuals was estimated to be between 4.5% and

14.6%.^{10–12} This is likely an overestimate; but, if we use it as a placeholder, only an estimated 89,000 people will need annual HDV PCR tests globally. Table 1 suggests that double reflex testing for HDV will not overburden healthcare systems and may result in cost savings by reducing costly end-stage disease.²⁵

The only exception to this recommendation is for countries and regions with a high prevalence of HBV but a low prevalence of HDV infection (e.g., mainland China, Taiwan, Korea, Japan), for which a cost-effectiveness study is needed to assess the benefit of reflex testing; serum pooling techniques could be considered in this setting.²⁶ Nonetheless, in regions and at-risk groups with a high HDV prevalence, such as persons who inject drugs and prisoners,²⁶ reflex testing remains beneficial. In addition, reflex testing may be warranted in individuals previously diagnosed with HBV who engage in high-risk behaviours. Our recommendation still applies to countries with a low prevalence of HBV infection (Europe and North America), where fewer HBV-positive individuals will be diagnosed, and thus fewer reflex tests will be needed. The recommendation does not apply to quantitative HBsAg testing, which is used repeatedly for reasons other than diagnosis.

Today, there is limited availability and standardisation of HDV RNA PCR tests in anti-HDV tests used in different countries and there are no World Health Organization prequalified tests. However, this limitation is mainly a result of the low demand for these tests, given current practices. With the implementation of double reflex testing, there will be an incentive for diagnostics companies to register their tests and compete based on quality and price, as well as to commercialise rapid anti-HDV diagnostic tests with high sensitivity and specificity that can be used in resource-limited settings as well as other countries.²⁷

The double reflex test is manageable for healthcare systems. In addition, it will provide more accurate estimates of the prevalence of HDV infection as well as help develop more reasonable strategies to identify HDV-infected individuals early in the disease course and offer appropriate linkage to care, counselling, follow-up, and interventions, with the ultimate goals of reducing morbidity and mortality.

Affiliations

¹Center for Disease Analysis Foundation, Lafayette, United States; ²Liver Unit, Hospital Universitari Vall d'Hebron and CIBEREHD del Insituto Carlos III. Universidad Autonoma de Barcelona, Barcelona, Spain; ³Keck Medicine of University of Southern California, Los Angeles, United States; ⁴Department of Medicine, University Hospital, Frankfurt, Germany; ⁵Department of Gastroenterology and Hepatology, Koç University Medical School, Istanbul, Turkey; ⁶Epidemiology, Infectious Disease Control and Prevention, Hiroshima University, Hiroshima, Japan; ⁷Department of Biomedical Sciences, Humanitas University, Pieve Emanuele, Italy; ⁸Department of Gastroenterology, Humanitas Research Hospital IRCSS, Rozzano, Italy; ⁹Department of Gastroenterology, Ege University, Medical School, Izmir, Turkey; ¹⁰Department of Gastroenterology & Hepatology, Prince Sultan Medical Military City (PSMMC), Riyadh, Saudi Arabia; ¹¹Department of Hepatobiliary Science and Liver Transplantation King Abdulaziz Medical City, King Abdullah International Medical Research Center, King Saud Bin Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia; ¹²Department of Infectious Diseases, Karolinska University Hospital, Stockholm, Sweden; ¹³Gastroenterology Unit/Medical Department, King Fahad General Hospital, Jeddah, Saudi Arabia; ¹⁴Liver & Small Bowel Health Centre Department, King Faisal Specialist Hospital & Research Centre, Riyadh, Saudi Arabia; ¹⁵Department of Medicine, King Saud University, Riyadh, Saudi Arabia; ¹⁶Department of Clinical Sciences, College of Medicine, Dar Al Uloom University, Riyadh, Saudi Arabia; ¹⁷Hepatology Division - Hepatobiliary Sciences and Organ Transplant Center, Ministry of National Guard Health Affairs, Riyadh, Saudi Arabia; ¹⁸Hepatology Department, University of Paris-Cité, Hôpital Beaujon, AP-HP, INSERM UMR1149, Paris, France; ¹⁹Liver Diseases Center, Sheba Medical Center, Ramat Gan, Israel; ²⁰Sackler School of Medicine, Tel-Aviv University, Tel-Aviv, Israel; ²¹Division of Hepatology, Department of Medicine II, Leipzig University Medical Center, Leipzig, Germany; ²²School of Nursing, York University, Toronto, Canada; ²³Epidemiology, Center for Disease Analysis Foundation, Lafayette, United States; ²⁴Virology Department, Fundação de Medicina Tropical Doutor Heitor Vieira Dourado, Manaus, Brazil; ²⁵Internal Medicine & Gastroenterology, University of Rio de Janeiro, Rio de Janeiro, Brazil; ²⁶Clinica de Doenças do Fígado, Rio de Janeiro, Brazil; ²⁷Clinical and Experimental Medicine, University of Pisa, Pisa, Italy; ²⁸Integrated Department of Medical Specialties, University Hospital of Pisa, Pisa, Italy; ²⁹Gastroenterology and Hepatology Department, Marques de Valdecilla University Hospital, Santander, Spain; ³⁰Clinical and Translational Research in Digestive Diseases, IDIVAL, Santander, Spain; ³¹Department of Gastroenterology and Hepatology, Hospital de Clinicas de Porto Alegre (HCPA), Porto Alegre, Brazil; ³²Hepatitis Research Center, National Taiwan University, Taipei, Taiwan; ³³Division of HIV/AIDS Prevention and Control, Korea Disease Control and Prevention agency, Osong, Republic of Korea; ³⁴Hepatobiliary Division,

Department of Internal Medicine, Kaohsiung Medical University Hospital, Kaohsiung Medical University, Kaohsiung, Taiwan; ³⁵Medicine / Microbiology and Infectious Diseases Department, Cumming School of Medicine, University of Calgary, Calgary, Canada; ³⁶Mental Health and Public Medicine, University of Campania, Naples, Italy; ³⁷PROMISE, School of Medicine, University of Palermo, Palermo, Italy; ³⁸Gastroenterology and Hepatology Department, Clinical and Translational Research in Digestive Diseases, Valdecilla Research Institute (IDIVAL), Marqués de Valdecilla University Hospital, Santander, Spain; ³⁹School of Medicine, University of Cantabria, Santander, Spain; ⁴⁰Service d'Hépatologie et de Transplantation Hépatique, CHU, Bordeaux, France; ⁴¹Department of Infectious Diseases, Faculty of Medicine and Health, Örebro University, Örebro, Sweden; ⁴²Department of Gastroenterology and Liver Diseases, Soroka University Medical Center, Beersheva, Israel; ⁴³Faculty of Health Sciences, Ben-Gurion University of the Negev, Beersheva, Israel; ⁴⁴Gastroenterology/Hepatology, Federal University of São Paulo, São Paulo, Brazil; ⁴⁵Division of Infectious Disease, Federal University of São Paulo, São Paulo, Brazil; ⁴⁶Liver Unit, Hospital Clínic. IDIBAPS and CIBEREHD. University of Barcelona., Barcelona, Spain; ⁴⁷Blizard Institute, Barts Liver Centre, Queen Mary University London, London, United Kingdom; ⁴⁸Infectious Diseases, University of Vanvitelli, Napoli, Italy; ⁴⁹Liver Unit, Hospital Universitario La Paz, CIBEREHD/IdiPAZ. Universidad Autónoma de Madrid, Madrid, Spain; ⁵⁰Department of Gastroenterology & Hepatology, Carol Davila University of Medicine & Pharmacy, Bucharest, Romania; ⁵¹Department of Gastroenterology & Hepatology, Fundeni Clinical Institute, Bucharest, Romania; ⁵²Medicine, Case Western Reserve University School of Medicine, Cleveland, United States; ⁵³Hepatitis B Foundation, Doylestown, United States; ⁵⁴Medicine and Microbiology & Immunology, Stanford University, Palo Alto, United States; ⁵⁵Liver Unit, Centre Hospitalier de l'Université de Montreal, Montreal, Canada; ⁵⁶Department of Medical Research, E-Da Hospital/I-Shou University, Kaohsiung, Taiwan; ⁵⁷Gastroenterology and Hepatology, Keelung Chang Gung Memorial Hospital, Keelung, Taiwan; ⁵⁸Hepatitis Center, Kaohsiung Medical University Hospital, Kaohsiung Medical University, Kaohsiung, Taiwan; ⁵⁹BC Centre for Disease Control, Vancouver, Canada; ⁶⁰Liver Research Center, Beijing Friendship Hospital, Capital Medical University, Beijing, China, Mainland; ⁶¹Department of Global Public Health, Karolinska Institutet, Stockholm, Sweden; ⁶²Internal Medicine, Section of Hepatology, University of Manitoba, Winnipeg, Canada; ⁶³Hepatitis Research Center, National Taiwan University Hospital, Taipei, Taiwan; ⁶⁴National Center for Global Health, Istituto Superiore di Sanità, Rome, Italy; ⁶⁵Department of Infectious Diseases / Virology, Institute of Biomedicine, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden; ⁶⁶Department of Clinical Microbiology, Sahlgrenska University Hospital, Region Västra Götaland, Gothenburg, Sweden; ⁶⁷Independent Health Services Researcher, Madrid, Spain; ⁶⁸Barcelona Institute for Global Health (ISGlobal), Hospital Clínic, University of Barcelona, Barcelona, Spain; ⁶⁹Institute of Clinical Medicine, National Yang Ming Chiao Tung University, Taipei, Taiwan; ⁷⁰Gastroenterology, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea, Republic of; ⁷¹Department of Medicine, Western University, London, Canada; ⁷²Grupo de Gastrohepatología, Facultad de Medicina, Universidad de Antioquia, Medellín, Colombia; ⁷³Gastroenterología y Hepatología, Clínica Las Americas AUNA, Medellín, Colombia; ⁷⁴Hepatology Department, Clínica Las Vegas Quiron, Medellín, Colombia; ⁷⁵Viral Hepatitis and Bloodborne Pathogens Department, National Microbiology Lab, Public Health Agency of Canada, Winnipeg, Canada; ⁷⁶Division of Gastroenterology and Hepatology, Department of Medicine, NYU Langone Health, NYU Grossman School of Medicine, New York, United States; ⁷⁷Division of Gastroenterology and Hepatology, Hospital das Clínicas, University of São Paulo School of Medicine, São Paulo, Brazil; ⁷⁸Department of Clinical and Experimental Medicine, University of Messina, Messina, Italy; ⁷⁹Department of Medicine, University of British Columbia, Vancouver, Canada; ⁸⁰Dirección de Promoción y Prevención, Ministerio de Salud y Protección Social, Bogotá, Colombia; ⁸¹Liver Unit. Division of Gastroenterology and Hepatology, Hospital Universitario Central de Asturias, Oviedo, Spain; ⁸²Institute for Liver and Digestive Health, Division of Medicine, UCL, London, United Kingdom; ⁸³APHP, Hôpital Avicenne, Unité d'Hépatologie, Université Sorbonne Paris Nord, Bobigny, France; ⁸⁴Hepatology, NIHR Nottingham Biomedical Research Centre, Nottingham University Hospitals NHS Trust, Nottingham, United Kingdom; ⁸⁵The Liver Institute, Hadassah Medical Organization, Jerusalem, Israel; ⁸⁶Gastroenterology, King Abdulaziz Medical City, Jeddah, Saudi Arabia; ⁸⁷Department of Medical and Surgical Sciences, University of Foggia, Foggia, Italy; ⁸⁸Medizinische Klinik 2, St. Josefs-Hospital, Wiesbaden, Germany; ⁸⁹Medizinische Klinik 1, Goethe-University, Frankfurt Am Main, Germany; ⁹⁰Department of Hepatology & Gastroenterology, Charité Universitätsmedizin Berlin, Berlin, Germany; ⁹¹Department of Gastroenterology, Hepatology and Endocrinology, Hannover Medical School, Hannover, Germany; ⁹²Research Center for Tropical Medicine of Rondônia, Porto Velho, Brazil; ⁹³Genomics Research Center, Academia Sinica, Taipei, Taiwan; ⁹⁴Graduate Institute of Medicine, Kaohsiung Medical University, Kaohsiung, Taiwan, Kaohsiung, Taiwan; ⁹⁵Biomedical Translation Research Center, Academia Sinica, Taipei, Taiwan; ⁹⁶School of Medicine, College of Medicine and Center of Excellence for Metabolic Associated Fatty Liver Disease, National Sun Yat-sen University, Kaohsiung, Taiwan; ⁹⁷Hepatobiliary Section, Department of Internal Medicine and Hepatitis Center, Kaohsiung Medical University Hospital, Kaohsiung Medical University, Kaohsiung, Taiwan; ⁹⁸School of Medicine and Hepatitis Research Center, College of Medicine, Kaohsiung Medical University, Kaohsiung, Taiwan; ⁹⁹Liver Unit, Carmel Medical Center, Faculty of Medicine, Technion Institute of Technology, Haifa, Israel

Abbreviations

HBsAg, HBV surface antigen; HBV, hepatitis B virus; HCC, hepatocellular carcinoma; HDV, hepatitis D virus.

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Conflict of interest

SB, IG, HAR, DRS, KRS, AV – CDA Foundation received an investigator sponsored research grant to study HDV prevalence. NAM reports personal fees from AbbVie. HC reports a grant from Gilead Sciences. CF reports grant and personal fees from Gilead Sciences. ASD has received honorary for lectures from Gilead, MSD and AbbVie, and has participated in an expert meeting for Gilead. GF reports personal fees from Gilead. CS reports personal fees from Gilead & AbbVie. RG – consult for Gilead, Quest, LabCorp and Diasorin. NT reports grants from NIH, GSK, Genentech-Roche, Helio Health, Gilead Sciences and Durect Corp, and consulting with Eiger Biopharmaceuticals.

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Authors' contributions

Conceptualization – All authors, Data curation - All authors; Formal Analysis – HR, SB, DRS, IG, AV, and KRS; Methodology - HR; Project administration - HR; Supervision - HR; Validation - All authors; Visualization - HR; Writing – original draft - HR; Writing – review & editing - All authors.

Data availability statement

The data reported in this publication is available through Center for Disease Analysis Foundation's website <https://cdfafound.org/polaris-observ-access/> for a period of 12 months and is refreshed quarterly.

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Supplementary data

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