

Hepatitis B virus elimination status and strategies in circumpolar countries, 2020

Celia Haering, Brian McMahon, Aaron Harris, Nina Weis, Josefine Lundberg Ederth, Maria Axelsson, Sigurdur Olafsson, Carla Osiowy, Kristina Tomas, Signe Bollerup, Kirsi Liitsola, Chris Archibald, Hans Blystad, Michael Bruce & Leisha Nolen

To cite this article: Celia Haering, Brian McMahon, Aaron Harris, Nina Weis, Josefine Lundberg Ederth, Maria Axelsson, Sigurdur Olafsson, Carla Osiowy, Kristina Tomas, Signe Bollerup, Kirsi Liitsola, Chris Archibald, Hans Blystad, Michael Bruce & Leisha Nolen (2021) Hepatitis B virus elimination status and strategies in circumpolar countries, 2020, International Journal of Circumpolar Health, 80:1, 1986975, DOI: [10.1080/22423982.2021.1986975](https://doi.org/10.1080/22423982.2021.1986975)

To link to this article: <https://doi.org/10.1080/22423982.2021.1986975>



© 2021 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.



[View supplementary material](#)



Published online: 20 Oct 2021.



[Submit your article to this journal](#)



Article views: 765



[View related articles](#)



[View Crossmark data](#)

Hepatitis B virus elimination status and strategies in circumpolar countries, 2020

Celia Haering^a, Brian McMahon^{b,c}, Aaron Harris^d, Nina Weis^{e,f}, Josefine Lundberg Ederth^g, Maria Axelsson^g, Sigurdur Olafsson^{h,i}, Carla Osiowy^j, Kristina Tomas^k, Signe Bollerup^e, Kirsi Liitsola^l, Chris Archibald^m, Hans Blystadⁿ, Michael Bruce^b and Leisha Nolen^b

^aUniversity of California San Francisco School of Medicine, San Francisco, California, USA; ^bArctic Investigations Program, Division of Preparedness and Emerging Infections, National Center for Emerging and Zoonotic Infectious Diseases, US Centers for Disease Control and Prevention (CDC), Anchorage, Alaska, USA; ^cLiver Diseases and Hepatitis Program, Alaska Native Tribal Health Consortium, Anchorage, Alaska, USA; ^dDivision of Viral Hepatitis, Centers for Human Immunodeficiency Virus, Tuberculosis Prevention, Sexually Transmitted Diseases, and Viral Hepatitis, Centers for Disease Control and Prevention (CDC), Atlanta, Georgia, USA; ^eDepartment of Infectious Diseases, Copenhagen University Hospital, Hvidovre, Copenhagen, Denmark; ^fDepartment of Clinical Medicine, Faculty of Health and Medical Sciences, University of Copenhagen, Copenhagen, Denmark; ^gDepartment of Public Health Analysis and Data Management, Unit for Epidemiological Monitoring, Public Health Agency of Sweden, Stockholm, Sweden; ^hDepartment of Gastroenterology and Hepatology, Landspítali University Hospital, Reykjavik, Iceland; ⁱSchool of Health Sciences, University of Iceland, Reykjavik, Iceland; ^jViral Hepatitis and Bloodborne Pathogens National Microbiology Laboratory, Public Health Agency of Canada, Winnipeg, Manitoba, Canada; ^kSti and Hepatitis Section | La Section Des Its Et Des Hépatites, Stbbi Surveillance Division | Division De La Surveillance Des ITSS, Public Health Agency of Canada | L'Agence De La Santé Publique Du Canada, Ottawa, Ontario, Canada; ^lDepartment of Health Security, Finnish Institute for Health and Welfare, Helsinki, Finland; ^mCentre for Communicable Diseases and Infection Control, Public Health Agency of Canada, Ottawa, Ontario, Canada; ⁿNorwegian Institute of Public Health, Oslo, Norway

ABSTRACT

Hepatitis B virus (HBV) infection remains a global health threat. The World Health Organization (WHO) established a goal to eliminate HBV infection as a public health threat by 2030, and defined targets for key interventions to achieve that goal. We evaluated HBV burden and relevant national recommendations for progress towards WHO targets in circumpolar countries. Viral hepatitis experts of circumpolar countries were surveyed regarding their country's burden of HBV, achievement of WHO targets and national public health authority recommendations for HBV prevention and control. Eight of nine circumpolar countries responded. All countries continue to see new HBV infections. Data about HBV prevalence and progress in reaching WHO 2030 elimination targets are lacking. No country was able to report data for all seven WHO target measures. All countries have recommendations targeting the prevention of mother-to-child transmission. Only the USA and Greenland recommend universal birth dose vaccination. Four countries have recommendations to screen persons at high risk for HBV. Existing recommendations largely address prevention; however, recommendations for universal birth dose vaccination have not been widely introduced. Opportunities remain for the development of trackable targets and national elimination planning to screen and treat for HBV to reduce incidence and mortality.

ARTICLE HISTORY

Received 23 June 2021
Revised 24 September 2021
Accepted 24 September 2021

KEYWORDS



Hepatitis B infection; public health policy; elimination; vaccination recommendation; policy survey; Circumpolar Viral Hepatitis Working Group


Introduction

Hepatitis B virus (HBV) infects the liver causing inflammation, and can have an acute course followed by recovery or develop into a chronic infection. HBV infection remains a global health threat, with 2 billion people worldwide estimated to have past or prior infection and approximately 257 million people in the world estimated to have chronic hepatitis B (CHB) [1,2]. Without treatment, 20–30% of those with CHB develop cirrhosis or hepatocellular carcinoma (HCC), and at least 650,000 people are estimated to die annually from

complications of HBV infection [2,3]. Effective antiviral treatment for CHB is available, and has been shown to decrease mortality from liver failure and decrease the risk of HCC [4–7]. As of 2016, only 10% of persons with CHB worldwide were estimated to have been diagnosed, and it is estimated that 17% of those diagnosed were on treatment [7].

HBV is transmitted from mother to child at the time of birth or through percutaneous or mucosal exposure to infected blood or body fluids, such as through sexual exposure later in life [2]. Without post-exposure

CONTACT Michael Bruce  zwa8@cdc.gov  Arctic Investigations Program, Division of Preparedness and Emerging Infections, National Center for Emerging and Zoonotic Infectious Diseases, US Center for Disease Control and Prevention (CDC), Anchorage, Alaska, USA

 Supplemental data for this article can be accessed [here](#).

© 2021 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.

This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

prophylaxis with HBV vaccination or hepatitis B immune globulin (HBIG), approximately 90% of infants and 30% of children younger than 5 years of age who are infected with HBV will develop CHB. In contrast, the likelihood of developing CHB after infection as an adult is 5–7% [8–10]. A highly effective vaccine against HBV has been widely available since the 1980s, and the World Health Organization (WHO) recommends that the vaccine be administered to every child as soon as possible after birth, ideally with the first dose within 24 hours [2].

The WHO has adopted a goal of eliminating HBV infection as a public health threat by 2030, defined as a 90% decrease in incidence and a 65% decrease in mortality compared to 2015 baseline estimates [11,12]. Using mathematical modelling, the WHO established targets for key interventions identified as sufficient to achieve the elimination goal [13] (Table 1). The WHO has called for member states to track these targets in order to better understand how each country is progressing towards elimination.

The Circumpolar Viral Hepatitis Working Group (CVHWG) is a collaboration of Arctic Council member countries that fall within the WHO American and European regions. These countries share factors related to health and health care delivery, including relatively low population densities, populations living in areas far from urban health care centres, historical presence of indigenous populations and environmental challenges such as a changing climate [14–16]. Prior reports have described broadly the status of viral hepatitis in Arctic countries and the epidemiology of viral hepatitis in the circumpolar region [14,17,18]. A report from a working group meeting in 2012 highlighted recent successes in decreasing the incidence of HBV in the Russian

Federation and the Alaska Native population as a result of two to three decades of vaccination campaigns [14]. This remarkable progress was accomplished through major political and public health commitments and calls for ongoing collaboration to affect change in the circumpolar region at the policy and public health level [14].

This project aims to summarise the current status of HBV elimination in circumpolar countries, specifically evaluating the burden of disease, achievement of WHO targets, presence of national public health authority recommendations and barriers to elimination.

Methods

Survey development

A 5-page survey instrument regarding the burden of HBV and the presence of national public health authority recommendations for HBV prevention and control was developed by the project team with input from international viral hepatitis experts. The survey included specific questions regarding HBV screening practices (overall, newborns, immigrants, pregnant women and high-risk populations) and methods (serology and HBV DNA), burden (number/incidence of acute and chronic HBV infections, data available on the prevalence of CHB), prevention programmes (vaccination: overall and targeted, immune globulin, tenofovir), surveillance (chronic and acute HBV), reporting mandates (clinician, laboratory), vaccine coverage, treatment programmes and mitigation strategies (engineered devices and syringe exchanges). Chronic and acute HBV infections were defined using the World Health Organization guidelines [19]. Open-ended questions were included inviting respondents to offer further insight into their country's health systems and barriers to HBV elimination in their country.

Respondents

The survey was disseminated via email to viral hepatitis experts of nine circumpolar countries (USA (Alaska), Canada, Sweden, Norway, Finland, Denmark, Greenland, Iceland and the Russian Federation). Surveys were sent to individuals identified by attendants of the CVHWG meetings. These people either completed the survey themselves or identified the most appropriate person in that country to complete the survey.

Completed surveys were returned between April 2019 and February 2020. Respondents were asked to review tabulated results for the correctness and provide

Table 1. WHO targets that would eliminate HBV infection as a public health threat by 2030. Adapted from WHO [13].

WHO Targets	Intervention	2030 target
Prevention	1. Three-dose hepatitis B vaccine for infants (coverage %)	90%
	2. Prevention of mother-to-child-transmission of HBV: hepatitis B birth dose vaccination or other approaches (coverage %)	90%
	3. Blood and injection safety (coverage %)	
	Blood safety: donations screened with quality assurance	100%
	Injection safety: use of engineered devices in healthcare contexts	90%
	4. Harm reduction (sterile syringe/needle sets distributed per person per year for people who inject drugs [PWID])	300
Treatment eligible	5. Diagnosis and treatment (coverage %)	
	Diagnosis of HBV	90%
	Treatment of HBV	80% of

answers to additional questions arising throughout the process of manuscript development.

Burden

Population and birth numbers of each country were obtained from online population databases (Supplementary Table S1) and used to calculate incidence and prevalence rates. Rates were calculated using numbers of tracked or estimated cases reported in the survey and population or birth numbers from the countries in the corresponding year. Denmark's rate of children born to HBV surface antigen (HBsAg)-positive women was calculated using the total number of births in the country over the same years as the available data.

WHO targets

The survey included questions pertaining to countries' achievement of WHO targets (Table 1). The number of sterile syringe/needle sets distributed per person who injects drugs (PWID) was calculated from reported numbers of sterile syringe/needle sets distributed and PWID.

Policies

Survey questions focused on the countries' national recommendations related to HBV prevention, surveillance and treatment. Survey responses relating to key opportunities for public health intervention were tabulated, and a subset was selected for inclusion through discussion between multiple authors. Responses to open-ended questions were reviewed and catalogued into categories related to systemic barriers to HBV elimination and opportunities for policy development.

The survey asked about the existence of a recommendation for universal birth dose vaccination for HBV. In addition, the authors compiled a summary of recommended routine HBV vaccine schedules from each country's public health authority website (Supplementary Table S1). Respondents reviewed the routine vaccine schedules table for correctness relative to WHO guidelines.

Results

Respondents

Surveys were completed and returned by representatives from eight of the nine countries to which they were distributed. No response was received from the Russian Federation and, therefore not included in the study.

Burden

All countries were able to report the number of acute HBV infections recorded in their most recent year of data in the national registry (Table 2). These data only represent 1 year of reporting, limiting our ability to compare rates in Scandinavian countries, as small fluctuations in the absolute number of cases in different years would produce significant changes in rate.

Finland was able to report the number of diagnosed cases of CHB among people living in the country based on surveillance data (131/100,000), while Sweden and Denmark provided estimates of the prevalence of CHB using screening and registry data (196–342/100,000 and 131/100,000, respectively), and the USA estimated prevalence from serosurvey data (267/100,000) [20,21]. None of the other countries were able to provide

Table 2. Rate of births by HBsAg-positive women, incidences of acute and chronic HBV and prevalence of diagnosed CHB in circumpolar countries, based on most recent data available in 2020.

Burden of disease	USA	Canada	Sweden	Norway	Finland	Denmark	Greenland	Iceland
Cases of acute HBV infection reported (year of data)	3,409 (2017)	192 (2017)	46 (2018)	12 (2018)	<5~ (2018)	6 (2018)	5 (2018)	<5~ (2018)
Incidence of acute HBV infection per 100,000 population (95% CI)	1.1 (1.01, 10.8)	0.5 (0.46,0.63)	0.5 (0.33, 0.06)	0.2 (0.12, 0.40)	<0.09 (3.32, 20.07)	0.11 (0.04, 0.24)	8.95 (3.28, 19.84)	<1.37 (0.50, 3.04)
Cases of chronic HBV infection reported (year of data)	13,391 (2017)	4,086 (2017)	1,055 (2018)	368 (2018)	233 (2018)	259 (2017)	NT	47 (2019)
Incidence of chronic HBV infection per 100,000 population (95% CI)	4.11 (4.04, 4.18)	11.4 (11.1, 11.8)	10.3 (9.7, 2.0)	6.95 (6.27, 7.7)	4.22 (3.7, 4.8)	4.49 (3.97, 5.06)	NT	12.9 (0.94, 1.67)
Children born to HBsAg positive mothers (year of data)	20,832 (2017)	NT	NT	~500 (2018)	NT	6,86 (2006–2010)*	6 (2018)	5 (2019)
Incidence of children born to HBsAg positive mothers per 1,000 births (95% CI)	5.40 (5.33, 5.48)	NT	NT	~9.07 (8.3, 9.9)	2.21 (1.83, 2.65)	2.68 (2.48, 2.88)	7.35 (2.98, 15.3)	1.12 (0.41, 2.49)

HBV: hepatitis B virus; NT: not tracked; USA: United States of America. * best data for this data for Denmark is based on publications [36] ~Data points representing less than 5 individuals is not shown.

prevalence estimates for CHB. Six of the eight countries reported the number of births to HBsAg-positive mothers. Among these, Iceland reported the lowest rate with 1.12 births/1,000 births to HBsAg-positive mothers in 2019, while Norway reported the highest at an estimated 9.07 births/1,000 births annually.

WHO targets

Data provided by respondents regarding the WHO targets was incomplete. No country was able to report data for all seven measures (Table 3). All countries provided data on screening of blood donations, for which all countries reported 100% coverage. Data regarding the percent of people with HBV who have been diagnosed or the percent on treatment was sparse. The USA and Denmark provided estimates of the percent diagnosed, while Denmark and Iceland provided estimates of those with treatment indications who are on treatment [20,21]. Iceland indicated that it had achieved four of the WHO targets for 2030. The USA, Sweden, Finland, Denmark and Greenland had each achieved three, while Canada and Norway each achieved two.

Policies

National coordination

All countries have a national surveillance system with mandated reporting of HBV infection. Greenland mandates reporting only of acute infections, while all other countries mandate reporting of both acute and chronic infections. The USA was the only country that reported having a national strategic plan for HBV elimination [22]. Representatives of Sweden, Norway, Denmark and Canada noted that while their countries do not have specific national strategic plans for hepatitis B elimination, they do have some form of broader guidance on viral hepatitis and/or blood-borne diseases [23–26].

Representatives of five of the eight countries (USA, Canada, Sweden, Norway and Denmark) made a specific note in open-ended responses that there are important recommendations from sub-national authorities, professional societies and other stakeholders which are not captured by the survey due to its focus on national public health authority recommendations.

The most common category of responses to the open-ended question about societal perception of HBV was that HBV is largely regarded as a problem of specific high-risk populations, commonly immigrants and not a priority for the broader public. Several respondents from Nordic countries reported that the

majority of cases of HBV in their country are diagnosed amongst foreign-born individuals. It was noted that at a national planning level, HBV is grouped with other blood-borne infections and that continuing the overall approach is felt to be an adequate course for achieving HBV elimination.

All respondents noted that developing national strategies for prevention and control of HBV infection was identified as an important next step towards reaching HBV elimination and that improved quality and availability of data regarding burden, epidemiology and vaccine coverage would be important to inform recommendations and policies. They cited increasing awareness amongst health care providers, the general population and high-risk groups as important public health actions that need to be taken to increase vaccination and screening rates.

Prevention of mother-to-child-transmission and vaccine schedules

All countries reported having national public health authority recommendations to screen all pregnant women for HBsAg (Table 4). Four of the eight countries reported a recommendation to screen all HBsAg-positive pregnant women for HBV DNA and administer tenofovir to women with levels above 200,000 IU/mL (Table 4). All countries reported a recommendation to administer prophylaxis in the form of HBV vaccine with or without HBIG within 12 hours of birth to infants born to HBsAg-positive mothers. Sweden noted that recommendations take into account HBV e antigen (HBeAg) status to determine whether administration of HBIG is added to hepatitis B vaccination, which is recommended for all infants born to HBsAg-positive mothers.

Vaccine recommendations and practices varied between responding countries (Table 5). The USA and Greenland are the only two countries with a recommendation for universal birth dose vaccination for HBV; two provinces of Canada do as well. Childhood vaccination is routinely offered in Canada, Sweden and Norway. In Canada, there is a national recommendation for childhood vaccination, but the timing of the vaccine is established by sub-national public health authorities, some of which do recommend birth dose vaccination. Norway and Sweden recommend the first dose be given to infants at 3 months of age, while Finland, Denmark and Iceland only recommend vaccination of groups of people determined to be high-risk.

In open-ended responses, respondents from countries with universal childhood vaccine strategies cited costs, patient hesitation and limited health care provider knowledge of adult vaccination practices as barriers to increased vaccination rates. Respondents from

Table 3. Circumpolar countries' achievement of WHO targets for elimination of HBV infection as a public health threat, based on most recent data available in 2020.

WHO Targets	USA	Canada	Sweden	Norway	Finland	Denmark	Greenland	Iceland	WHO 2030 Target
Three dose HBV vaccine coverage	91% of 19–35 months (2017)	74% of 2 years	92% of 2 years (2018)	NT	NT	NT	84% of 12 months (2019)	NT	90%
Birth dose vaccine coverage	74% (2017)	NT	NT	NT	NT	NT	NT	0.1% (2019)	90%
Blood donations screened with quality assurance	100%	100%	100%	100%	100%	100%	100%	100%	100%
Proportion of unsafe injections	0% (est)	0% (2018)	0% (2018)	NT	0%	0%	0% (est)	0% (2019)	0%
Syringes/needles distributed/PWID/year	NT	NT	NT	306–435 (est)	369	NT	N/A ^a	> 400	300
Percent of infected diagnosed	34% (est, 2016) [21]	NT	NT	NT	NT	67% (est, 2007) [20]	NT	NT	90%
Percent diagnosed with HBV on treatment ^b	NT	NT	NT	NT	NT	84% (est) [37]	> 90% (est, 2019)	> 90% (est, 2019)	80%

Est: estimated; HBV: hepatitis B virus; NT: Not tracked N/A: not applicable; PWID: persons who inject drugs. ^aGreenland reports that there are zero or very few PWID in the country. ^bOf those eligible for treatment.

Table 4. Presence of national public health authority recommendations for prevention of mother-to-child-transmission of hepatitis B virus in circumpolar countries, 2020.

Prevention of mother-to-child-transmission	USA	Canada	Sweden	Norway	Finland	Denmark	Greenland	Iceland
Do the public health authorities in your country make recommendations to ...								
Screen all pregnant women for HBsAg?	Y	Y	Y	Y	Y	Y	Y	Y
Screen all pregnant women who test positive for HBsAg for HBV DNA?	Y	N	N	Y	Y	Y	N	Y
Administer tenofovir to all HBsAg-positive pregnant women with HBV DNA levels above 200,000 IU/ml?	Y	N	N	Y	Y	Y	Unk	N
Vaccinate all children born to mothers who are HBsAg-positive within 12 hours of birth?	Y	Y	Y	Y	Y	Y	Y	Y
Administer hepatitis B immune globulin within 12 hours of birth to all children born to mothers who are HBsAg-positive?	Y	Y	N	Y	Y	Y	Y	Y
Administer universal birth dose vaccination?	Y	N	N	N	N	N	Y	N

USA: United States of America; HBV: hepatitis B virus; N (No) and Y (Yes) indicate the absence or presence of recommendation, respectively. Unk: Unknown.

Table 5. Schedules of routinely recommended/offered hepatitis B vaccines in circumpolar countries, 2020.

	Birth	1 month	2 months	3 months	4 months	5 months	6 months	9 months	12 months	15 months	18 months
USA	Dose 1			Dose 2					Dose 3		
Canada (Yukon)			Dose 1		Dose 2		Dose 3				
Canada (NWT)	Dose 1	Dose 2					Dose 3				
Canada (Nunavut)	Dose 1	Dose 2						Dose 3			
Canada (Nunavik)			Dose 1		Dose 2						Dose 3
Sweden				Dose 1		Dose 2			Dose 3		
Norway				Dose 1		Dose 2			Dose 3		
Finland											
Denmark											
Greenland	Dose 1			Dose 2		Dose 3			Dose 4		
Iceland											

USA: United States of America.

countries that recommend only targeted vaccination of high-risk individuals cited a lack of recommendation for routine vaccination as limiting vaccination rates. They also noted that their national public health authorities do not feel universal vaccination is a priority given low rates in indicators of burdens of HBV in their countries and that most HBV in their countries is diagnosed amongst foreign-born individuals.

Screening and treatment

Five of eight responding countries reported a recommendation to screen 'high-risk' persons for HBV (Table 6). All of those countries reported a definition for 'high-risk', which includes both PWID and persons emigrating from countries with a high prevalence of HBV infection. Two additional countries have guidelines specific to people either migrating or seeking asylum from high

prevalence countries. Three of seven countries have recommendations for the treatment of CHB.

Open-ended responses regarding barriers to screening made frequent mention of costs and difficulty connecting follow-up services to high-risk populations, specifically immigrants. Countries with recommendations to screen high-risk populations additionally noted lack of patient and provider awareness and concerns for privacy and stigma as limiting rates of HBV screening.

Discussion

Circumpolar countries have basic systems in place for screening all pregnant women and preventing maternal transmission, and detecting acute and chronic HBV infection, but the opportunity remains for national

Table 6. Presence of national public health authority recommendations for hepatitis B virus screening and treatment in circumpolar countries, 2020.

Screening and treatment	USA	Canada	Sweden	Norway	Finland	Denmark	Greenland	Iceland
Do the national public health authorities in your country make recommendations to screen for HBV all ...								
Persons at high risk as defined by the country?	Y	Y	N	Y	N	Y	N	N
Persons emigrating from countries with a high prevalence of HBV infection?	Y	Y	N ^a	Y	N ^a	Y	N	Y
Persons who inject drugs?	Y	Y	Y	Y	N	Y	N	N
Do the national public health authorities in your country make a recommendation for treatment of chronic HBV?	Y	Y	N	Y	N	N	N	N

USA: United States of America; HBV: hepatitis B virus; Y (Yes) and N (No) indicate the absence or presence of recommendation, respectively. ^aSweden and Finland have recommendations to screen refugees and asylum seekers for HBV.

public health authorities to develop strategies and recommendations to achieve the WHO goal of HBV elimination by 2030. Comparable data from respondents on the prevalence and overall burden of disease is lacking, but new cases of HBV infection continue to be diagnosed in all responding countries throughout the circumpolar region. WHO has identified targets that are meant to measure and encourage progress towards elimination; however, none of the countries surveyed were able to provide data for all targets. All countries have recommendations for the prevention of mother-to-child transmission in HBsAg-positive pregnancies. While most countries have moved towards routine childhood vaccination for HBV, recommendations for universal birth dose vaccination have yet to be widely introduced, and there is wide variability in the presence of recommendations for HBV screening and treatment. However, a strategy to screen all pregnant women for HBsAg and vaccinate all newborns of those positive starting at birth should be effective at preventing most HBV transmission at birth. Nevertheless, those countries that do not screen household contacts of HBsAg-positive persons and vaccinate those not yet infected risk increasing their rates of chronic HBV infection. In addition, a lack of effective strategies to screen all immigrants from endemic countries also may result in elevated rates of chronic HBV infection.

Burden

Data collected regarding the burden of disease showed widely variable incidences of acute and chronic HBV between circumpolar countries and limited data available on the prevalence of CHB. This is in agreement with previous publications, where prevalence estimates of CHB range from 0.91% to 0.01%, depending on the specific country [27]. A study in Finland that corrected for asymptomatic infection, estimated the true rate of acute infection is 1.67 per 100,000 per year or over four-fold higher than that detected in the national registry, suggesting data from national registries may be an underestimate [28]. The variation in rates for the different countries likely reflect true differences in incidence and prevalence, but these differences likely are impacted by recommendations and practices for screening in different countries.

Defining high-risk populations can be quite challenging, as historical and societal differences in demographics are variable across the circumpolar region. In northern Canada, western Alaska and Greenland, HBV is endemic primarily among indigenous populations [14]. In contrast, Nordic countries have experienced recent influxes of immigrants from highly endemic countries,

resulting in the majority of cases being detected in immigrants, while in North America, injection drug use is driving the increase in cases [29]. Both of these recent trends have resulted in an increase in the number of persons at high risk for HBV infection living in the circumpolar region [30,31]. Respondents to this survey noted that those populations at the highest risk for CHB are sometimes the same populations least connected to health care and screening services. This suggests that there may be a significant burden of unidentified HBV in circumpolar countries.

Challenges in obtaining accurate data regarding the burden and epidemiology of HBV have been noted as a limiting factor in creating evidence-based guidelines for prevention and control [32]. Our project suggests that data for assessing the current burdens of HBV in circumpolar countries are limited. While surveillance systems and mandatory reporting are already in place, increased screening for HBV is needed, particularly of high-risk groups, to create better data regarding the true prevalence of CHB that would inform and guide policy and recommendations.

WHO targets

We aimed to ascertain the status of the WHO elimination targets in circumpolar countries. Results demonstrated that even amongst this group of high-income countries with robust health care systems, data on WHO targets is sparse. Some of the targets, such as the use of engineered devices and distribution of sterile syringe/needle sets, are often regulated and monitored by entities such as hospitals or civil society organisations, making tracking of nationwide data impractical. This lack of data limits the ability to assess national progress towards achieving WHO targets and goals. WHO identified these targets using mathematical modelling, but it may be important to define targets that are more easily trackable by countries.

Policies

National coordination

Our project suggests that there are opportunities for circumpolar countries to develop national HBV elimination plans. These plans could help focus strategies to improve data collection, track the uptake of interventions and move the circumpolar region towards the achievement of HBV elimination. Respondents indicated that lack of political and population awareness of HBV infection as a public health threat as well as the stigma surrounding risk factors for HBV infection likely

contribute to the gap in the development of national strategic plans. Increased messaging and education about HBV to providers and the public could help engage communities and result in increased rates of testing and treatment.

Prevention of mother-to-child transmission and vaccine schedules

All countries that responded to our survey have a recommendation to screen all pregnant women for HBsAg and a mandate to report all HBV infections. This makes the data regarding CHB in pregnant women the most complete and comparable metric of CHB burden in these countries, as no other population is universally tested. Our data show that there continue to be infants exposed to HBV at birth in every country. Given the significant risk to infants exposed to HBV during pregnancy or childbirth, the perinatal period remains a critical opportunity to interrupt the perpetuation of CHB. The universal birth dose of vaccine is crucial in the prevention of transmission both to infants whose HBsAg-positive mothers were not identified during pregnancy and to infants exposed to horizontal transmission in the first months of life when the risk for subsequent development of CHB remains extremely high.

WHO recommends that all national immunisation programmes should include a timely monovalent HBV birth dose vaccine, and that one performance measure for immunisation programmes is the number of children receiving at least three doses of HBV vaccine [33]. Several circumpolar countries have moved towards earlier initiation of the HBV vaccine and inclusion of the HBV vaccine in childhood immunisation programmes. Vaccine schedules in the USA, Greenland and some regions of Canada include universal birth dose vaccination and three or four total childhood doses. The birth dose has been left off the schedule recommended by national authorities in some countries, including Sweden, Norway and some regions of Canada, where children receive HBV vaccine through routine multi-valent vaccines at or after 2 months of age. Throughout most of the countries, data on birth dose and three-dose vaccine coverage is limited due to a lack of a national vaccine reporting system. Some circumpolar health authorities do not perceive routine immunisation against HBV to be necessary based on what is known about the burden and epidemiology of HBV infection in their countries and instead offer vaccination only to individuals at high risk. Future elimination planning should consider whether the varying approaches

to vaccination within the context of country-specific epidemiology are appropriate.

Screening and treatment

Improving identification of people with CHB and linkage to care hold great opportunities in the HBV cascade of care for decreasing mortality to meet the 2030 WHO goal as pre-vaccine era generations continue to age. WHO recommends that all individuals in certain high-risk groups should be tested for HBV and that routine testing be widely offered in populations with an intermediate or high prevalence of HBsAg [19]. WHO also recommends monitoring of all individuals with CHB and that antiviral therapy, which is now widely available, be initiated to prevent morbidity and mortality [2,7].

It is notable that only four of eight countries responding to this survey reported a recommendation for screening people in defined high-risk groups, while an additional three have recommendations to screen individuals who have recently immigrated from high prevalence countries. Only three of eight countries reported a recommendation for the treatment of CHB. This may be compensated by the fact that many of the circumpolar countries have sub-national health authorities in addition to national authorities, and recommendations and policies may exist from either or both. For instance, while Sweden's national public health authority does not have a recommendation defining 'high-risk' groups that should be screened for HBV, many of the regional authorities in Sweden make screening recommendations, and testing is felt to be widely available to persons emigrating from countries with a high prevalence of HBV infection, as well as PWID through various health care contexts. In addition, the national authority does define high-risk populations that should be offered HBV vaccination. Similarly, numerous professional societies and organisations in circumpolar countries offer recommendations for treatment, which are felt by some to be preferable to recommendations coming directly from a national public health authority because professional organisations may be more quickly adaptable to new data and evidence. This highlights the importance of involving this broader set of organisations when forming cohesive national approaches to HBV elimination planning.

Limitations

A primary limitation of this project stems from the variable health care structures of the circumpolar countries, which limits both availability of data and the ability to compare policies and recommendations. To

most effectively offer a direct comparison of countries, we sought specific national-level data and recommendations offered by national public health authorities, however, this did not capture recommendations issued and data tracked at sub-national levels. This manuscript intends to evaluate the general adherence to WHO standards, not compare rates or trends within or between countries, nor provide a detailed investigation of specific protocols. Future studies that delve into these details would be valuable to further elucidate the trends and contributing factors.

The survey instrument used was created by collaborating with international experts in the field but was neither completely standardised nor validated. Respondents were encouraged to clarify any points of concern about the survey with the authors, and the survey was updated in response. Respondents were also asked to review the data collected several times throughout manuscript preparation to ensure accurate representation.

Prior studies using surveys to evaluate the existence of hepatitis policies have demonstrated a discrepancy between responses of parties representing the same country, suggesting that surveys may not always accurately capture policies in a country [34,35]. We sought responses from topic experts in each country and specified that we were interested in national public health authorities' recommendations. In most cases, the respondent was affiliated with the country's national public health authority. The manuscript's first author additionally searched national public health authority websites to verify recommendations, though in some cases, this was limited by available language translations or inability to locate a reference to a topic.

Next steps

Achievement of global elimination of HBV infection as a public health threat by 2030 will require resource investment and coordination between WHO and national, regional and civil society organisations to create and implement cohesive policies and recommendations [5,6]. National elimination planning is needed for countries to identify opportunities within their own systems and epidemiology to reduce HBV morbidity and mortality.

Circumpolar countries have had variable success in monitoring and meeting WHO targets and creating national elimination plans, which will help identify easily trackable targets and recognise where increased screening is needed to improve data on the epidemiology of hepatitis virus infection.

Recommendations in circumpolar countries currently focus on the prevention of perinatal transmission of HBV, but most countries have yet to introduce a recommendation for universal birth dose vaccination. Large-scale efforts are needed in the areas of HBV screening and treatment to significantly reduce mortality from CHB by 2030.

Continued study is warranted to monitor and evaluate national progress towards meeting 2030 elimination targets.

Disclosure statement

No potential conflict of interest was reported by the author(s).

ORCID

Carla Osiowy  <http://orcid.org/0000-0002-5429-7220>

References

- [1] World Health O. Global hepatitis report 2017. Geneva: World Health Organization; 2017.
- [2] World Health Organization. Guidelines for the prevention, care and treatment of persons with chronic hepatitis B infection. Geneva: WHO; 2015.
- [3] Lozano R, Naghavi M, Foreman K, et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the global burden of disease study 2010. *Lancet*. 2012;380(9859):2095–10.
- [4] Liaw YF, Sung JJ, Chow WC, et al. Lamivudine for patients with chronic hepatitis B and advanced liver disease. *N Engl J Med*. 2004;351(15):1521–1531.
- [5] Thomas DL. Global elimination of chronic hepatitis. *N Engl J Med*. 2019;380(21):2041–2050.
- [6] McMahon BJ. Meeting the WHO and US goals to eliminate hepatitis B infection by 2030: opportunities and challenges. *Clin Liver Dis*. 2018;12(1):29–32.
- [7] Hutin Y, Nasrullah M, Easterbrook P, et al. Access to treatment for hepatitis B virus Infection - worldwide, 2016. *MMWR Morb Mortal Wkly Rep*. 2018;67(28):773–777.
- [8] McMahon BJ, Alward WL, Hall DB, et al. Acute hepatitis B virus infection: relation of age to the clinical expression of disease and subsequent development of the carrier state. *J Infect Dis*. 1985;151(4):599–603.
- [9] Beasley RP, Hwang LY, Lee GC, et al. Prevention of perinatally transmitted hepatitis B virus infections with hepatitis B immune globulin and hepatitis B vaccine. *Lancet*. 1983;2(8359):1099–1102.
- [10] McMahon BJ. Chronic hepatitis B virus infection. *Med Clin North Am*. 2014;98(1):39–54.
- [11] World Health Organization. Global health sector strategy on viral hepatitis 2016–2021 Toward ending viral hepatitis. Geneva: WHO; 2016.
- [12] World Health Organization. Global hepatitis report. Geneva: WHO; 2017.

- [13] World Health Organization. Combating hepatitis B and C to reach elimination by 2030. Geneva: WHO; 2016.
- [14] FitzSimons D, McMahon B, Hendrickx G, et al. Burden and prevention of viral hepatitis in the Arctic region, Copenhagen, Denmark, 22-23 March 2012. *Int J Circumpolar Health*. 2013;72(1):211-63.
- [15] Huot S, Ho H, Ko A, et al. Identifying barriers to health-care delivery and access in the circumpolar North: important insights for health professionals. *Int J Circumpolar Health*. 2019;78(1):1571385.
- [16] Bruce M, Zulz T, Koch A. Surveillance of infectious diseases in the Arctic. *Public Health*. 2016;137:5-12.
- [17] McMahon BJ. Viral hepatitis in the Arctic. *Int J Circumpolar Health*. 2004;63(Suppl 2):41-48.
- [18] Tulisov A, McMahon BJ, Koch A, et al. Viral hepatitis in the Arctic. A review from a circumpolar workshop on viral hepatitis, ICCH13. *Alaska Med*. 2007;49(2 Suppl):193-203.
- [19] WHO Guidelines Approved by the Guidelines Review Committee. WHO guidelines on hepatitis B and C testing. Geneva: World Health Organization, Copyright © World Health Organization 2017; 2017.
- [20] Hansen N, Hay G, Cowan S, et al. Hepatitis B prevalence in Denmark - an estimate based on nationwide registers and a national screening programme, as on 31 December 2007. *Euro Surveill*. 2013;18(47):47.
- [21] Patel EU, Thio CL, Boon D, et al. Prevalence of hepatitis B and hepatitis D Virus Infections in the USA, 2011-2016. *Clin Infect Dis*. 2019;69(4):709-712.
- [22] Centers for Disease Control and Prevention (CDC) . Division of Viral Hepatitis 2025 Strategic Plan. (CDC). 2020.
- [23] Folkhälsomyndigheten. Hälsöfrämjande och förebyggande arbete med hepatit och HIV för personer som injicerar droger. Falun: Folkhälsomyndigheten; 2015. Contract No: 15001 978-91-7603-441-5.
- [24] Helse- og omsorgsdepartementet. Nasjonal strategi mot hepatit. 2018.
- [25] Public Health Agency of Canada. Reducing the health impact of sexually transmitted and blood-borne infections in Canada by 2030: a pan-Canadian STBBI framework for action. 2018.
- [26] Sundhedsstyrelsen. Vejledning om HIV (human immunodefekt virus), hepatitis B og C virus. 2013.
- [27] Schweitzer A, Horn J, Mikolajczyk RT, et al. Estimations of worldwide prevalence of chronic hepatitis B virus infection: a systematic review of data published between 1965 and 2013. *Lancet*. 2015;386(10003):1546-1555.
- [28] Karvonen T, Auranen K, Kuusi M, et al. Epidemiology of hepatitis B infection in Finland: implications for immunisation policy. *Vaccine*. 2017;35(3):412-418.
- [29] Johansson ED, Nunez M. Acute hepatitis B Surge: opioid epidemic implication and management challenges. *Open Forum Infect Dis*. 2020;7(6):ofaa190.
- [30] Chu JJ, Wörmann T, Popp J, et al. Changing epidemiology of hepatitis B and migration—a comparison of six Northern and North-Western European countries. *Eur J Public Health*. 2013;23(4):642-647.
- [31] Hyun Kim B, Ray Kim W. Epidemiology of Hepatitis B Virus infection in the USA. *Clin Liver Dis*. 2018;12(1):1-4.
- [32] Lazarus JV, Safreed-Harmon K, Colombo M, et al. Many European countries 'flying blind' in their efforts to eliminate viral hepatitis. *Nat Rev Gastroenterol Hepatol*. 2017;14(8):445-446.
- [33] World Health Organization. Hepatitis B vaccines: WHO position paper, July 2017 - Recommendations. *Vaccine*. 2019;37(2):223-225.
- [34] World Hepatitis Alliance. Global community hepatitis policy report. 2014.
- [35] Safreed-Harmon K, Hetherington KL, Aleman S, et al. Policy responses to hepatitis C in the Nordic countries: gaps and discrepant reporting in the Hep-Nordic study. *PLoS One*. 2018;13(1):e0190146.
- [36] Weis N, Cowan S, Hallager S, et al. Vertical transmission of hepatitis B virus during pregnancy and delivery in Denmark. *Scand J Gastroenterol*. 2017;52(2):178-184.
- [37] Bollerup S, Hallager S, and Baek O, et al. Implementation of treatment recommendations for chronic hepatitis B in patients attending specialized hospital care in Denmark - a region wide study. *Scand J Gastroenterol*. 2020 55 (7) ;1-5.