Public health impact of a population-based approach to HCV treatment in Oregon

This is a summary of the key outcomes of a hepatitis C virus (HCV) disease burden analysis undertaken by the CDA Foundation's Polaris Observatory, in collaboration with ASTHO, CDC, Oregon Health Authority, Oregon Health and Science University, Providence Health Systems, Oregon Department of Corrections, Oregon Medicaid Program, and the Portland Area Indian Health Board.

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Executive Summary and Key Recommendations

Hepatitis C virus (HCV) is a blood-borne virus that causes substantial liver-related morbidity and an increased risk of liver cancer and liver-related death.[1] Hepatitis C is often known as a "silent disease," as there are few noticeable symptoms, especially in early stage infection.[2] Because of this, many infected individuals are unaware of their HCV status until more serious, late-stage complications arise. Treatment is available for HCV, with success measured by the sustained viral response (SVR) rate at 12–24 weeks post treatment. Prior to 2014, an average of 48%–70% of patients achieved SVR with the available therapies; however, recent therapeutic advances mean that SVR rates in 2018 have increased to more than 95%.[3] Achieving SVR can reverse the effects of early-stage fibrosis and slow the progression of cirrhosis into hepatic decompensation or hepatocellular carcinoma (HCC).[4,5] This reduces liver-related mortality or need for liver transplantation by 95% and all-cause mortality by 75%.[6] Transmission of HCV can be prevented by avoiding direct exposure to contaminated blood or blood products, including objects that may have come in contact with contaminated blood, such as needles and syringes.

Over the last 14 years, the HCV epidemic has drastically changed in the United States. Originally a disease affecting "baby boomers" (people born between 1945 and 1965), HCV infection has reemerged as a syndemic with opioid misuse, overdose and HIV infection.[7] In 2010, approximately 3.5 million Americans had chronic hepatitis C (CHC)[8] and, according to CDC data, HCV now kills more Americans than any other infectious disease.[9] Additionally, HCV is the leading cause of cirrhosis and liver cancer, and the most common reason for liver transplantation in the U.S.[10] In 2013, HCV-related deaths surpassed the combined numbers of deaths from 60 other infectious diseases reported to CDC, including HIV and tuberculosis; and in 2014, HCV-related deaths reached an all-time high with more than 19,600 deaths reported.[11] Simultaneously, the number of persons newly identified with HCV increased across the U.S., particularly among people with a history of injection-drug use.[12] Acute hepatitis C and hospital admissions for opioid injection increased between 2004 and 2014, with the number of persons newly diagnosed with HCV more than doubling between 2010 and 2014.[13]

National-level programs to control the burden of HCV have focused primarily on the older cohort of previously infected individuals. These programs include screening for HCV in the baby-boomer birth cohort (1945–1965) as well as programs through the Veteran's Administration (VA) to diagnose and cure all veterans infected with HCV. Despite these efforts, barriers to treatment still exist within many state Medicaid programs, as evidenced by fibrosis requirements for treatment of patients with early-stage liver disease.[14] Universal precautions exist to prevent transmission of bloodborne pathogens in medical settings across the U.S. (though localized outbreaks may still occur when procedures fail). However, the recent opioid crisis presents a new challenge for HCV prevention efforts. At present, policies to prevent transmission among drug users are entirely state-specific, and in many states non-existent.[15]

This report presents the conclusions of a multi-stakeholder collaboration to assess the HCV disease burden in the state of Oregon. This work follows a standard methodology (modified Delphi process) developed and facilitated by the CDA Foundation's Polaris Observatory staff. It engages local stakeholders to ensure that the best available data are used to develop momentum and consensus toward a common goal. The tool used in this analysis is a Microsoft Excel®-based Markov model, populated with state-specific consensus estimates, which answer the basic questions needed for HCV policy development.

Key Insights and Recommendations

Who is affected?

- At the beginning of 2018, there were 57,200 HCV-RNA positive (viremic) infections in Oregon (based on numbers of cases reported to OHA, and assuming 75% of cases are viremic and that only 48% of cases had been diagnosed). By the end of the year 4,100 more infections were diagnosed in 2018, and 6% of patients initiated on treatment that year (n=3,600). There were an estimated 1,400 new infections, an incidence rate of 34 per 100,000, in 2018.
    - 57% of total infections were in the 1945–1965 birth cohort*
    - 13% of total infections were among women of childbearing age*
    - 11% of total infections were among people who inject drugs (PWID)*
    - 4% of total infections were among the incarcerated population*
    - 20% of infected individuals were enrolled in Oregon Medicaid*[+]

    *Percentages do not sum to 100% because overlap exists across groups, and not all subpopulations are considered here

    [+]The true HCV prevalence among Oregon Medicaid patients was unknown, but 11,500 persons are estimated to be currently infected

What is the impact of current policies?

- If the current policies projected for 2019 continue and there is no change to the HCV treatment paradigm in Oregon, the total number of HCV infections will decline 60% by 2030; liver-related deaths, hepatocellular carcinoma (HCC), and cirrhosis will decrease by 45% as fibrosis restrictions are lifted and treatment rates remain high.

What needs to be done to eliminate HCV in Oregon?

- Eliminating HCV (defined by the WHO as requiring diagnosis of 90% of all infections, an 80% reduction in new infections and a 65% reduction in liver-related mortality) would require 3,200-5,500 patients treated annually. The expansion of harm-reduction and prevention efforts could reduce the incidence rate from 34 per 100,000 cases in 2018 to around 26 per 100,000 by 2030.
    - In 2019, Oregon removed treatment restrictions for Medicaid and incarcerated populations. These opportunities can be leveraged to expand treatment to the highest-risk populations.
    - Oregon currently maintains a few syringe-exchange programs around the state. To achieve the reduction-in-new-infections elimination targets, Oregon can look to expand ongoing harm-reduction strategies and treat HCV-positive people who are actively injecting drugs.

Background

HCV globally

Today, an estimated 71 million individuals globally are infected with Hepatitis C virus, a curable infection that, untreated, can lead to cirrhosis, liver cancer, and liver-related death. Approximately 400,000 people die each year from causes related to HCV, which can be eliminated through coordinated efforts for prevention and treatment. Unfortunately, as of 2017, only 20% of those infected patients had ever been diagnosed, and, currently, only 2% of infected patients are being treated for the disease annually.

The CDA Foundation and the Polaris Observatory

The CDA Foundation (CDAF) is a non-profit organization that specializes in the study of complex and poorly-understood diseases in order to provide countries and states with the data and information to create and implement successful elimination strategies. The Polaris Observatory, an initiative of CDAF, provides epidemiologic data, modeling tools, training and decision analytics to support eliminating Hepatitis B and C globally by 2030. The observatory offers the most up-to-date estimates for the HCV and hepatitis B virus disease burdens and economic impacts, and offers strategies for elimination of each virus, along with financing options. An independent advisory board with representatives from global health organizations, academia, civil societies and donors oversees the activities of the observatory. The Polaris Observatory's teams of epidemiologists work directly with stakeholders in more than 100 countries to assess the current—and future—disease burden of hepatitis, to model economic impact, and to develop strategies that can achieve country or state-defined targets to eliminate it. By developing partnerships at country and regional levels, the observatory collects and analyzes data for its platform and publishes key findings to facilitate adoption of policies around hepatitis elimination.

How this model has been used globally

This work has resulted in the adoption of national hepatitis-elimination strategies in countries such as Egypt and Mongolia. In Egypt, this included an economic analysis that accounted for both direct costs (healthcare, screening, diagnostic and antiviral therapy costs) and indirect costs (costs based on disability-adjusted life years). The analysis showed that it would cost Egypt US$90 billion over a 15-year period if the government kept the status quo. A plan of action was then developed beginning in 2014 with a goal of treating 300,000 patients annually, including cost subsidies for four years. After seeing successes, the plan continued each year. In 2016, Egypt treated 577,000 patients and the plan expanded to include patients at all stages of disease, even those without any HCV-related consequences.

In Mongolia, CDAF and its Polaris Observatory team worked with the World Health Organization's Regional Office for the Western Pacific (WPRO), first to design an economic analysis and understand the disease burden. Working with partners including WPRO, the president of the Mongolian Association on Study of Liver Diseases, a physician professor and a group of other researchers, the team developed the co-payment method based on income level. The Mongolian government subsidized part of drug treatment, and as prices declined, treatment became even less expensive for patients. CDAF also worked with the WPRO to develop a national screening program in urban and rural areas after concluding that, even if the prevalence of HCV goes down in the next decade, there will still be more transmission and deaths unless there is an increase in screening and diagnosis.

How this model has been used in the United States

In 2014, this work expanded to include state-based analyses within the U.S. Through collaborations with a combination of state health departments, the CDC Foundation, Association of State and Territorial Health Officials (ASTHO) and state collaborators this model has been used to encourage the removal of Medicaid fibrosis restrictions (Colorado), to publish the HCV epidemiology and an elimination scenario (Rhode Island) and to inform the development of state elimination scenarios (District of Columbia and New York, *in progress*). These results can be found on the Polaris Observatory website (http://cdafound.org/polaris-hepC-dashboard/). Analyses have been completed in ten states (California, Colorado, Georgia, Iowa, Louisiana, New Mexico, Pennsylvania, Rhode Island, Tennessee and Washington), and ongoing analyses include collaborations with ASTHO, CDC and state partners to identify the disease burden and associated elimination strategies in Oregon.

Hepatitis C Related Disease Burden – Oregon

This analysis represents the work of stakeholders from the Oregon Health Authority (OHA), Oregon Health and Science University, Providence Health Systems, Oregon Department of Corrections, Oregon Medicaid Program, Portland Area Indian Health Board, ASTHO, CDC and CDAF. The primary objectives were to quantify the current and future disease burden of HCV in Oregon and to identify a path towards elimination.

Oregon has one of the highest rates of chronic HCV infection among U.S. states and has reported significant associated mortality. [16] Since 2000, HCV-related mortality rates in Oregon have nearly tripled and have consistently been higher than the national average.[17] Based on a 2014 OHA report, it was estimated that approximately 71,250 Oregonians were chronically infected (RNA positive) with HCV in 2011. This equates to a 1.83% viremic prevalence in 2011.

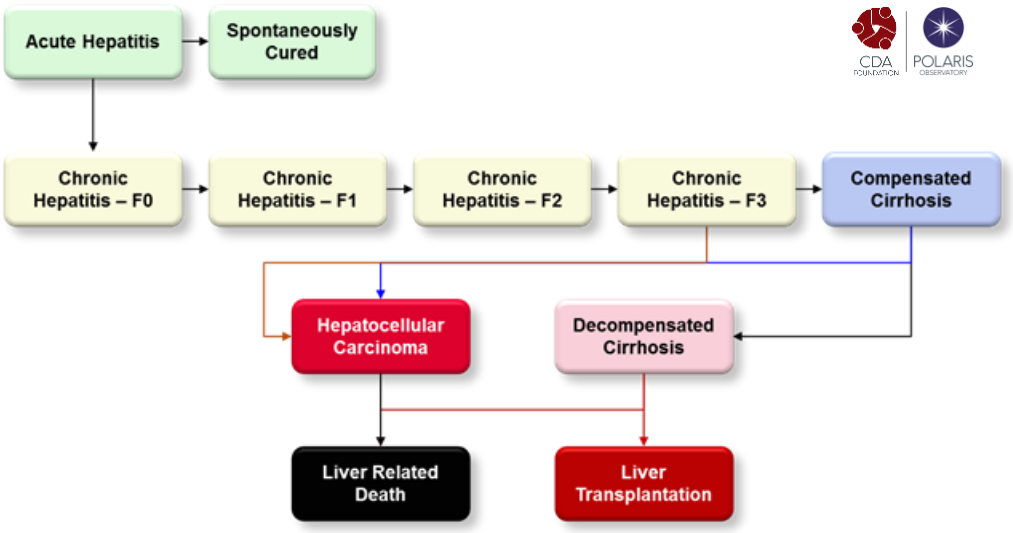
Achieving a sustained virologic response (SVR) to HCV treatment can reverse the effects of early-stage fibrosis and slow the progression of cirrhosis into decompensation or hepatocellular carcinoma (HCC).[18,19] This reduces liver-related mortality by 95% and all-cause mortality by 75%.[20] Direct-acting antivirals (DAAs) can achieve SVR in >95% of patients with HCV.

As in the United States as a whole, in Oregon, almost 70% of HCV-infected individuals have HCV genotype 1.[21] Though genotype 1 chronic infection was previously the most difficult to treat, DAAs have become the standard of care and are safe for the treatment of genotype 1 patients. For this modeling exercise, based on input from expert meetings, we assumed an SVR rate of 95% for all genotypes.

The Model

The mathematical model is an Excel®-based disease-progression model that was calibrated using reported, state-specific, epidemiologic data. The progression is as follows (Figure 1):

Figure 1.[*]



The details of the model have been described previously in Blach 2016.[22] Briefly, a Markov disease-progression model grounded in population, mortality, and state-specific HCV data was developed. The model captures new (acute) infections by age and sex starting in 1950, and then follows the annual progression from acute infection to spontaneous clearance or through the stages of chronic infection. Additionally, the model accounts for age-specific mortality as well as patients who maintain a sustained virologic response (SVR). Based on state-specific inputs, the model is used to forecast the disease burden by HCV sequelae, including fibrosis, cirrhosis, decompensated cirrhosis, hepatocellular carcinoma (HCC), and liver-related death from 1950 to 2030.

[*] F0 indicates no fibrosis; F1 = mild fibrosis; F2=moderate fibrosis; F3=severe fibrosis.

Input Data

The following epidemiologic data were input into the model (Table 1):

Table 1.

Historical Input	Estimate (Range)	Estimate Year	Reference	Source Description
HCV-RNA positive Infections	71,250	2011	[23]	OHA* CHC notification data adjusted by the national diagnosis rate
Anti-HCV Prevalence by Age and Sex	See Figure 2	2006	[24]	NHANES 2003-2010 age and sex distribution
HCV-RNA Prevalence by Age and Sex	See Figure 3	2018	[25, 26]	Denniston 2014, scaled to the Oregon prevalent population and aged through the model, accounting for patients notified to OHA in the under-40 population
HCV Genotype	See Table 2	2019	[27]	Unpublished surveillance data from Providence Health Systems
Total Diagnosed (HCV-RNA)	31,000	2018	[28, 29]	Notification data provided by the Oregon Health Authority
Annual Newly Diagnosed (HCV-RNA)	4,100	2018	[30]	Notification data provided by the OHA
Annual Number Treated	3,600	2018	[31, 32, 33, 34, 35]	2004–2014, annual U.S. treatment rates applied to the Oregon population. 2015–2018, treatment data aggregated for three populations: All-Payer-All-Claims data (OHA), Veterans (Oregon VA), and incarcerated (Oregon DOC)

*Abbreviations: OHA, Oregon Health Authority; CHC, Chronic hepatitis C; NHANES, National Health and Nutrition Evaluation.

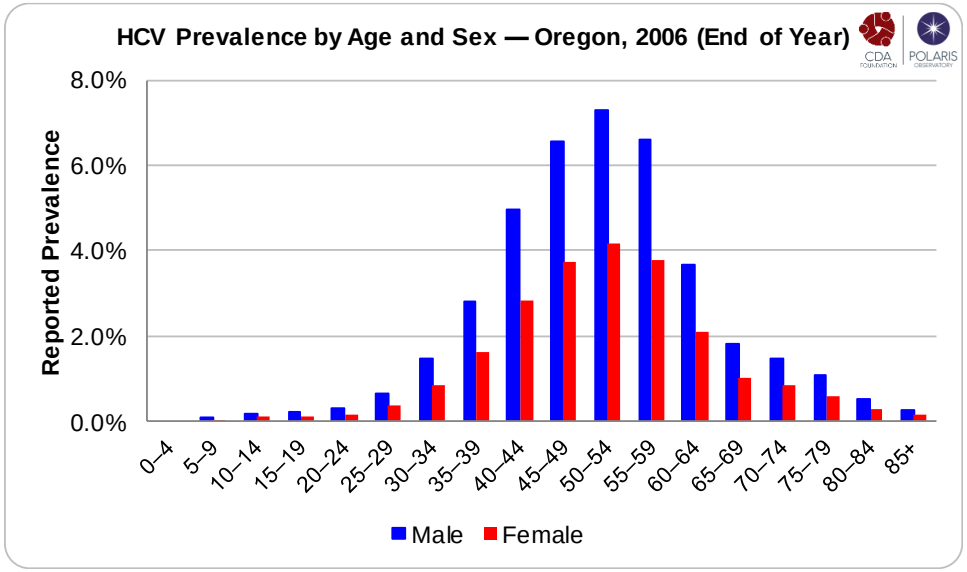
HCV Prevalence

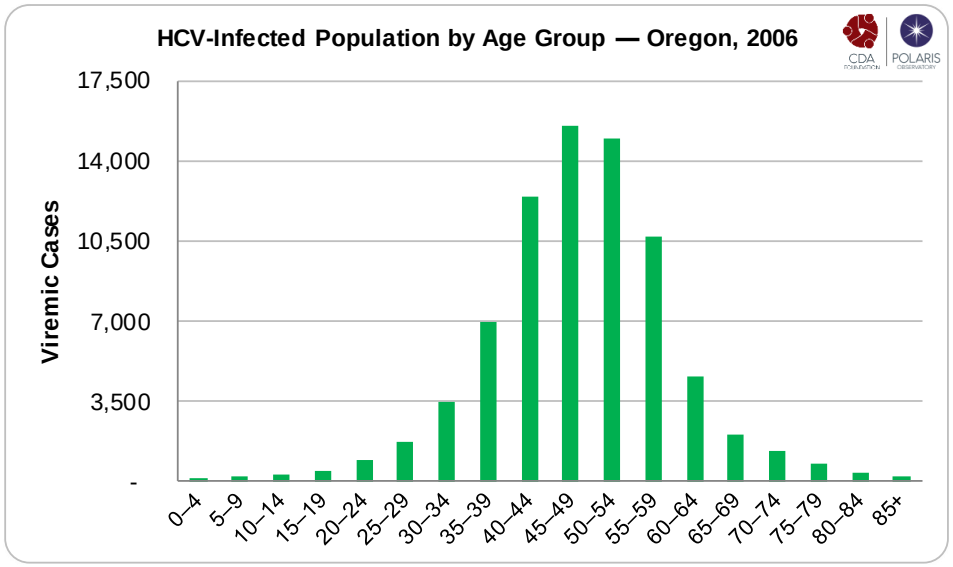
In a 2014 OHA report, a total of 47,400 cases of chronic hepatitis C were reported during 2005–2013.[36] Total prevalence in the state was estimated by adjusting the total reported cases first for viremia, (75%), and then again assuming that only 50% of all cases had been reported.[37,38] Based on these adjustments, a total of 71,250 individuals, or 1.83% prevalence, were chronically infected (RNA-positive) in Oregon in 2011.

The historical age and sex distribution of the infected population in Oregon was assumed to be similar to that of the U.S. as a whole, so data reported from the 2003–2010 National Health and Nutritional Examination Survey (NHANES) were chosen for the baseline prevalence by age and sex in 2006.[39] U.S. prevalence by age and sex was multiplied by the Oregon population by age and sex in 2006, with

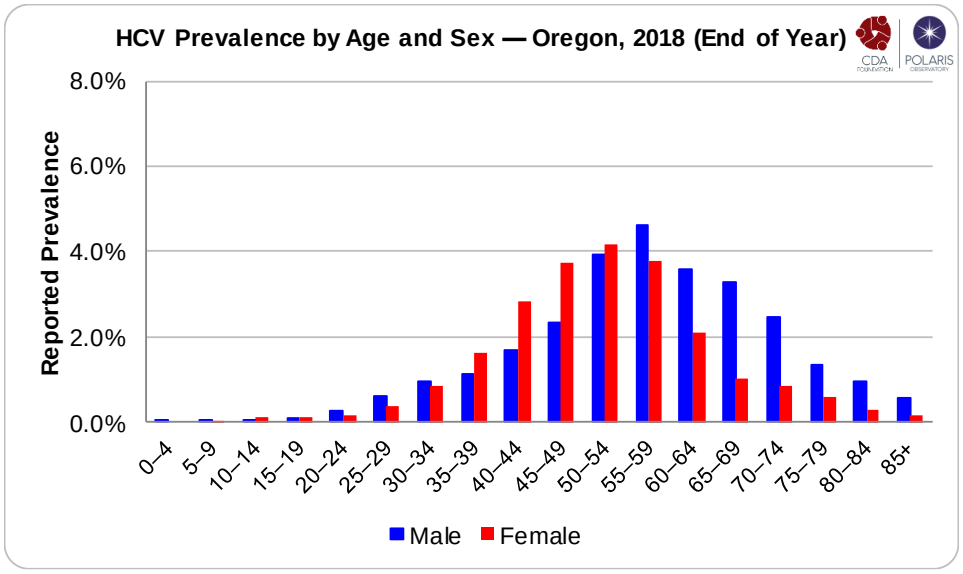
extrapolations for younger age groups. The resulting 2006 prevalence curve is bell-shaped with a peak in 50–54-year-olds (Figures 2a and 2b). The HCV-infected population was then aged through the model to estimate the age and sex distribution of the infected population in 2018 (Figures 3a and 3b). Additionally, the modeled incidence after 2010 was adjusted to ensure that the extrapolated age and sex distribution exceeded notified cases (i.e., in OHA surveillance data) for those less than 40 years of age.[40] Figure 3a shows the distribution of total viremic patients by age group for Oregon in 2018. As the opioid epidemic grows in the United States, we see an increase in the number of infected individuals in the 25–39 age group. More so, in Figure 3b, we see that females have a slightly higher prevalence than males among those aged 35–54.

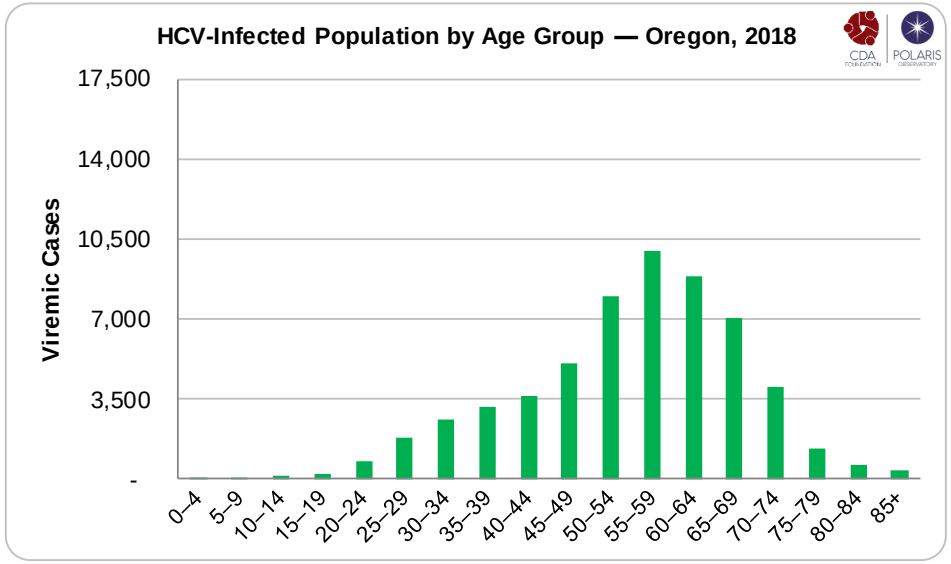
Figures 2a and 2b.





Figures 3a and 3b.





Genotype

The genotype distribution in Oregon was based on unpublished surveillance data collected in 2019 and provided by Providence Health Systems (n=2,100) (Table 2).[41]

Table 2.

Genotype	G1	G2	G3	G4	G5	G6
Providence Health Systems 2019	67%	15%	12%	3%	-	4%

Incidence

Incidence was back calculated to fit the total number of infections in 2011 and adjusted to best match notified cases in those aged 40 years and younger. Before 2010, the incidence trend in Oregon was assumed to mirror that of the United States.[42] Beginning in 2011, it was assumed that incidence increased to reflect growing use of injection drugs and sharing of injection equipment in Oregon. The incidence in 2018 in Oregon was assumed to be similar to that of California and Washington.

Diagnosis

By linking CHC notification data with vital statistics death records, OHA estimated 70,376 individuals reported with chronic HCV were still alive in 2018. Adjusting for 75% viremia, this would equate to 52,782 people ever diagnosed HCV-RNA positive. Removing the modeled number of cases estimated to have been cured (21,800 cases estimated to have been cured during 2004-2018) would leave in a total of 31,000 viremic patients diagnosed by 2018[43].

In 2018 alone, OHA received reports of 5,483 Oregonians with positive HCV rest results; assuming a 75% viremic rate, 4,100 would be diagnosed and RNA-positive.[44]

Treated

The historical number of patients treated each year during 2004–2014 was estimated using annual U.S. treatment rates applied to the Oregon population.[45] For 2015 through 2018, annual treatment data were combined from three key sources that account for the majority of Oregonians (treatment through tribal health providers could not be ascertained):

1. OHA All-Payer-All-Claims (APAC) data reported the number of direct-acting antiviral (DAA) treatments for Medicaid, Medicare (parts A–D) and commercial payers.[46] Data for 2018 were not available and assumed to be equal to those of 2017. APAC is estimated to cover 87%–98% of Oregon residents.[47]
2. The Oregon Veterans Administration reported DAA and IFN treatment estimates, adjusted for the number of non-residents (5%; expert input). [48]
3. The Oregon Department of Corrections reported annual numbers of treated persons in custody.[49]

Subpopulations

Approximately 30% of the total population of Oregon is currently enrolled in Medicaid.[50] As of 2019, a total of 11,500 viremic cases (15,400 CHC cases with 75% viremia applied) have been diagnosed in the Medicaid population.[51]

Routine opt-out screening for anti-HCV antibody in the prison population is in effect for Oregon inmates; however, the number screened is unknown.[52] An estimated 14,900 individuals were incarcerated in 2019, of whom about 20% were estimated to be anti-HCV antibody-positive.[53, 54] Adjusting for 75% viremia, this equates to 2,200 viremic cases.

There were an estimated 10,500 people who actively inject drugs (PWID) in Oregon in 2018 (injecting within the last year; 0.3% of the population).[55] Based on respondent-driven sampling in Multnomah and Clark Counties, approximately 72% of this population was anti-HCV antibody-positive.[56] A sensitivity analysis was done to assess the size of the PWID population at two to three times higher, per expert input.[57]

The model was used to calculate the prevalence among women of childbearing age (WoCBA) and among the baby-boomer cohort (persons born between 1945 and 1965). In 2018, approximately 22% of the total population in Oregon were WoCBA, and 45% of all Oregonians were baby boomers (aged 53–73).

Results

Past and Present Burden of Disease

Annual incidence was estimated with expert input to have peaked in 1989, around the time systematic blood screening began. It was then modeled to increase again in 2013, reflecting an increase in HCV transmission due to high rates of unsterile injection drug use in Oregon. In 2018, it was estimated that 1,400 Oregonians acquired HCV (34 per 100,000).

By the end of 2018 (after accounting for cures), 63%, or 35,800 of the 57,200 viremic infections were diagnosed. Of the total infected population, 3,600 (6%) were treated. Of the 3,600 treated, 3,400 (95%) were cured. This cascade of care in 2018 can be seen in Figure 4. The distribution of Oregonians with HCV by fibrosis stage, as calculated by the model, can be seen in Figure 5. In 2018, 30% of patients were estimated to be fibrosis stage F1, and more than 50% were F2, F3 or cirrhotic.

HCV prevalence in subpopulations was also considered. Among persons in custody there were close to 2,200 viremic infections in 2018. This was calculated by applying the anti-HCV antibody prevalence (20%) and a viremic proportion (75%) to the number of persons in custody (14,900). At the start of 2018, about 4% of all viremic infections (2,200/57,200) were among persons who were incarcerated.

Based on the number of Oregonians enrolled in Medicaid in 2018, this corresponds to a diagnosed prevalence of 1.2% (11,500/971,000). In 2018, 20% of viremic infections were among Medicaid recipients.

Applying an anti-HCV antibody-positivity rate of 72% and a viremic rate of 75% to the total PWID population (10,500), there would be 6,200 viremic PWID– approximately 11% of all viremic infections at the beginning of 2018. If the PWID population was two to three times as high, the number of PWID would range from 11,600–16,300 and increase the 2018 prevalence by 100 cases.

Prevalence by age in the WoCBA population ranged from 0.1%–1.6% in 2018, with the peak prevalence in women 45–49 years old. Prevalence by age within the baby-boomer cohort ranged from 2.1%–3.7% in 2018. Of all viremic infections at the beginning of 2018, 13% were among WoCBA, and 57% were among baby boomers.

Figure 4.

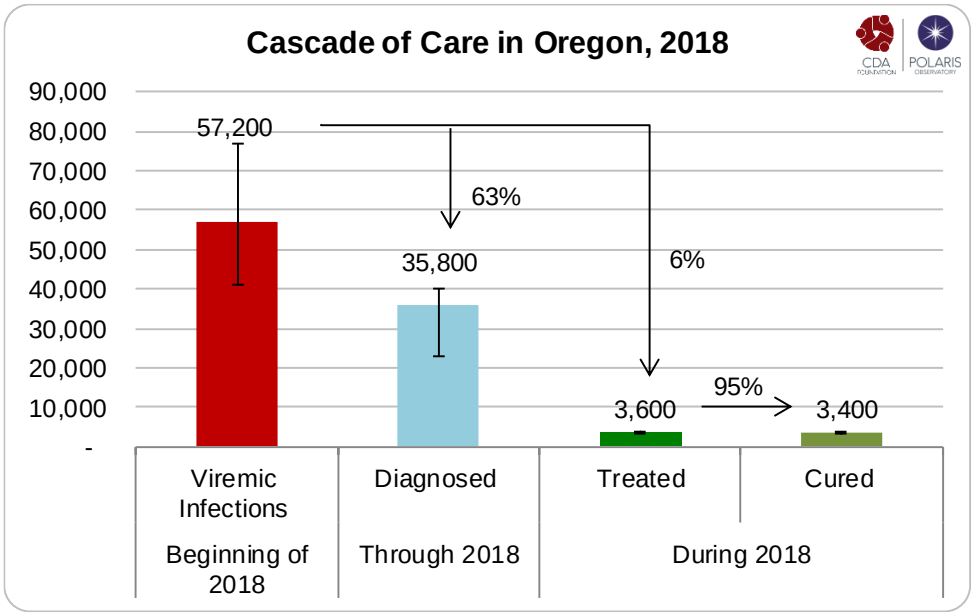
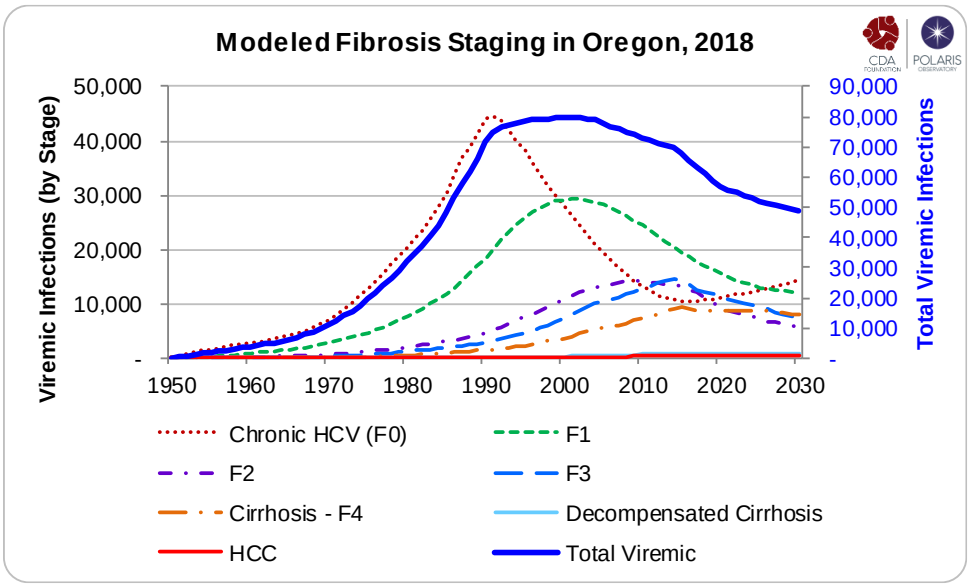


Figure 5.



Disease Burden Scenarios

We created three disease burden scenarios:

1) **Standard of Care (SOC)**; a 50% reduction in treatment and diagnosis from 2019 to 2023*. Due to the removal of Medicaid fibrosis restrictions in 2019, treatment is expected first to increase in 2019, and then to decline by 50%.
2) **WHO Elimination, Strategy A**; achieve WHO elimination targets by 2030 by altering the number of patients treated and reducing new infections through harm-reduction practices. WHO targets are defined as an 80% reduction in new infections, 90% diagnosis of all infections, and a 65% reduction in liver-related mortality between 2015 and 2030.
3) **WHO Elimination, Strategy B**; achieve WHO elimination targets by 2030 by altering the number of patients treated. Additional patients must be diagnosed in 2024 to maintain a pool of individuals eligible for treatment.

**The US National Academies report projects a 50% decline in treatment over five years following the peak number of patients treated.*

For all scenarios and all years, it is assumed that patients over 15 years of age are eligible for treatment and that treatment has an average SVR of 95%. The above scenarios require the following numbers of people to be diagnosed and treated for HCV:

Table 3.

Scenario		Model Parameter	2018	2019	2020	2021	≥2024
Standard of Care		Incident Infections	1,400	1,400	1,400	1,300	1,300
		Treated	3,600	4,500	3,200	2,800	2,500
		Newly Diagnosed	4,100	3,400	2,600	2,300	2,100
		Treatment Fibrosis Stage	≥F2	≥F0	≥F0	≥F0	≥F0
		Screens	126,000	117,000	99,600	96,100	112,000
WHO Elimination	Strategy A	Incident Infections	1,400	1,400	1,400	1,300	1,100
		Treated	3,600	4,500	5,000	5,000	5,500
		Newly Diagnosed	4,100	3,400	2,600	2,300	3,000
		Treatment Fibrosis Stage	≥F2	≥F0	≥F0	≥F0	≥F0
		Screens	126,000	117,000	99,600	96,100	174,000
	Strategy B	Incident Infections	1,400	1,400	1,200	900	470
		Treated	3,600	4,500	3,200	3,200	3,200
		Newly Diagnosed	4,100	3,400	2,600	2,200	1,400
		Treatment Fibrosis Stage	≥F2	≥F0	≥F0	≥F0	≥F0
		Screens	126,000	117,000	99,600	74,100	77,200

Under the current standard of care, the number of Oregonians with viremic HCV peaked in 2001 and will continue to decline by 60% between 2015 and 2030, leaving 28,800 Oregonians with HCV by the end of 2030 (Figure 6). Given the current treatment and diagnosis efforts in Oregon, total liver-related deaths, hepatocellular carcinoma (HCC), and decompensated cirrhosis (DC) will each decrease by about 45%—to 240, 165, and 130 cases, respectively, by 2030 (Figure 6).

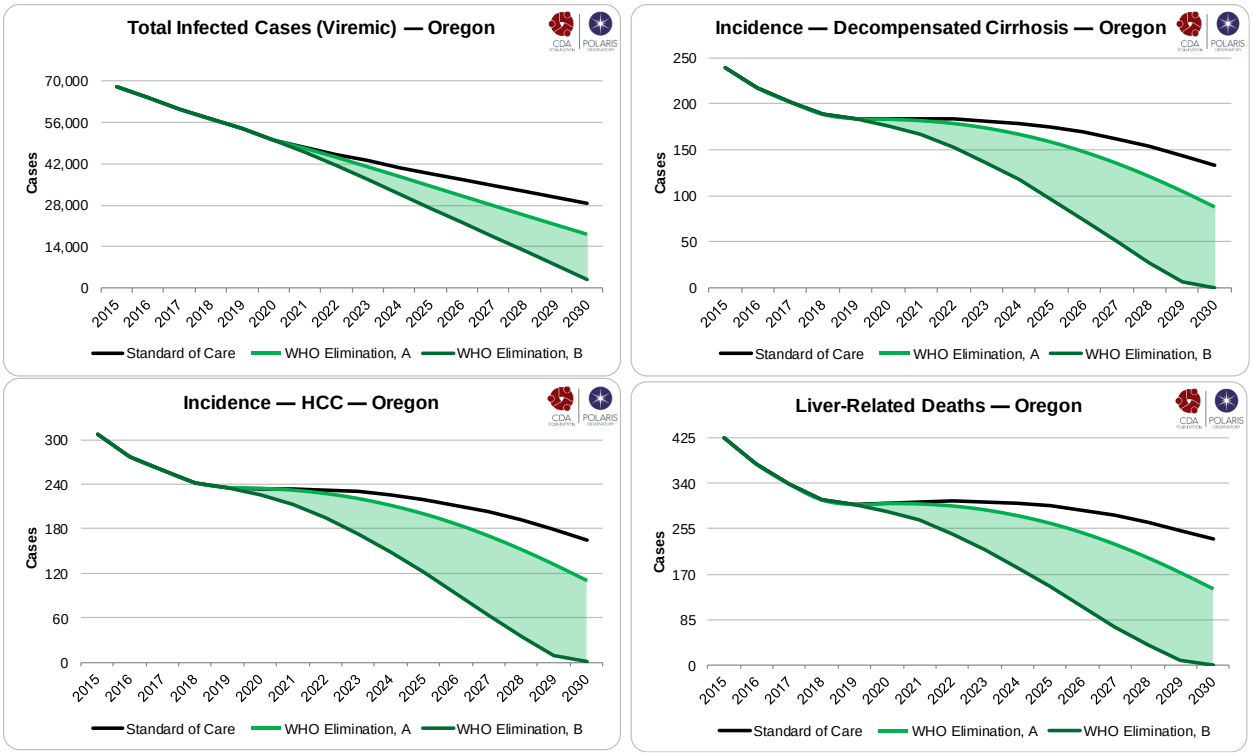
WHO Elimination can be achieved through a combination of prevention, screening and treatment measures. To illustrate a range of possibilities, two strategies were generated, that, at minimum, achieve all targets. Strategy A achieves targets through treatment and prevention and Strategy B achieves targets through aggressive treatment alone. Under Strategy A, new cases are prevented, presumably due to harm-reduction programs, resulting in fewer patients needing to be treated annually. Meanwhile, Strategy B requires a much higher number of patients treated in order to reduce the viral pool so that new infections reduce in parallel. Scenario B exceeds the other targets, due to the higher total number of patients treated.

At minimum, 3,200 patients must be treated annually to achieve WHO targets, ranging up to 5,500 in the absence of harm-reduction. This equates to between 35,000-65,000 total patients started on treatment from 2020-2030. When treatment is increased, case-finding must also be augmented. For this reason, Strategy B would require screening more than twice the number of patients each year compared to Strategy A. However, harm-reduction could be leveraged to balance treatment efforts (Scenario A) – at minimum, new infections would need to be reduced by 20% each year to achieve WHO targets. The outcomes of each scenario are detailed below, however a range of options between the two strategies exists (Figure 6).

Strategy A would reduce total infections by 50,000, preventing 200 cases of incident decompensated cirrhosis and 250 cases of incident HCC. As well, 420 lives could be saved between 2015-2030.

Strategy B would decrease total infections by 65,300, averting 840 cases of incident decompensated cirrhosis and 1,100 cases of incident HCC. About 1,600 lives could be saved between 2015-2030.

Figure 6.



Discussion

The ability to forecast the HCV disease burden that would remain under various intervention scenarios gives policy makers the power to test hypotheses and to quantify the impact of their decisions. Using a Microsoft Excel®-based Markov model, a team of state collaborators developed consensus estimates to answer three primary questions: 1) Who in Oregon is most affected by HCV? 2) What is the impact of various policies on indicators such as HCV prevalence and HCV-related liver cancer and mortality? 3) What level of effort will be necessary to eliminate HCV?

Currently in Oregon, it is estimated that more patients are being treated annually for HCV than are newly infected. This, coupled with mortality from an aging infected population, means that the number of persons living with HCV is declining in Oregon. At the same time, the aging population is progressing to costly advanced liver disease, which could be prevented through timely treatment. Although the annual number of new infections is low compared with the number of patients treated, most new infections are not diagnosed for many years. Without an active screening campaign to identify these individuals, they could remain silent carriers for decades, and may continue to transmit the virus and progress in their liver disease. Additionally, although an estimated 60% of infected persons are diagnosed, not all are linked to care. Efforts will be needed to screen and diagnose new patients and to engage previously diagnosed patients with services.

Elimination of HCV in Oregon could be achieved through a combination of treating 3,200 patients and reducing new infections by 20% per year through harm-reduction efforts. In the absence of harm-reduction, at least 5,500 patients must be treated annually to achieve HCV elimination. A treatment-only plan, however, is likely to be less efficient and more costly: requiring additional testing, treatment, and disease mitigation. Dedicating some resources to disease prevention could result in 21,000 fewer treatments needed from 2020-2030. Due to increasing injection drug use in the state, including a rise in methamphetamine, more HCV-targeted harm-reduction strategies are needed. Oregon maintains a few syringe-exchange programs around the state, mostly in urban areas. Program scale-up will likely be necessary to target more rural areas.[58] To achieve significant reductions in new infections through harm-reduction, the WHO recommends providing 200–300 sterile needles and syringes per person who injects drugs per year.[59] Recent studies have shown that Opioid Substitution Therapy (OST) can reduce the risk of new HCV infections by 50%, Needle Syringe Programs (NSP) by 76%, and a combination of the two by 74%.[60]

Oregon's Medicaid program dropped treatment restrictions in early 2019, allowing all patients, regardless of presence or stage of fibrosis, to seek treatment. This will reduce the total number of infections. Treatment may be expensive; however, it significantly reduces the number of patients that progress to more costly stages of HCV. Lack of adequate funding has slowed Oregon's adoption of policies and programs to address HCV prevention and care and led to a reluctance to expand case finding since no funding exists to support treating more patients.

Recently, more funding has been made available for treatment of persons in custody. Starting in July 2019, fibrosis staging treatment restrictions were removed for all incarcerated persons.[61] This will allow the numbers of persons in custody treated for HCV annually to increase from 120 inmates in 2015 to more than 700 in 2019.[62]

Oregon has taken significant steps towards HCV elimination by removing treatment restrictions and establishing harm-reduction programs. These efforts must be maintained and bolstered to eliminate HCV in Oregon.

Appendix A: Expert Panel Participants

The following individuals contributed to the content of this report through their participation in the expert panel discussions and in report revisions. We are grateful for their efforts.

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