Research Article

Evaluation of 2012/2013 Public Health Recommendations for Hepatitis C Testing Using Multiple Data Sources

William W Thompson[1]*, Lauren Canary[1], Jay Soh[1,2], Mohammed Khan[1,3], Jane Sullivan[4], Ade Osinubi[1], Aaron M Harris[1], Harvey W Kaufman[5], John W Ward[1,6], Carolyn Wester[1], Claudia Vellozzi[1] and Noele P Nelson[1]

[1]Division of Viral Hepatitis, National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention, Centers for Disease Control and Prevention, Atlanta, GA

[2]Department of Biostatistics and Bioinformatics, Rollins School of Public Health, Emory University, Atlanta, GA

[3]Department of Epidemiology and Laney Graduate School, Emory University, Atlanta, GA

[4]OptumLabs, 11000 Optum Circle, Eden Prairie, MN

[5]Quest Diagnostics, 500 Plaza Drive, Secaucus, NJ 07904

[6]Coalition for Global Hepatitis Elimination, Task Force for Global Health, Decatur GA, 30030

*Corresponding author: William W Thompson, U.S. Centers for Disease Control and Prevention, Atlanta, Georgia

Abstract

Objective: Using medical claims, laboratory test orders and self-reported survey data, examine the impact of the CDC's 2012 and USPSTF's 2013 public health recommendations for hepatitis C testing between 2011 through 2017.

Data Sources and Study Setting: Commercial claims data were obtained from IBM Health Truven Market Scan® and Optum Labs® Data Warehouse. Laboratory data were obtained from Quest Diagnostics and LabCorp. Self-reported HCV testing was obtained from the National Health Interview Survey (NHIS).

Study Design: Using multiple data sources, evaluate the recommendations for one-time hepatitis C testing. Hepatitis C testing rates were estimated by year and birth cohort from 2011 through 2017.

Data Collection: Markets can and Optum labs medical claims data were restricted to adults with commercial claims and continuous enrollment in a given calendar year. Laboratory data and the NHIS data were restricted to adults.

Principal Findings: Hepatitis C testing rates increased significantly from 2011 through 2017 among the 1945-1965 birth cohort with a sharper increase in 2017 relative to the other two cohorts. Annual testing rates among the birth cohort increased from 1.70% [95% CI 1.69-1.71] to 8.06% [95% CI 8.04-8.08] using IBM Health Truven Market Scan®, 1.71% [95% CI 1.70-1.73] to 8.55% [95% CI 8.52-8.58] using Optum Labs®, and 2.97% [95% CI 2.95-2.97] to 7.09% [95% CI 7.08-7.10] using laboratory data between 2011 and 2017. Rates of self-reported hepatitis C testing (ever tested) among baby boomers increased from 12.27% [95% CI 11.47-13.07] to 17.33% [95% CI 16.34-18.33] between 2013 and 2017. Self-reported HCV testing rates were substantially lower than cumulative annual testing rates obtained from the medical claims and laboratory tests.

Conclusions: Medical claims and laboratory data appear to be more reliable for assessing the impact of public health recommendations relative to self-reported survey responses.

Keywords: Hepatitis C; Testing; Prevention; Birth Cohort; Recommendations

Introduction

Hepatitis C virus (HCV) infection is a leading cause of liver-related morbidity and mortality in the United States. An estimated 3.2 million people were living with HCV infection based on the 1999-2002 National Health and Nutrition Examination Surveys (NHANES), and most chronic infections were among persons in the 1945-1965 birth cohort (baby boomers) [1], who were primarily exposed to HCV decades ago from contaminated blood products or from unsafe injection drug use [2] In response, in 2012 the Centers for Disease Control and Prevention (CDC) expanded risk-based hepatitis C testing recommendations to include a one-time HCV antibody test for all persons born during 1945-19652. In 2013, the U.S. Preventive Services Task Force (USPSTF) followed with recommendations for hepatitis C testing of persons at high risk for infection and a one-time test for adults born during 1945-1965 [3].

In 2016, approximately 2.4 million people were living with HCV infection, a slight decline likely due in part to increased testing and treatment among the 1945-1965 birth cohort [4,5]. However, despite the availability of direct-acting antivirals that can cure more than 90% of persons with chronic hepatitis C, among 2015-2018 NHANES participants aged ≥20 years who were HCV RNA-positive, 60.6% (95% CI 46.1%-73.9%) reported having been told that they had hepatitis C [6]. Persons in the 1945-1965 birth cohort remain at the highest risk for chronic HCV infection and death from hepatitis C-related causes. Hepatitis C-associated deaths have substantially increased in the last decade and hepatitis C was reported as the underlying or contributing cause for 15,713 deaths in 2018 [6,7] Furthermore, there has been a rapid increase in hepatitis C incidence since 2010 primarily due to an increase in persons injecting drugs likely related, in part, to the opioid crisis [7-11].

Hepatitis C testing and treatment is critical to prevent HCV-related morbidity and mortality. Therefore, understanding trends and socio-economic health disparities associated with testing are critical for identifying and implementing targeted interventions to increase the uptake of hepatitis C testing recommendations. In this study, we used multiple data sources including medical claims data, laboratory test orders and self-reported survey data to assess the impact of CDC's 2012 and USPSTF's 2013 recommendations for one-time hepatitis C testing of the birth cohort (i.e., those born from 1945 through 1965).

Methods

Study Design

An observational non-experimental study design using secondary data sources was carried out using data sources available annually from 2011 through 2017.

Source of Participants

Descriptive information regarding data sources, modes of data collection, representativeness, and annual sample size for the five data sources are provided in Table 1. Two commercial claims data sources (IBM Health Truven Market Scan® and Optum Labs® Data Warehouse) and two laboratory data sources (Quest Diagnostics and LabCorp) were used to estimate annual numbers and rates of hepatitis C testing. The National Health Interview Survey (NHIS) provided self-reported rates of ever being tested for hepatitis C. Institutional Review Board was not required because data were anonymized and publicly available. We provide further detail regarding data sources below.

Table 1: Description of data sources used to estimate rates of hepatitis C testing in the United States, 2011–2017

Data Source	Years	Mode of Data Collection	Representativeness	Average Sample Size Per Year
Quest Diagnostics & Lab Corp (1)	2011 - 2017	Tests ordered from outpatient clinics and hospitals	Commercial laboratories serving clinicians and hospitals in all 50 U.S. states and the District of Columbia that include insured, uninsured and incarcerated populations.	45,357,313
Optum Labs® Data Warehouse	2011 - 2017	Commercial claims data from individuals enrolled and tested in managed care organizations.	Managed care organizations serving privately insured or those with Medicare Advantage insurance	8,011,365
IBM Health Truven Market Scan®	2011 - 2017	Commercial claims data from individuals enrolled and tested in managed care organizations.	Managed care organizations serving privately insured those with Medicare Advantage insurance	20,665,507
National Health Interview Survey	2013 - 2017	Self-report household survey	Nationally representative population of noninstitutionalized civilians	29,735

(1) Lab Corp data was only available through the 3rd quarter of 2017.

IBM Health Truven Market Scan® Medical Claims Data

We obtained health plan enrollment information and claims data for the 2011-2017 IBM Health Truven Market Scan® Commercial Claims and Encounters and Medicare Supplemental and Coordination of Benefits databases. These data consist of inpatient and outpatient service claims for persons with employer-sponsored health insurance coverage and their dependents. The database also contains longitudinal health information on enrollees.

Claims for HCV antibody testing was identified using CPT codes. We defined the annual hepatitis C testing rate as the number of

patients with an HCV antibody test claim divided by the number of adults continuously enrolled in a commercial or Medicare Supplemental plan in a given calendar year. A 45-day gap was allowed during continuous enrollment. Enrollees were restricted to persons enrolled in managed care programs who also had outpatient prescription drug claims information.

Optum Labs® Data Warehouse Medical Claims Data

We obtained data from the Optum Labs® Data Warehouse (OLDW), which includes de-identified claims data for privately insured and Medicare Advantage enrollees. The health plan provides comprehensive full insurance coverage for physician, hospital, and prescription drug services. The database also contains longitudinal health information on enrollees.

Claims for HCV antibody testing was identified using CPT codes. We defined the annual hepatitis C testing rate as the number of patients with an HCV antibody test claim divided by the number of adults continuously enrolled in a commercial or Medicare Supplemental plan in a given calendar year. A 45-day gap was allowed during continuous enrollment. Enrollees were restricted to persons enrolled in managed care programs who also had outpatient prescription drug claims information.

Quest Diagnostics and LabCorp Laboratory Testing Orders

Laboratory testing orders were obtained from Quest Diagnostics and LabCorp which are commercial laboratories serving clinicians and hospitals in all 50 U.S. states and the District of Columbia. These data include both insured and uninsured individuals, and incarcerated persons. De-identified person-level data from HCV antibody immunoassay screening tests ordered during January 1, 2011 through December 2017 for Quest Diagnostics, and January 1, 2011 through October 2017 for LabCorp, were included in the analysis. Additionally, aggregate data on the number of unique patients served by each commercial laboratory for any purpose were used to account for fluctuations in population coverage during the study period and for accurate interpretation of observed trends.

Outpatient service claims with American Medical Association Current Procedural Terminology (CPT®) codes for HCV antibody testing (80074, 86803) were used to calculate patient-level data from the commercial laboratories. The numerator was defined as the number of unique individuals who received their first HCV antibody test during a month. The denominator was defined as the number of unique individuals who had any laboratory test performed by the commercial laboratory during the same month.

All numerators and denominators were stratified by year of birth. The estimated HCV antibody testing rates are reported as number of persons tested for HCV antibody per 100 unique patients served.

National Health Interview Survey (NHIS)

The NHIS is a nationally representative cross-sectional face-to-face household interview of civilian noninstitutionalized individuals in the United States [12]. The NHIS survey is a multistage probability-based survey design that includes stratification, clustering, and oversampling. Hepatitis C questions were administered on the survey from 2013 to 2017. The question used for this study was: "Have you ever had a blood test for hepatitis C?" We combined the responses "no" and "don't know" into a single category because from a public health perspective "no" and "don't know" are equally problematic in terms of the decision of whether to test or not test someone.

Statistical Analyses

Hepatitis C testing rates for all data sources were calculated for three different cohorts based on CDC's 2012 and USPSTF's 2013 recommendations for 1) persons born before 1945, 2) the "birth cohort" (i.e., persons born during 1945 through 1965) and 3) persons born after 1965. Proportions and 95% CIs were estimated for the commercial claims and laboratory data. Weighted proportions and 95% confidence intervals (CI) were calculated for NHIS. Nonoverlapping CIs were considered statistically significant. All statistical analyses were performed using SAS v9.4 and R version 3.5.2.

Results

IBM Health Truven Market Scan® Medical Claims Data

For the Market Scan sample, there were a total of 144,658,551 person years analyzed during the study period from 2011-2017. Across this time period, there were 4,709,184 individuals who had one or more inpatient or outpatient service claim with a CPT code for HCV antibody testing (average of 3.26% individuals tested per year). Overall, the annual testing rate increased from 2.21% in 2011 to 5.47% in 2017. Stratified by cohort, testing rates also increased significantly from 2011 to 2017 among all three cohorts. Among those born before 1945, the testing rates increased from 0.46% [95% CI 0.45-0.47] in 2011 to 0.67% [95% CI 0.65-0.69] in 2017. For the 1945-1965 birth cohort, testing rates increased from 1.70% [95% CI 1.69-1.71] to 8.06% [95% CI 8.04-8.08]. For those born after 1965, the annual testing rates increased less sharply from 3.04% [95% CI 3.03-3.05] to 4.45% [95% CI 4.44-4.46] (Table 2).

Table 2: Laboratory test orders and medical claims for hepatitis C antibody testing by data source, year, and birth cohort, 2011–2017

Data Source	Year	Born Before 1945				Birth Cohort (1945-1965)				Born After 1965			
		N	Tested (freq)	Tested (%)	95% CI	N	Tests (freq)	Tested (%)	95% CI	N	Tested (freq)	Tested (%)	95% CI
Laboratory Data (1)	2011	8,245,860	118,344	1.44	(1.43, 1.44)	14,625,436	433,941	2.97	(2.95, 2.97)	19,838,869	969,826	4.89	(4.87, 4.89)
	2012	7,775,859	110,936	1.43	(1.42, 1.43)	14,600,930	439,489	3.01	(3.00, 3.01)	20,089,495	890,292	4.43	(4.42, 4.44)
	2013	7,311,680	110,477	1.51	(1.50, 1.52)	14,759,863	491,932	3.33	(3.32, 3.34)	20,543,993	901,020	4.39	(4.37, 4.39)
	2014	6,835,744	107,793	1.58	(1.57, 1.59)	15,411,972	596,572	3.87	(3.86, 3.88)	21,971,986	1,038,573	4.73	(4.71, 4.73)
	2015	6,268,984	100,092	1.6	(1.59, 1.61)	15,532,329	617,824	3.98	(3.96, 3.98)	22,931,663	1,146,355	5	(4.99, 5.00)
	2016	6,190,107	101,374	1.64	(1.62, 1.64)	17,159,639	774,397	4.51	(4.50, 4.52)	26,423,714	1,389,294	5.26	(5.24, 5.26)
	2017	5,716,224	121,072	2.12	(2.10, 2.13)	17,398,351	1,234,280	7.09	(7.08, 7.10)	27,868,492	1,550,338	5.56	(5.55, 5.57)
Market scan	2011	2,644,936	12,069	0.46	(0.45, 0.47)	10,547,910	179,768	1.7	(1.69, 1.71)	11,930,032	362,610	3.04	(3.03, 3.05)
	2012	2,154,654	11,576	0.54	(0.53, 0.55)	10,218,351	212,809	2.08	(2.07, 2.09)	12,849,851	408,155	3.18	(3.17, 3.19)
	2013	2,045,670	11,958	0.58	(0.57, 0.59)	8,725,623	237,614	2.72	(2.71, 2.73)	11,468,472	391,954	3.42	(3.41, 3.43)
	2014	1,597,479	8,519	0.53	(0.52, 0.54)	8,559,533	269,363	3.15	(3.14, 3.16)	12,252,129	430,601	3.51	(3.50, 3.52)
	2015	1,187,750	6,947	0.58	(0.57, 0.59)	6,236,809	241,523	3.87	(3.85, 3.89)	9,582,466	365,745	3.82	(3.81, 3.83)
	2016	1,056,067	6,251	0.59	(0.58, 0.60)	5,918,105	282,832	4.78	(4.76, 4.80)	9,983,290	410,796	4.11	(4.10, 4.12)
	2017	687,629	4,606	0.67	(0.65, 0.69)	5,137,799	414,295	8.06	(8.04, 8.08)	9,873,996	439,193	4.45	(4.44, 4.46)
Optum Labs	2011	1,178,014	11,258	0.96	(0.94, 0.97)	2,821,041	48,290	1.71	(1.70, 1.73)	3,386,718	95,250	2.81	(2.79, 2.83)
	2012	1,235,318	15,390	1.25	(1.23, 1.27)	2,818,553	59,734	2.12	(2.10, 2.14)	3,557,282	99,946	2.81	(2.79, 2.83)
	2013	1,225,699	16,829	1.37	(1.35, 1.39)	2,831,537	76,898	2.72	(2.70, 2.73)	3,680,502	104,236	2.83	(2.82, 2.85)
	2014	1,079,357	14,642	1.36	(1.33, 1.38)	2,540,366	75,884	2.99	(2.97, 3.01)	3,609,230	101,837	2.82	(2.80, 2.84)
	2015	1,149,235	18,273	1.59	(1.57, 1.61)	2,707,024	98,591	3.64	(3.62, 3.66)	3,959,340	116,078	2.93	(2.92, 2.95)
	2016	1,314,569	21,435	1.63	(1.61, 1.65)	3,132,176	145,559	4.65	(4.62, 4.67)	4,451,247	139,776	3.14	(3.12, 3.16)
	2017	1,385,545	32,086	2.32	(2.29, 2.34)	3,293,967	281,784	8.55	(8.52, 8.58)	4,722,835	155,720	3.3	(3.28, 3.31)

1. Laboratory data included both Quest Diagnostics and LabCorp data.

Between 2011 and 2017, there was a 373% increase in the testing rate among the birth cohort while only a 46% and 32% increase during the same time period for those born before 1945 and those born after 1965, respectively (Figure 1).

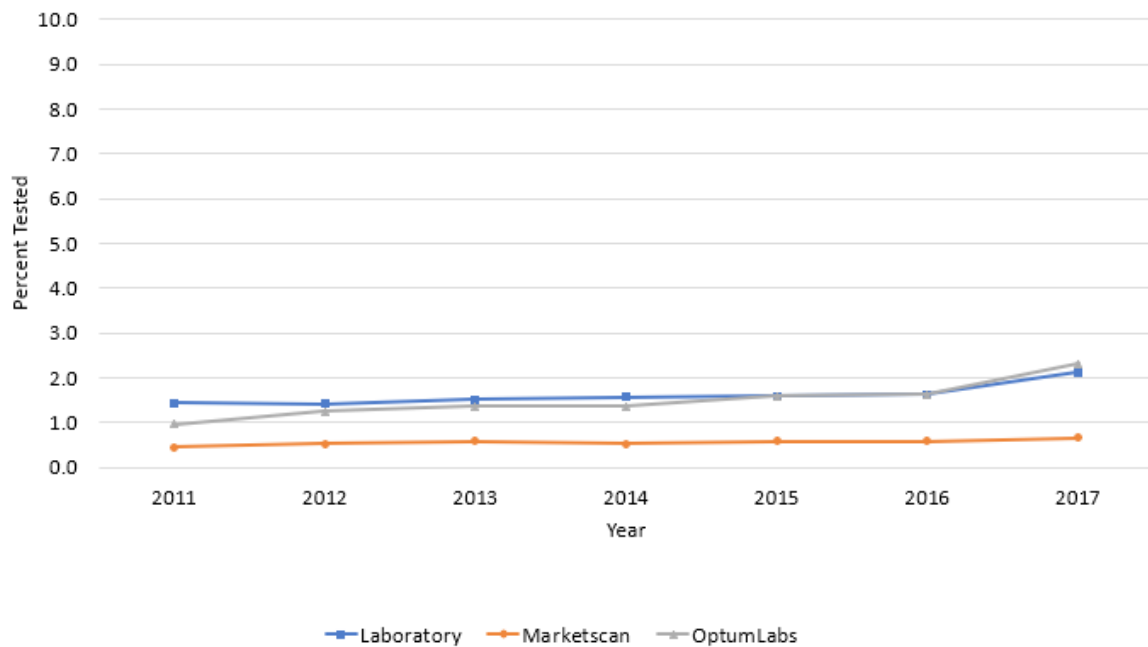Figure 1a: Hepatitis C Antibody Testing For Those Born Before 1945

Figure 1b: Hepatitis C Antibody Testing For Those Born Before 1945 Birth Cohort (born between 1945 and 1965)
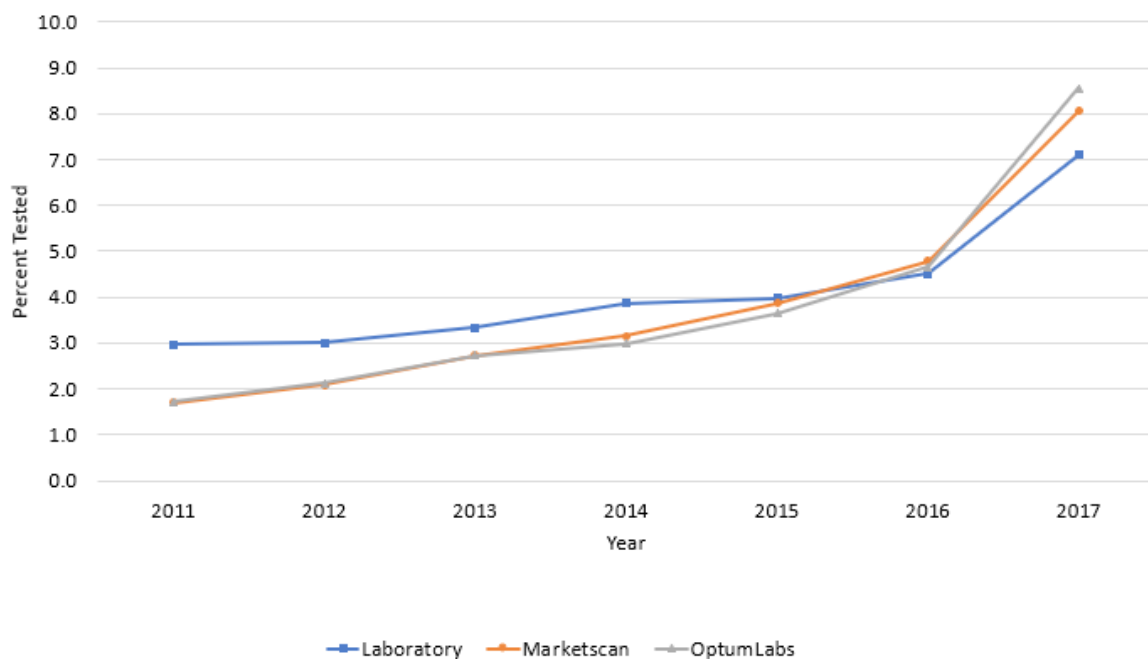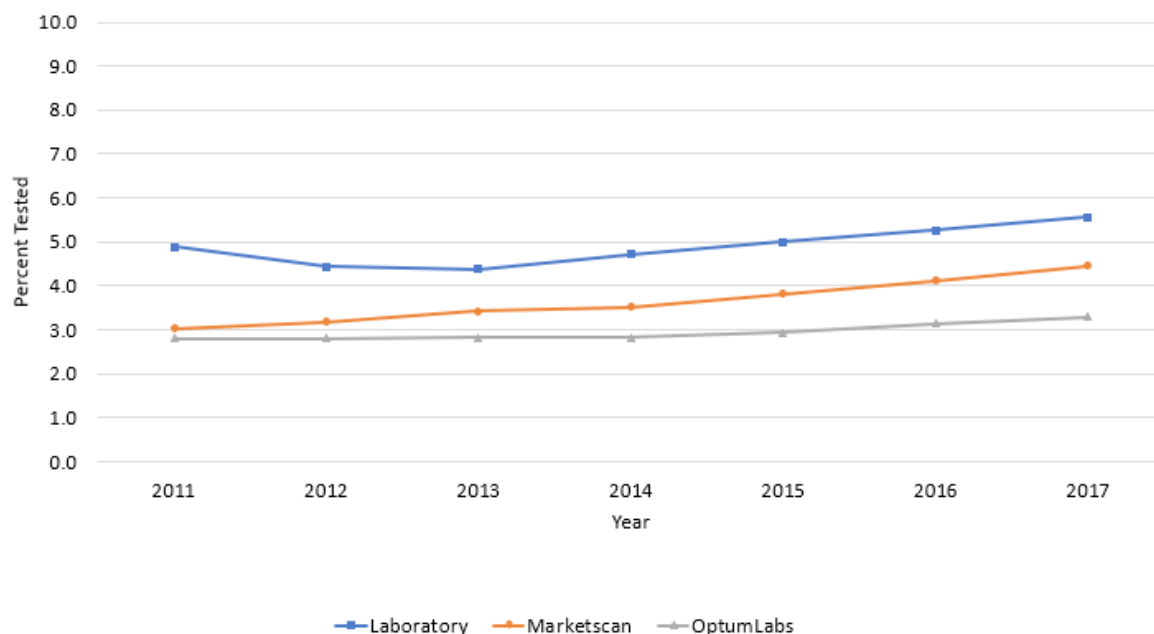
Figure 1: (panel a, b, c). Hepatitis C virus antibody testing by data source, year, and birth cohort, 2011–2017.

Optum Labs® Data Warehouse Medical Claims Data

For the Optum Labs® Data Warehouse Medical Claims Data, a total of 56,079,555 person years were examined from 2011 through 2017. There were 1,729,496 individuals who had one or more inpatient or outpatient service claim with a CPT code for HCV antibody testing (average of 3.08% individuals tested per year). The overall annual testing rate increased from 2.10% in 2011 to 4.99% in 2017. We also found testing rates increased significantly among all cohorts from 2011 through 2017. Among those born before 1945, the testing rates increased from 0.96% [95% CI 0.94-0.97] to 2.32% [95% CI 2.29-2.34]. For the 1945-1965 birth cohort, testing rates increased from 1.71% [95% CI 1.70-1.73] to 8.55 % [95% CI 8.52-8.58]. For those born after 1965, the testing rates increased from 2.81% [95% CI 2.79-2.83] to 3.30% [95% CI 3.28-3.31].

From 2011 to 2017, a 400% increase in the testing rate among the birth cohort was observed while only a 142% and 15% increase was noted during the same time period for those born before 1945 and those born after 1965, respectively.

Quest Diagnostics and LabCorp Laboratory Test Orders

The two laboratory data sources provided a total of 317,501,190 person-years during 2011-2017, which included 13,244,221 individuals who had one or more claims with a CPT code for HCV antibody testing (average of 4.17% individuals tested per year). The overall annual testing rate increased from 3.56% in 2011 to 5.70% in 2017. The testing rates across all age cohorts increased significantly from 2011 compared to 2017. Among those born before 1945, the testing rates increased from 1.44% [95% CI 1.43-1.44] to 2.12% [95% CI 2.10-2.13]. For the 1945-1965 birth cohort, the testing rates increased from 2.97% [95% CI 2.95-2.97] to 7.09% [95% CI 7.08-7.10]. And for those born after 1965, the testing rates increased from 4.89% [95% CI 4.87-4.89] to 5.56% [95% CI 5.55-5.57].

Between 2011 and 2017, there was a 139% increase in the testing rate among the birth cohort while only a 48% and 12% increase during the same time period for those born before 1945 and those born after 1965, respectively.

National Health Interview Survey

We analyzed a sample of 148,674 adults who responded to the hepatitis C test question that was administered on the NHIS from 2013 through 2017. For this sample, 12.82% (weighted; 95% CI 12.54-13.10) responded that they had received a hepatitis C test ("yes"). In Table 3, sample size, number tested, and weighted annual rates of self-reported hepatitis C testing are reported by birth cohorts. In 2013, among those born before 1945, 4.42% [95% CI 3.55, 5.29] reported ever having been tested for hepatitis C. This increased to 5.68% [95% CI 4.72-6.63] in 2017 but was not statistically significantly different. The rates of testing statistically significantly increased from 12.27% [95% CI 11.47-13.07] in 2013 to 17.33% [95% CI 16.34-18.33] in 2017 for the 1945-1965 birth cohort and from 12.98% [95% CI 12.23-13.73] in 2013 to 15.34%

[95% CI 14.46-16.22] in 2017 for those born after 1965. The increase in testing rates was greater for persons with government insurance (i.e., Medicaid, Medicare, or military insurances) relative to those with private insurance (Appendix 1). Conversely, those with no insurance had lower testing rates and very small increases in testing relative to those with other types of insurance.

Table 3: Self-Reported Hepatitis C Testing (National Health Interview Survey 2013-2017).

Survey Year	Born Before 1945			Birth Cohort (1945-1965)			Born After 1965		
	Sample Size	Weighted Percent Ever Tested	Weighted 95% CI	Sample Size	Weighted Percent Ever Tested	Weighted 95% CI	Sample Size	Weighted Percent Ever Tested	Weighted 95% CI
2013	5,158	4.42	(3.55, 5.29)	10,945	12.27	(11.47, 13.07)	15,182	12.98	(12.23, 13.73)
2014	5,235	4.7	(3.92, 5.47)	11,686	12.41	(11.60, 13.21)	16,221	13.11	(12.29, 13.94)
2015	4,824	4.78	(3.96, 5.59)	10,730	13.4	(12.47, 14.33)	15,054	13.2	(12.44, 13.97)
2016	4,516	4.99	(4.16, 5.82)	11,036	14.38	(13.52, 15.23)	14,230	14.32	(13.52, 15.11)
2017	3,373	5.68	(4.72, 6.63)	8,652	17.33	(16.34, 18.33)	11,832	15.34	(14.46, 16.22)

Discussion

This study demonstrated significant increases in annual rates of hepatitis C testing from 2011 through 2017 in the United States using multiple data sources including medical claims data, laboratory test orders, and self-reported survey data. Among the 1945-1965 birth cohort, rates of hepatitis C testing increased substantially faster relative to the other two cohorts suggesting a clear positive impact of the CDC 2012 and USPSTF 2013 testing recommendations. Extremely consistent results were found using the two medical claims data sources which represent large samples of insured noninstitutionalized individuals in the U.S. The results from the two commercial laboratory data sources also showed results that were quite consistent and similar in magnitude to medical claims data. Among the three data sources (i.e, MarketScan, Optum Labs, and Laboratory Data (Quest Diagnostics and Labcorp) there was a 374%, 400%, and 139% increases in testing among the birth cohort between 2011 and 2017, respectively, with the largest increase in testing occurring between 2016 and 2017.

Using the NHIS self-reported rates of hepatitis C testing data, rates of testing among the birth cohort increased from approximately 12% to 17% between 2013 and 2017. This represents an individual's awareness of whether they have been tested. Using the two medical claims data sources and laboratory data sources, the sum of the testing rates across the study period from 2011 to 2017 for the birth cohort ranged from 26.4% to 28.8% tested which likely represents a lower limit of the total number of individuals that have been tested in these populations. The medical record estimates for hepatitis C testing rates are approximately 56% higher than the estimates from the NHIS suggesting that self-reporting hepatitis C testing status may be problematic. In addition, a substantial percentage of persons surveyed by NHIS reported that they "don't know" if they were tested (8%). Persons unaware of their testing status are also likely to be unaware of their disease status; an estimated 39% of persons with HCV infection were unaware of their disease status.6 Although there may be some issues with self-reported information, awareness of an individuals' testing and treatment status is critical for persons to advocate for care and treatment if appropriate.

Although a clear positive impact for the cohort-specific CDC and USPTF recommendations appears to have occurred, there is still substantial room for improvement in HCV testing rates. In addition, in response to the CDC and USPSTF recommendations, several additional actions helped to promote HCV testing of the 1945-1965 birth cohort. The Centers for Medicare and Medicaid Services implemented reimbursement for hepatitis C testing in January 2015 (two years after the USPSTF recommendations were issued) for adults at high risk for HCV infection or who were born during 1945-1965 [13], which likely led providers to be more likely to test. Increased awareness of hepatitis C among providers and patients was also an important factor. The CDC's "Know More Hepatitis" campaign, including promotional messaging and providing limited clinical education, was developed with the goal of increasing hepatitis C testing and knowledge among persons born 1945-1965 and their primary care providers [14] This national campaign likely played a role in hepatitis C testing implementation in conjunction with other promotional programs. Finally, widespread pharmaceutical company advertising for curative treatments with funding and support of testing also brought greater provider and public awareness of hepatitis C.

For persons testing positive for HCV infection, linkage to care and treatment has been shown to be cost effective and improves health outcomes [15-17] Direct-acting antiviral agents, initially approved in 2011 are now safe, all-oral, interferon-free, tolerable, and highly curative.16 Cure rates are over 90% and access to care and treatment has improved over time due to Medicaid expansion as part of the Affordable Care Act, decreases in Medicaid restrictions (i.e., liver damage, sobriety, prescriber) and decreases in drug prices, though barriers remain. Improved access to available treatments and the likelihood of cure for treated persons also provides greater incentive for providers to test for HCV infection and for the public to request testing [18].

In the future, this approach of analyzing multiple diverse data sources to study national hepatitis C testing rates over time could be utilized for state level data, as well as for evaluating other steps of the care continuum, such as trends in engagement in care or treatment among persons with current HCV infection.

The CDC and USPSTF recommendations for hepatitis C birth cohort testing was followed by significant increases in hepatitis C testing rates among persons born during 1945-1965. After the implementation of the recommendation, a wide range of additional factors also likely contributed to the success of this policy. Together, the data reveal the birth cohort recommendation was a successful public health policy initiative that also required sufficient time to fully implement due to necessary changes in health systems (e.g., electronic message prompt), reimbursements, standard operating procedures (e.g., electronic message prompts, reflex PCR testing) and behaviors of both providers and patients. Increased hepatitis C testing is critical for identifying infected persons in time for curative treatment prior to liver disease progression and HCV transmission. Improved implementation of hepatitis C testing recommendations is needed, particularly as attention shifts to the post-1965 birth cohort and the increase in incident HCV infections among injection drug users.

There were several limitations associated with the analyses and data presented in this paper. First, the results for commercial claims data sources were based on a sample of individuals receiving benefits from commercial insurance or Medicare Advantage plans and excluded uninsured individuals or those who were covered by other types of insurance. Second, the denominators for the laboratory tests were based on individuals tested and were not necessarily representative of the individuals who were not tested. Therefore, factors that would lead one to obtain laboratory tests, most notably, having a chronic condition, may have biased the results. Third, for the NHIS survey data, the question represented self-reported awareness of testing and likely underestimates actual testing rates due to recall bias. Future studies should consider assessing the impact of recall bias by comparing self-reported awareness to actual medical records.

In the future, analyzing multiple diverse data sources to study trends in hepatitis C testing rates appears to be promising and could be used to assess trends at the national and state level in order to monitor federal goals to eliminate HCV. In addition, using multiple data sources to evaluate the effectiveness of more recent HCV public health testing recommendations will be important [19].

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Disclaimer

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the US Centers for Disease Control and Prevention or the authors' affiliated institutions.

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