Viral Hepatitis C Surveillance Report, 2018-2019

SAN FRANCISCO, CALIFORNIA

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INTRODUCTION

The Viral Hepatitis C Surveillance Report for 2018-2019 presents data collected by the San Francisco Department of Public Health's (SFDPH) Viral Hepatitis Surveillance Program from January 1, 2018 through December 31, 2019 on persons who have chronic hepatitis C infection. SFDPH receives confidential disease reports containing basic demographic information from laboratories and providers, as mandated by state regulation. This basic information comprises core surveillance for chronic hepatitis C infection. This report provides an overview of hepatitis C infection, a description of the SFDPH Viral Hepatitis Registry, and findings of chronic hepatitis C infection core surveillance.

ACKNOWLEDGEMENTS

This report summarizes information collected by the Viral Hepatitis Surveillance Program in 2018 and 2019. The report was written by Melissa Sanchez, PhD, MA, Amy Nishimura, MS, MPH, and Shelley Facente, PhD, MPH. The data were curated and analyzed by Amy Nishimura. The geographic analysis was done by Autumn Albers, MPH. We thank the Viral Hepatitis Surveillance Team (Rachel Arrington, Jennifer-Xuan Do, MPH, Jessie Wong) who collected data and maintained the Registry. We are grateful to Katie Burk, MPH, SFDPH Viral Hepatitis Prevention Coordinator, and the End Hep C SF initiative for their support. Most of all, we thank the laboratorians, clinicians, and persons living with chronic hepatitis C who provided the information that made this report possible.

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OVERVIEW OF HEPATITIS C INFECTION

Hepatitis C virus (HCV) is one of the most common bloodborne causes of chronic liver disease in the United States. HCV is transmitted primarily through contact with infected blood or blood products. Currently, injection drug use is the most common mode of HCV transmission in the United States and can be acquired from the use of shared, unsterilized needles, syringes or other injection equipment. Another possible mode of HCV transmission is mother-to-child transmission, which occurs in 4%-8% of infants born to mothers living with HCV.[1] Other possible, but less frequent, sources of exposure to HCV include needlestick injuries in healthcare settings; mishandling and/or contamination of injection equipment (e.g., diabetes testing equipment, multi-dose vials); sexual contact with a person living with HCV; and sharing personal items contaminated with infectious blood (e.g. razors, toothbrushes). Receipt of donated blood, blood products or organs was once a common means of HCV transmission; however, due to the implementation of routine blood screening in mid-1992, and the introduction of virus inactivation procedures for clotting factor concentrates in 1987, the risk of HCV infection from these procedures in the United States is now rare.[1]

HCV infection has an acute phase that can either resolve spontaneously or progress into a long-term chronic infection. Acute HCV infection is a short-term illness which occurs within the first six months after a person is exposed to the hepatitis C virus. Most people newly infected with HCV have mild symptoms or are asymptomatic. In those who do experience acute phase symptoms, symptoms typically occur 2-12 weeks after exposure and can include fever, fatigue, dark urine, light-colored stools, abdominal pain, loss of appetite, nausea, vomiting, joint pain, and jaundice.[1]

Acute HCV infection leads to chronic infection in approximately half of people infected with HCV, while the remaining half of those newly infected are able to clear the virus without treatment and do not develop chronic infection. Chronic HCV infection progresses very slowly; most persons with chronic HCV infection are asymptomatic, and the infection is often not recognized until routine blood tests identify abnormal liver function.[1]

Many people with chronic HCV infection eventually develop chronic liver disease, including cirrhosis and liver cancer. Of those chronically infected with HCV, 5-25% will develop cirrhosis over a period of 10-20 years and, of those who develop cirrhosis, the annual risk of developing liver cancer is 1-4%.[1] Chronic HCV infection is the leading indicator for liver transplants and, in 2018, U.S. death certificates listed chronic HCV as either a contributing or underlying cause of death for 15,713 people in the United States.[1]

The Centers for Disease Control and Prevention (CDC) recommends universal HCV screening for all adults 18 years and older and for all pregnant women during each pregnancy. One-time hepatitis C testing is also recommended for everyone with known risk factors or exposures to HCV, including: persons with HIV; those who have ever injected drugs, even if it was only once in the remote past; persons with certain medical conditions, including those who have ever received long-term

hemodialysis; persons with persistently abnormal liver enzyme tests; recipients of blood transfusions or organ transplants in the United States before 1992; recipients of clotting factor concentrates made in the United States before 1987; healthcare workers after needlestick injuries involving HCV-positive blood; and children born to HCV-positive mothers. In addition, routine hepatitis C screening is recommended for persons with ongoing risk factors for hepatitis C infection, including persons who currently inject drugs and share drug equipment and persons with certain medical conditions, including those who receive hemodialysis.[2]

Testing for HCV infection is often a multi-step process. A test for antibody to HCV virus (anti-HCV) is recommended for initial screening. A positive anti-HCV test identifies persons who were exposed to HCV but is unable to distinguish a past infection from a present infection. Therefore, to identify a current HCV infection, confirmation of positive anti-HCV tests is recommended with a nucleic acid test (NAT) to detect the amount or presence of HCV RNA. Distinguishing current from resolved HCV infections through a positive HCV NAT is a critical step in identifying people for hepatitis C counseling, preventive care, and, importantly, treatment.[3]

There is currently no vaccine for HCV.[1] However, in 2014, several new direct-acting antiviral (DAA) medications became available in the United States,[4] dramatically improving the options for non-toxic treatment and substantially improving HCV cure rates.[5] While extremely high costs of treatment with the new DAAs originally resulted in restrictive policies regarding treatment eligibility, by 2018 nearly all restrictions were lifted in California, allowing anyone age 18 or older with Medi-Cal to qualify for life-saving treatment, with the exception of those with a short life expectancy who were not expected to be mediated by HCV therapy.[6]

The most recent estimate of the number of HCV cases nationally was for the period from 2013-2016, during which approximately 4.1 million people in the United States were thought to have HCV antibodies (indicative of past or current infection), and an estimated 2.4 million of those were RNA positive (indicative of active, current infection).[7] This is the first time a decrease in both the prevalence of chronic infection and HCV-related mortality were observed nationally, possibly as a result of declining HCV incidence from 2001 through 2010. However, between 2014 and 2018, the rate of new HCV infections increased from 0.7 per 100,000 population to 1.2 per 100,000 population.[8] The largest increases in incidence were among individuals age 20 – 39,[9] and a similar trend has been seen in acute HCV infections among younger adults in the U.S.[10]

SAN FRANCISCO CHRONIC VIRAL HEPATITIS REGISTRY

In 2005, the SFDPH received funding from the CDC to develop a population-based registry of persons in San Francisco with chronic hepatitis B and/or hepatitis C infection. SFDPH was able to build upon a pre-existing database that contained limited information from the first laboratory report of possible lab markers of chronic hepatitis B or hepatitis C infection reported on an individual between 1984 and 2004. Beginning in 2005, standardized protocols were implemented for data entry into a longitudinal, person-

based information system that contains all positive hepatitis B and hepatitis C test results that are reported for San Francisco County residents and for persons whose residence is not known to be in another jurisdiction. The data that SFDPH receives from laboratories and clinicians represent core surveillance for chronic hepatitis B and hepatitis C and includes basic demographic information (name, sex, age, address) and hepatitis B or hepatitis C test results. Most of the data are reported by laboratories rather than clinicians. Laboratories have been mandated by the California Code of Regulations (CCR), Title 17, Section 2505[11] to report positive hepatitis B surface antigen results to public health since May 1995, while laboratory reporting of HCV test results was not required until July 2007.

METHODS

CORE SURVEILLANCE

Laboratorians, clinicians, and other mandated reporters report positive results of tests for hepatitis C to the SFDPH in compliance with Title 17, California Code of Regulations (CCR), Sections 2500 and 2505.[11] Additionally, according to the California Health and Safety Code (HSC) Section 120130, laboratories are required to submit lab results electronically to the state electronic reporting system.[12] Laboratories and providers are required to report test results, patient identifiers (e.g., name, date of birth, gender, address, phone number, medical record number) and provider identifiers (e.g., name, facility, address).[11] The SFDPH receives and stores the reported information in a secure electronic database, organized by the person reported.

The 2016 Centers for Disease Control and Prevention/Council of State and Territorial Epidemiologists (CDC/CSTE) laboratory criteria for diagnosis are applied to HCV test results to identify persons with probable and/or confirmed chronic hepatitis C. CDC/CSTE defines a probable case of chronic hepatitis C as a person with a positive test for antibodies to hepatitis C virus (anti-HCV), and no report of a positive HCV nucleic acid test (NAT). A confirmed case of chronic hepatitis C is a person who has a positive HCV RNA NAT, including qualitative, quantitative, or genotype testing. In addition to the laboratory criteria, both probable and confirmed case definitions require that cases have no report of, or do not meet, clinical or laboratory criteria indicative of an acute infection. SFDPH does not routinely receive clinical information (e.g., jaundice, liver enzyme tests, etc.) or negative HCV results to identify acute cases based on symptoms or test conversion (a negative HCV result followed within 12 months by a positive HCV result), respectively, and therefore use the CDC/CSTE laboratory criteria for case classification.[13]

For this report, age is defined as the age of the person at the time their first positive hepatitis C result was received by the SFDPH in 2018 or 2019. Age is calculated by subtracting the case's date of birth from the date the result was received by SFDPH, then dividing the difference by 365.25 (the .25 accounts for leap years). The number and percent of persons for whom age is unknown is shown in a table footnote.

Race/ethnicity is classified as American Indian/Alaska Native, Asian, Black/African American, Hispanic/Latino, Native Hawaiian/Pacific Islander, White, or Other. Hispanic/Latino ethnicity includes

all persons of Hispanic or Latino ethnicity regardless of race; all other race categories do not include persons of Hispanic or Latino ethnicity. The number and percent of persons for whom race/ethnicity is unknown is shown in a table footnote.

Data collected and summarized in this report is kept strictly confidential. SFDPH is authorized by law to collect information on cases of chronic hepatitis C infection for the purpose of controlling or preventing disease including: the reporting of disease, the conduct of public health surveillance, public health investigation and public health intervention.[14] SFDPH employees have a legal and ethical responsibility to protect the confidentiality of protected health information and to use that information only in the performance of their jobs.

DATA LIMITATIONS

1. Surveillance data do not measure prevalence: The data presented are not an estimate of the prevalence of HCV infection in San Francisco residents. Prevalence cannot be calculated because some persons infected with HCV are not tested, and others were tested before consistent reporting to SFDPH was established. In addition, some persons who were tested anonymously may not have been reported to SFDPH. Finally, people who were included in these data may not live in San Francisco, either because their address information was not provided or because they have moved.

2. Surveillance data do not measure incidence: The data presented are not an estimate of the incidence rate of chronic hepatitis C cases in 2018 and 2019. The incidence rate is the number of newly infected persons occurring within a defined time in a defined geographical area. While SFDPH does identify the first date the case was reported to them, this date is not necessarily the date the case became infected or was newly diagnosed. For example, some cases may have been infected many years ago but had no symptoms and were not tested when newly infected but were tested in 2018 or 2019 because a clinician was following recommended screening practices or because symptoms of chronic hepatitis had developed.

3. HCV Infection: The HCV infection data presented potentially overestimate the number of reported persons who have chronic HCV infection. Acute HCV infections may be included because no single laboratory test distinguishes acute from chronic HCV infection, and acute infection is based on clinical symptoms and liver function tests that are not reported to the health department. Resolved HCV infections may also be included, because no single laboratory test distinguishes chronic from resolved HCV infection; resolved HCV infection requires a clinician assessment and/or a pattern of negative tests (e.g., HCV NATs) that are not reported to public health. Distinguishing between acute, chronic, and resolved infections would require public health follow-up with clinicians and/or patients to collect symptom and additional laboratory test results. Due to the large volume of reports and limited resources for follow-up, SFDPH was limited to conducting HCV surveillance based on HCV test results that are required to be reported to public health and defines persons as having chronic hepatitis C according to CDC-defined laboratory criteria.

4. Reporting gaps: Complete identification of chronic hepatitis C cases depends on complete reporting by laboratories and clinicians. All reports of positive hepatitis C test results in this report were received electronically by SFDPH in 2018 and 2019 from laboratories, which are mandated to report positive hepatitis C test results under Title 17, California Code of Regulations (CCR).[11] Under-reporting of electronic laboratory reports by laboratories is believed to be minimal as the majority have automated processes for fulfilling their legally mandated obligations to report to SFDPH. Although the California Health and Safety Code (HSC) Section 120130 paragraph (g) requires laboratories to submit lab results electronically, some laboratories are unable to do so and send positive hepatitis C results by fax or mail. These results are not included in this report and, therefore, underestimate the number of cases with chronic hepatitis C in San Francisco. After a systematic review of these positive hepatitis C results sent by fax or mail, it was estimated that these results represent less than 5% of newly reported cases for the 2018-2019 period. Title 17, CCR also mandates clinicians to report cases of chronic hepatitis C to SFDPH;[11] however, the majority of cases are reported by laboratories and not by clinicians. In addition, there are likely San Francisco residents with chronic hepatitis C who did not receive laboratory testing for hepatitis C during this period and whose treating clinician did not report their condition. Information about these persons is therefore missing from this report. Finally, the data presented may include persons who have left San Francisco or who have died after they were reported to the SFDPH.

5. Missing information: Laboratory information systems frequently do not receive or store information about patient race and ethnicity, resulting in a large proportion of cases reported with unknown race and ethnicity.

Similarly, some laboratory reports are missing the case's address. Of the chronic hepatitis C cases reported to SFDPH in this period, approximately 7% were missing street address, city, and ZIP code information. Additionally, 15% of cases were reported with a home address identical to the clinic or outpatient medical facility where they received care; these cases' residences were considered unknown for this report. Information about cases whose county of residence was unknown was included in this report, along with cases that are known to live in San Francisco. Thus, the core surveillance data presented may overestimate the number of San Franciscans who were reported with chronic hepatitis C during this period.

6. Duplication: SFDPH follows procedures to minimize duplicate records for persons whose laboratory results may be submitted with slight variations in name spelling (e.g., use of middle initial, typographic error). However, in some instances it may not be obvious that two different names belong to the same person, so two cases will be recorded instead of one. This would lead to a slight overestimate of the number of persons who were reported with chronic hepatitis C in this period. Conversely, in some situations, information from a case may have been erroneously matched and joined to the information from another case, leading to potential underestimation of the number of chronic hepatitis C cases reported in this period.

EPIDEMIOLOGY OF CHRONIC HEPATITIS C INFECTION IN SAN FRANCISCO

CORE SURVEILLANCE DATA – 2018 AND 2019

From January 1, 2018 through December 31, 2018, SFDPH received over 7,330 positive hepatitis C laboratory reports on 4,035 individuals with probable or confirmed chronic hepatitis C infection. Of these 4,035 individuals, 1,319 (32.7%) were newly reported to SFDPH in 2018. From January 1, 2019 through December 31, 2019, SFDPH received over 6,890 positive hepatitis C laboratory reports on 3,750 individuals with probable or confirmed chronic hepatitis C infection. Of these 3,750 individuals, 1,248 (33.3%) were newly reported to SFDPH in 2019.

Data presented in the following tables are for all persons who met laboratory criteria for probable or confirmed chronic hepatitis C infection with at least one test reported to SFDPH in 2018 (n=4,035) or 2019 (n=3,750) and for persons newly reported with probable or confirmed chronic hepatitis C to SFDPH in 2018 (n=1,319) or 2019 (n=1,248). Newly reported cases are those who were reported to SFDPH with chronic hepatitis C for the first time and for whom no positive HCV laboratory case report had previously been received. Data presented in the following figures represent all individuals reported to SFDPH with chronic hepatitis C in 2018 or 2019 (n=6,632) and individuals newly reported to SFDPH with chronic hepatitis C in 2018 or 2019 (n=2,567). Significant differences were not observed between the 2018 and 2019 data of total cases and of newly reported cases; and therefore the 2018 and 2019 data in each group were merged for presentation in the figures. These data do not represent the number of incident or prevalent infections (see Limitations Section).

Sex and Age

Of the cases reported with chronic hepatitis C in 2018 and 2019, more infections were reported in males among all individuals (69.3% in 2018, 69.7% in 2019) and newly reported individuals (67.1% in 2018, 67.3% in 2019), where sex was known (Table 1). Cases between the ages of 45 and 64 years old comprised 52.0% and 49.1% of all cases reported in 2018 and 2019, respectively, while cases between the ages of 25 and 44 years old comprised 26.9% and 29.6% of all individuals reported in 2018 and 2019, respectively (Table 2). In contrast, of the newly reported chronic hepatitis C cases, 42.1% and 39.1% were 45 to 64 years old in 2018 and 2019, respectively, and 39.7% and 39.5% were 25 to 44 years old when first reported to SFDPH in 2018 and 2019, respectively (Table 2).

Table 1. Sex of reported cases with chronic hepatitis C, 2018 and 2019

Sex	All Cases Reported *				Newly Reported Cases^			
	2018		2019		2018		2019	
	n	%	n	%	n	%	n	%
Female	1240	30.7%	1129	30.3%	433	32.9%	403	32.7%
Male	2793	69.3%	2603	69.7%	885	67.1%	831	67.3%
Total	4033	100.0%	3732	100.0%	1318	100.0%	1234	100.0%

* Sex data missing for 2/4035 (0.05%) and 18/3750 (0.5%) of all cases reported in 2018 and 2019, respectively.

^ Sex data missing for 1/1319 (0.1%) and 14/1248 (1.1%) of cases newly reported in 2018 and 2019, respectively.

Table 2. Age group of reported cases with chronic hepatitis C, 2018 and 2019

Age Group (years)	All Cases Reported				Newly Reported Cases			
	2018		2019		2018		2019	
	n	%	n	%	n	%	n	%
<15	4	0.1%	4	0.1%	3	0.2%	2	0.2%
15-24	73	1.8%	59	1.6%	49	3.7%	41	3.3%
25-34	485	12.0%	507	13.5%	277	21.0%	254	20.4%
35-44	601	14.9%	604	16.1%	247	18.7%	239	19.2%
45-54	833	20.6%	730	19.5%	246	18.7%	197	15.8%
55-64	1264	31.3%	1110	29.6%	309	23.4%	291	23.3%
65-74	653	16.2%	629	16.8%	148	11.2%	177	14.2%
75+	122	3.0%	107	2.9%	40	3.0%	47	3.8%
Total	4035	100.0%	3750	100.0%	1319	100.0%	1248	100.0%

Figures 1A and 1B display the age and sex distributions of all individuals and newly reported individuals reported to SFDPH in 2018-2019 with chronic hepatitis C, respectively. These figures highlight the differences in ages between all cases reported, which are more likely to be older, as opposed to the newly reported cases, which have a larger proportion of younger cases (<45 years old). Similarly, Figure 2 presents cases grouped by birthyear and shows 52.0% of all 2018 and 2019 cases were born between 1945 and 1965 (baby boomer cohort), compared to 39.9% of newly reported cases in the baby boomer cohort. Newly reported cases had a larger proportion of cases born after 1984 (34 years or younger at first report), comprising 24.6% of newly reported cases, compared to 14.8% of all reported cases in the same 1984-2018 birth cohort.

Figure 1A. Age and sex distribution of all cases reported with chronic hepatitis C in 2018 and 2019

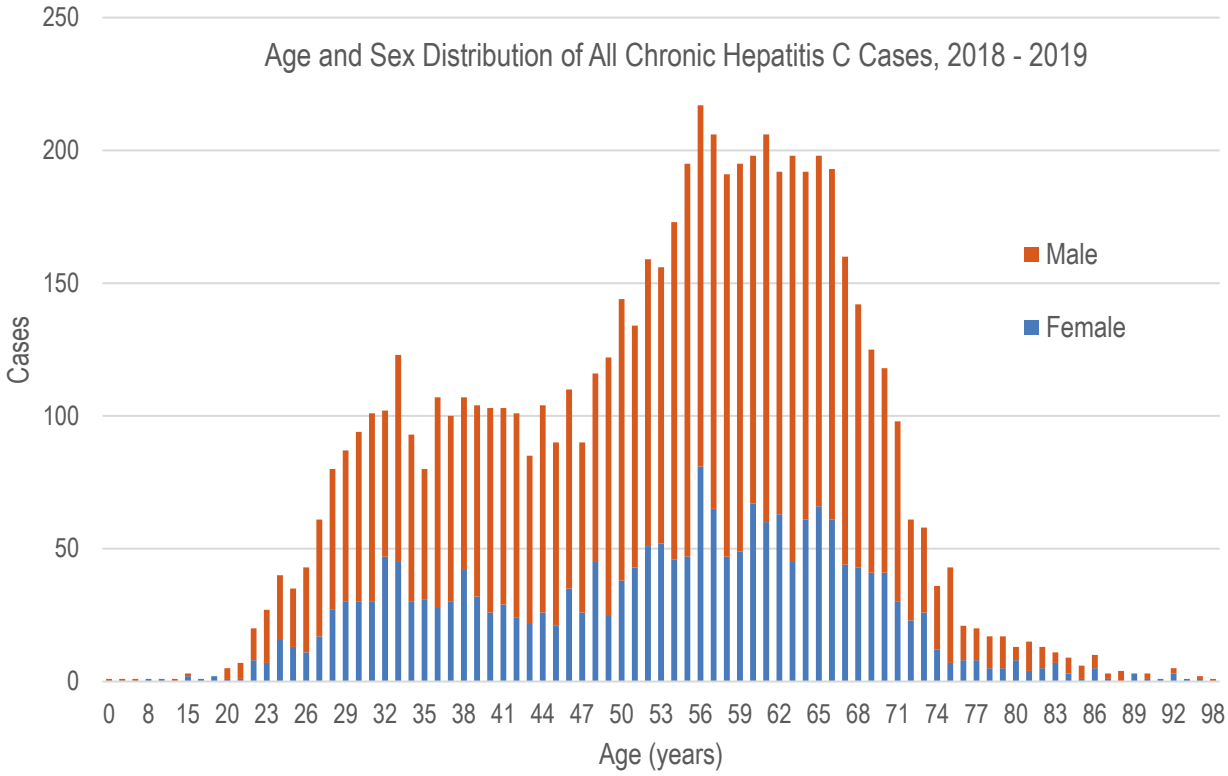


Figure 2B. Age and sex distribution of cases newly reported with chronic hepatitis C in 2018 and 2019

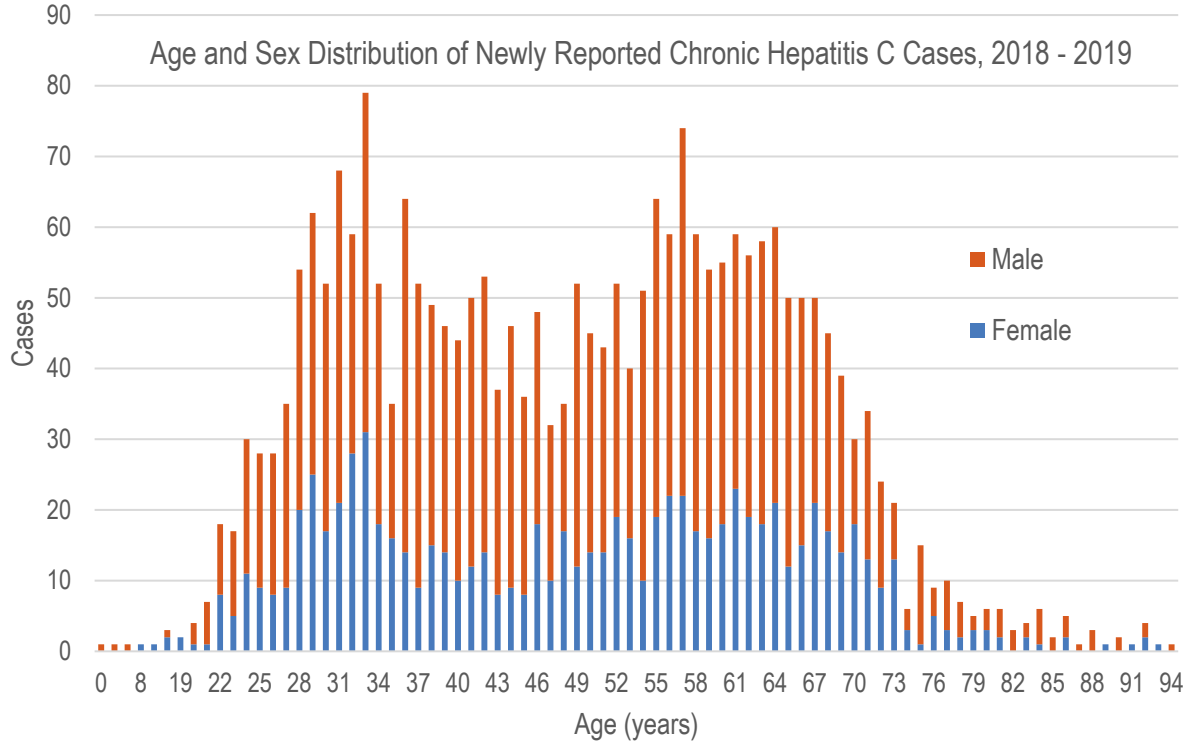
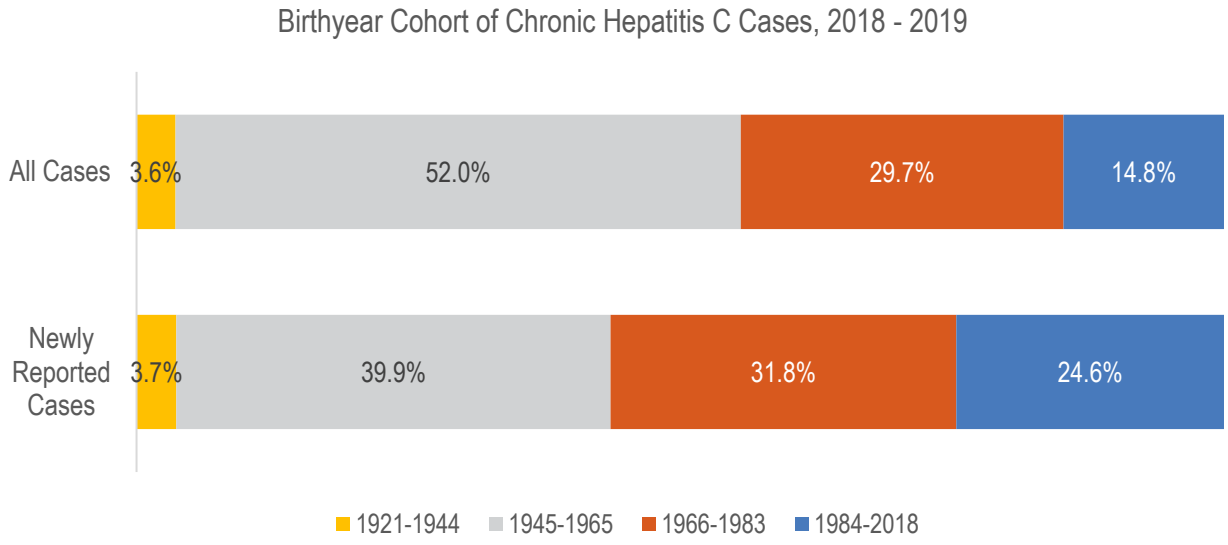


Figure 2. Birthyear cohort of all cases and newly reported cases with chronic hepatitis C in 2018 and 2019



Race/Ethnicity

Of the total individuals reported with chronic hepatitis C in 2018 and 2019, 48.2% were White and 23.5% were Black/African American, among the 73.3% of cases for whom race was known (Figure 3). Among individuals newly reported in 2018 and 2019, 50.5% were White and 14.7% were Black/African American, among the 62.5% of cases for whom race was known (Figure 3). In San Francisco, Whites comprise 40.5%, and Blacks/African Americans comprise 5.0% of the population[15], as shown in Table 3 and Figure 3, below.

Table 3. Race/Ethnicity of reported cases with chronic hepatitis C, 2018 and 2019 and the San Francisco population

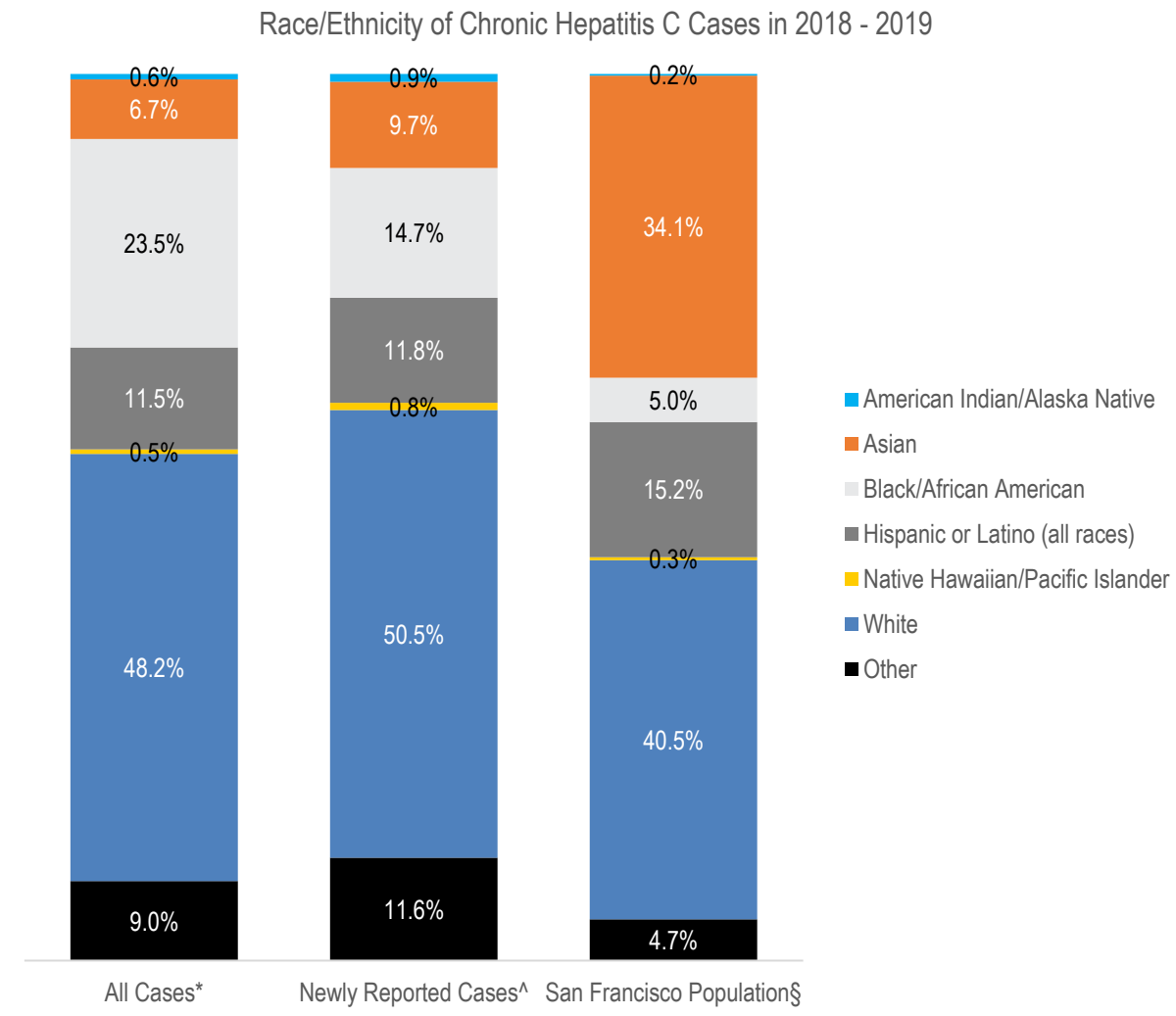
Race/Ethnicity	All Cases Reported*				Newly Reported Cases^				San Francisco Population§	
	2018		2019		2018		2019			
	n	%	n	%	n	%	n	%	n	%
American Indian/ Alaska Native	13	0.4%	18	0.6%	7	0.9%	7	0.9%	1,634	0.2%
Asian	180	6.0%	184	6.6%	70	8.7%	86	10.8%	298,108	34.1%
Black/ African American	748	25.0%	660	23.7%	113	14.1%	122	15.3%	43,782	5.0%
Hispanic/Latino (all races)	365	12.2%	315	11.3%	105	13.1%	85	10.6%	133,314	15.2%
Native Hawaiian/ Pacific Islander	15	0.5%	11	0.4%	9	1.1%	4	0.5%	2,934	0.3%
White	1417	47.4%	1344	48.2%	411	51.1%	399	49.9%	354,423	40.5%
Other	252	8.4%	256	9.2%	89	11.1%	97	12.1%	40,766	4.7%
Total	2990	100%	2788	100%	804	100%	800	100%	874,961	100%

* Race/Ethnicity data missing for 1045/4035 (25.9%) and 962/3750 (25.7%) of all cases in 2018 and 2019, respectively.

^ Race/Ethnicity data missing for 515/1319 (39.0%) and 448/1248 (35.9%) of cases newly reported in 2018 and 2019, respectively.

§ San Francisco Population data source: ACS 2019 5-year estimate[15]

Figure 3. Race/Ethnicity of all cases and newly reported cases with chronic hepatitis C in 2018 and 2019 and the San Francisco population



*Race/ethnicity data missing for 1767/6632 (26.6%) of all cases, 2018 - 2019

^Race/ethnicity data missing for 963/2567 (37.5%) of newly reported cases, 2018 - 2019

§San Francisco Population data source: ACS 2019 5-year estimate[15]

HCV Laboratory Test Results

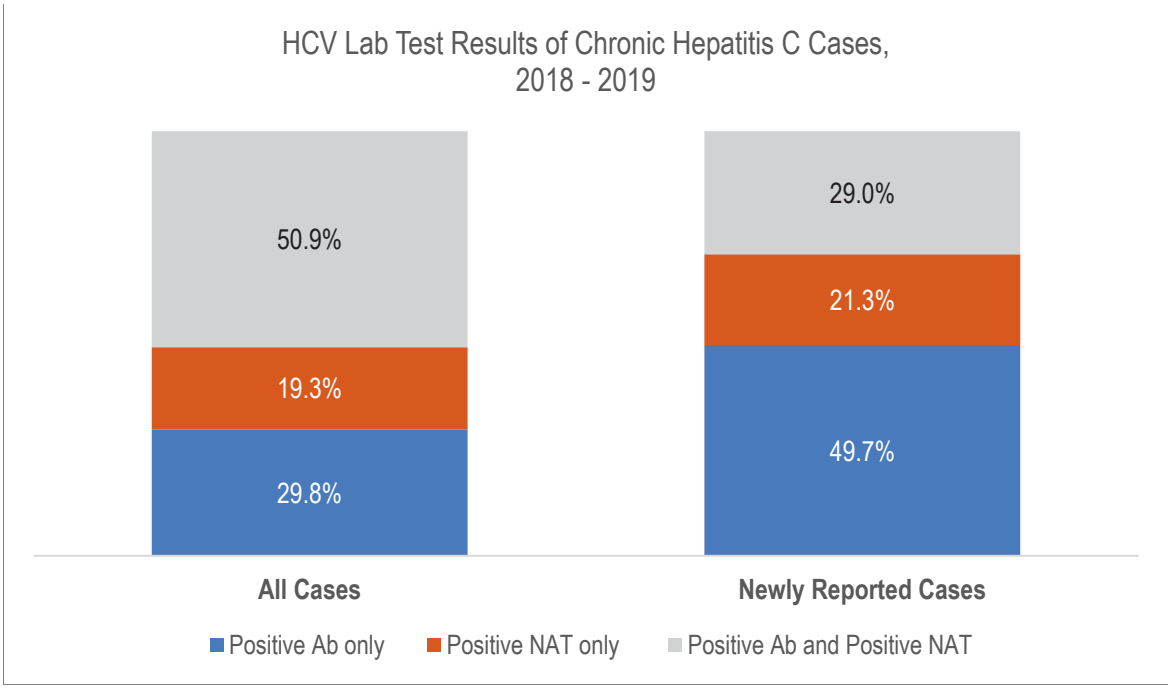
Table 4 presents the types of positive HCV laboratory results ever received by the SFDPH for cases reported in 2018 and 2019. 2018 data includes all positive results reported through December 31, 2018, while 2019 data includes all positive results reported through December 31, 2019. Per the CDC/CSTE case definition, cases reported with a positive HCV antibody (Ab) test and no report of a positive HCV nucleic acid test (NAT) are considered a probable chronic hepatitis C case. A confirmed chronic hepatitis C case is a person who has a positive HCV RNA NAT, including qualitative, quantitative, or genotype testing.

Table 4. Positive HCV lab test results of reported cases with chronic hepatitis C, 2018 and 2019

	All Cases Reported				Newly Reported Cases			
HCV Lab Test Results	**2018**		**2019**		**2018**		**2019**	
	n	%	n	%	n	%	n	%
Positive Ab Only	1060	26.3%	1100	29.3%	644	48.8%	660	52.9%
Positive NAT Only	784	19.4%	729	19.4%	288	21.8%	260	20.8%
Positive Ab and Positive NAT	2191	54.3%	1921	51.2%	387	29.3%	328	26.3%
Total	4035	100.0%	3750	100.0%	1319	100.0%	1248	100.0%

Figure 4 shows the types of positive HCV laboratory test results ever received by SFDPH for all cases reported in 2018-2019, and for cases newly reported in 2018–2019, and includes all positive results reported through December 31, 2019. Of the total cases reported in 2018-2019, 29.8% were probable chronic hepatitis C cases with only ever having one or more positive HCV antibody reports, compared with 49.7% of probable chronic hepatitis C cases among newly reported cases. Confirmed chronic hepatitis C cases comprised the remaining 70.2% and 50.3% of total and newly reported 2018-2019 cases, respectively. Of the total chronic hepatitis C cases reported in 2018-2019, 19.3% had only positive NAT results ever, while 50.9% had both positive HCV antibody and NAT results. Of the chronic hepatitis C cases newly reported in 2018-2019, 21.3% were reported with only positive NAT results, while 29.0% had both positive HCV antibody and NAT results.

Figure 4. HCV lab test results of all cases and newly reported cases with chronic hepatitis C in 2018 and 2019

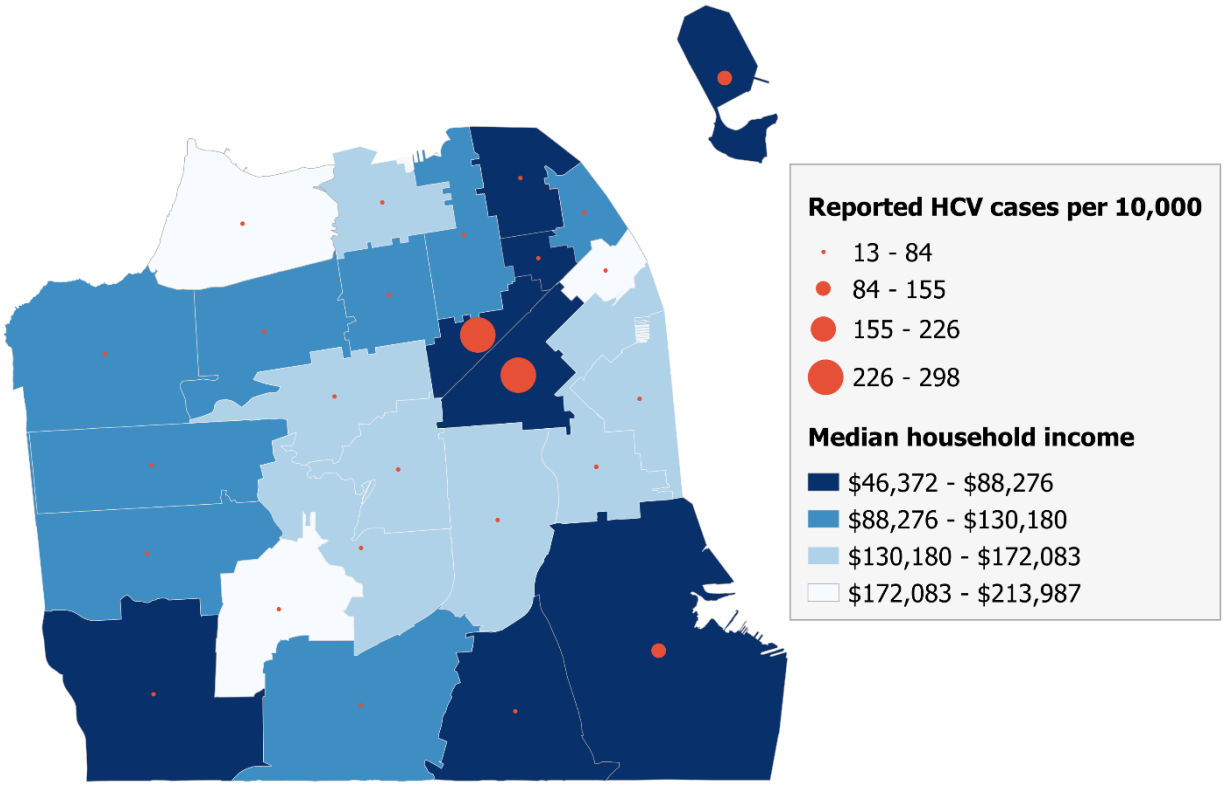


Geographic Distribution

To further understand trends of total cases of chronic hepatitis C infections in 2018-2019, as well as those newly reported in 2018-2019, the figures below map the number of reported cases by ZIP code.

Figure 5 highlights the number of all reported chronic hepatitis C cases in each ZIP code during 2018-2019, per 10,000 population. Cases were counted if any positive HCV laboratory report was received by SFDPH for that person in 2018 or 2019, regardless of whether this was a new or previously known case. Figure 5 shows the number of reported HCV cases per 10,000 residents in 2018-2019 as orange dots and the median household income in shades of blue. The larger the dot in Figure 5, the greater the number of reported cases in that ZIP code, proportionate to the number of total people living in that ZIP code. The ZIP codes in Figure 5 are also shaded by median household income, with darker shading representing lower-income ZIP codes. From this figure, it is clear that ZIP codes with the lowest median household income are more likely to have a higher number of HCV cases; especially for the 94102 (Tenderloin neighborhood) and 94103 (South of Market neighborhood) ZIP codes, with the 94130 (Treasure Island neighborhood) and 94124 (Bayview-Hunter's Point neighborhood) ZIP codes having the second highest rates of reported cases.

Figure 5. Chronic hepatitis C cases reported in San Francisco (2018-2019) and median household income (2019), by ZIP code of residence*

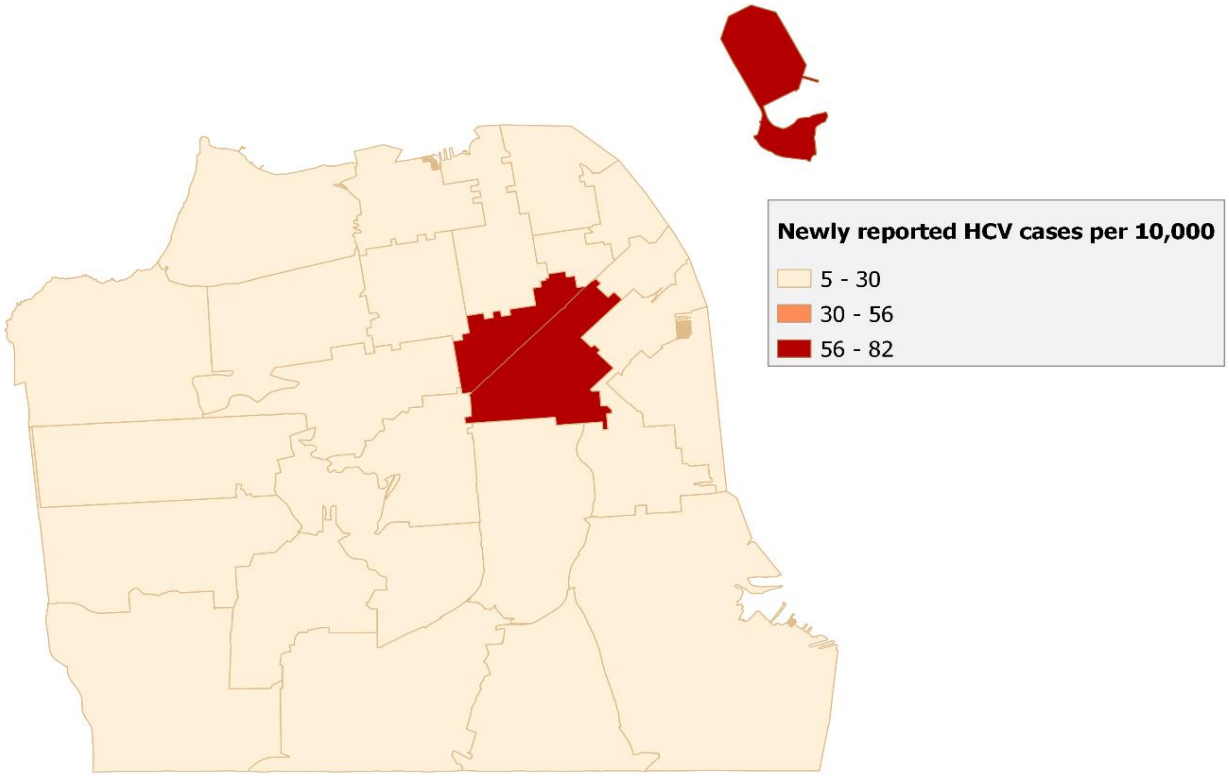


*Additional data details:

- Not shown are 1482/6632 (22.3%) of all reported cases with unknown ZIP codes.
- P.O. boxes were mapped to the standard ZIP code of the area in which they were located. Cases from ZIP codes 94143 and 94188 were mapped to the standard ZIP code of the area in which they were located. Due to disproportionately small baseline population size, data from ZIP code 94104 were merged with data from ZIP code 94108.
- San Francisco household income and population data source: ACS 2019 5-year estimate[15]

Figure 6 includes only cases that were newly reported in 2018-2019 in each ZIP code, per 10,000 population (people for whom no positive HCV laboratory case report had previously been received by SFDPH). In Figure 6, the darker the shading, the higher the number of reported cases in that ZIP code, proportionate to the number of total people living in that ZIP code. From this figure, it is possible to see that the rate of new cases is highest again for the 94102 (Tenderloin neighborhood), 94103 (South of Market neighborhood), and 94130 (Treasure Island neighborhood) ZIP codes.

Figure 6. Chronic hepatitis C cases newly reported in San Francisco (2018-2019) by ZIP code of residence*



*Additional data details:

- Not shown are 810/2567 (31.6%) of newly reported cases with unknown ZIP codes.
- P.O. boxes were mapped to the standard ZIP code of the area in which they were located. Cases from ZIP code 94143 were mapped to the standard ZIP code of the area in which they were located. Due to disproportionately small baseline population size, cases from ZIP code 94104 were merged with cases from ZIP code 94108.
- San Francisco population data source: ACS 2019 5-year estimate[15]

DISCUSSION

The San Francisco core surveillance data for cases reported in 2018-2019 with chronic hepatitis C were comparable to the latest findings on the national level;[7-10] approximately two thirds were male, with newly reported cases trending younger relative to previously reported cases. Specifically, 24.6% of newly reported San Francisco cases were born after 1984 (34 years or younger at first report), compared to 14.8% of all reported San Francisco cases in the same 1984-2018 birth cohort. Inversely, 39.9% of newly reported San Francisco cases were born between 1945 and 1965 (the baby boomer cohort), compared to 52.0% of all reported San Francisco cases in the same baby boomer cohort.

African Americans continued to be disproportionately affected in 2018-2019; comprising 23.5% of all reported San Francisco cases and 14.7% of newly reported cases but only 5.0% of the overall San Francisco population.[15] In addition, the geographic analysis of the surveillance data highlights another notable disparity. San Francisco neighborhoods with the lowest median household incomes are more likely to have a higher number of HCV cases. Identified priority areas include the Tenderloin and South of Market neighborhoods, with the Treasure Island and Bayview-Hunter's Point neighborhoods having the second highest rates of reported HCV cases.

Comparing HCV lab test results of all San Francisco cases to HCV lab test results of newly reported San Francisco cases, both groups had a large percentage of cases who only ever had positive HCV antibody reports. In addition, while both groups had a large percentage, there was a significant difference in the magnitude of these percentages between both groups. Of the total cases reported in 2018-2019, 29.8% were probable chronic hepatitis C cases with only positive HCV antibody reports ever, compared with 49.7% of probable chronic hepatitis C cases among newly reported cases. These large percentages highlight the fact that many cases who are identified as reactive by an HCV antibody test might not subsequently be evaluated for the presence of HCV RNA in their blood to determine if they have current HCV infection. Consequently, those currently infected with HCV who do not receive follow-up HCV RNA NAT testing will not receive appropriate preventive services and linked to medical care and treatment. Therefore, it is imperative that testing strategies ensure the identification of those persons with current HCV infection.[3]

The San Francisco core surveillance data do not estimate the prevalence of HCV across San Francisco; however, a recent paper by researchers within the Research and Surveillance Workgroup of *End Hep C SF* estimated the overall prevalence of HCV in San Francisco, regardless of whether people had been diagnosed and reported to SFDPH since the HCV case registry began.[16] They estimated that in 2018, there were approximately 7,400 more people who were HCV antibody positive (currently living with HCV or having had past infection) than appear in the SFDPH HCV case registry. If this estimate is accurate, San Francisco had a much higher seroprevalence in 2018 (2.5%)[16] than that for the country overall (1.4% per National Health and Nutrition Examination Survey (NHANES)).[17] According to this estimate, almost three-fourths of chronic HCV cases (71.7%) in San Francisco were among men and 37.6% were among people born between 1945 and 1964, who were 23.5% of San Francisco residents as of 2018.[16] The most

disproportionately affected group in San Francisco was people who inject drugs, who comprised an estimated 67.9% of chronic HCV cases but only 2.8% of the San Francisco population.[16] Also disproportionately affected were men who have sex with men (MSM), with 13.8% of cases despite being only 8.0% of the population, and trans women, who made up an estimated 1.0% of HCV cases overall despite being only 0.1% of the San Francisco population.[16]

To address these trends in San Francisco, in 2016, the SFDPH, University of California San Francisco (UCSF), and more than 30 other community partners established *End Hep C SF* (http://www.endhepcsf.org), a collective impact initiative with a mission to support all San Franciscans living with and at risk for HCV and to maximize their health and wellness. *End Hep C SF* achieves this through prevention, education, testing, treatment, and linkage to reduce morbidity, mortality, and stigma related to HCV. More than 190 individuals and 38 organizations have signed on to be a part of *End Hep C SF*, and the initiative's work has been featured in numerous venues throughout the Bay Area, California, and nationally – including in a series of short videos that illustrate the *End Hep C SF* model and the important impact community members have had on the work to eliminate HCV in San Francisco: https://endhepcsf.org/about-us/#videos. *End Hep C SF* continues to evaluate San Francisco's progress toward HCV elimination, including with a recently-launched data dashboard to track a variety of local HCV indicators; available here: https://endhepcsf.org/evaluation-dashboard/.

The opportunity to easily cure almost all HCV infections has energized clinical and community service providers, resulting in increased efforts to understand local HCV epidemiology and work collaboratively toward elimination of HCV infection, including in San Francisco. To this end, public health surveillance efforts have also taken on increased importance. New HCV surveillance efforts have included: (1) the recent shift to require reporting of negative HCV RNA tests in California, which will help us better understand treatment and cure patterns in the city; (2) the plan to establish a SFDPH perinatal HCV program in order to better monitor the burden of perinatal HCV in San Francisco, to identify potential prevention opportunities, and to work towards establishing universal HCV testing guidelines for pregnant women in San Francisco; and (3) the plan to explore additional surveillance activities to follow up with health care providers and/or case patients to improve completeness of demographic information for all cases.

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