

Estimating HCV Prevalence at the State Level: A Call to Increase and Strengthen Current Surveillance Systems

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The degree to which case surveillance captures persons ever infected with HCV is unknown. We determined the discrepancy between HCV seroprevalence, estimated from national survey data, among adults in New York State in 2008 ($n = 286\,262$, or 1.95%) and the number of infected persons reported to the state's surveillance hepatitis registries ($n = 144\,015$). Findings suggest the need to strengthen the existing surveillance system. (*Am J Public Health*. 2013;103:1402–1405. doi:10.2105/AJPH.2013.301231)

Chronic HCV infection is the most common chronic blood-borne infection in the United States.^{1–6} Without identification and treatment, HCV infection can lead to liver cirrhosis, hepatocellular carcinoma, liver failure, and death.^{1,7,8} HCV surveillance systems within states and localities have been developed, but the degree to which these systems identify those who have been infected with HCV, that is, those who are HCV antibody positive, is unknown.

A method to estimate HCV antibody prevalence nationally is provided by the ongoing National Health and Nutrition Examination Survey (NHANES), which conducts serosurveys on a representative sample of noninstitutionalized, civilian US residents.^{5,9} However, no similar ongoing survey exists at any state or local level.¹⁰ Therefore, we developed a method to estimate HCV case prevalence at the state level and then determined the

discrepancy between the estimated number of cases for New York State and the number reported to the state surveillance systems. We chose to estimate prevalence for 2008 because of data availability and compared this with surveillance data from 2001 to 2009, the years for which complete surveillance data were available.

METHODS

We used a quantitative extrapolation to estimate HCV antibody prevalence for persons aged 20 years and older (data for persons younger than 20 years was too limited). For the noninstitutionalized civilian population (i.e., the general population), we used aggregated NHANES data from 1999 to 2008.¹¹ We defined HCV cases according to NHANES methods.¹² We applied prevalence within cross-tabulations of age, gender, race/ethnicity, and poverty status to the proportion of New York State residents in each respective socio-demographic stratum by geographic region in 2008.¹³ We considered these sociodemographic characteristics significant independent risk factors for HCV antibody positivity following predictive modeling of the data. We used geographic regions as defined by a subsample of the American Community Survey.¹⁴ For populations excluded from NHANES sampling (i.e., persons who were incarcerated, hospitalized, nursing home residents, active military, or homeless), we determined prevalence with pooled prevalence from available literature in conjunction with the underlying population sizes determined from public sources.^{15–41}

To determine the number of living persons reported to have HCV antibodies in New York State, we used registries from hepatitis surveillance systems in the state: one covered New York City and the other the rest of the state.⁴² State public health law and New York City health code articles require laboratories to report positive HCV antibody tests and confirmatory assays, including polymerase chain reaction testing, to their respective systems.^{43,44} These systems are independently maintained; therefore, cases may be reported to both systems. To determine which cases identified by surveillance were for persons still residing in New York State, we

deduplicated registry data, matched them to vital statistics, and adjusted for out-migration. Figure 1 shows detailed methods and case delineation.

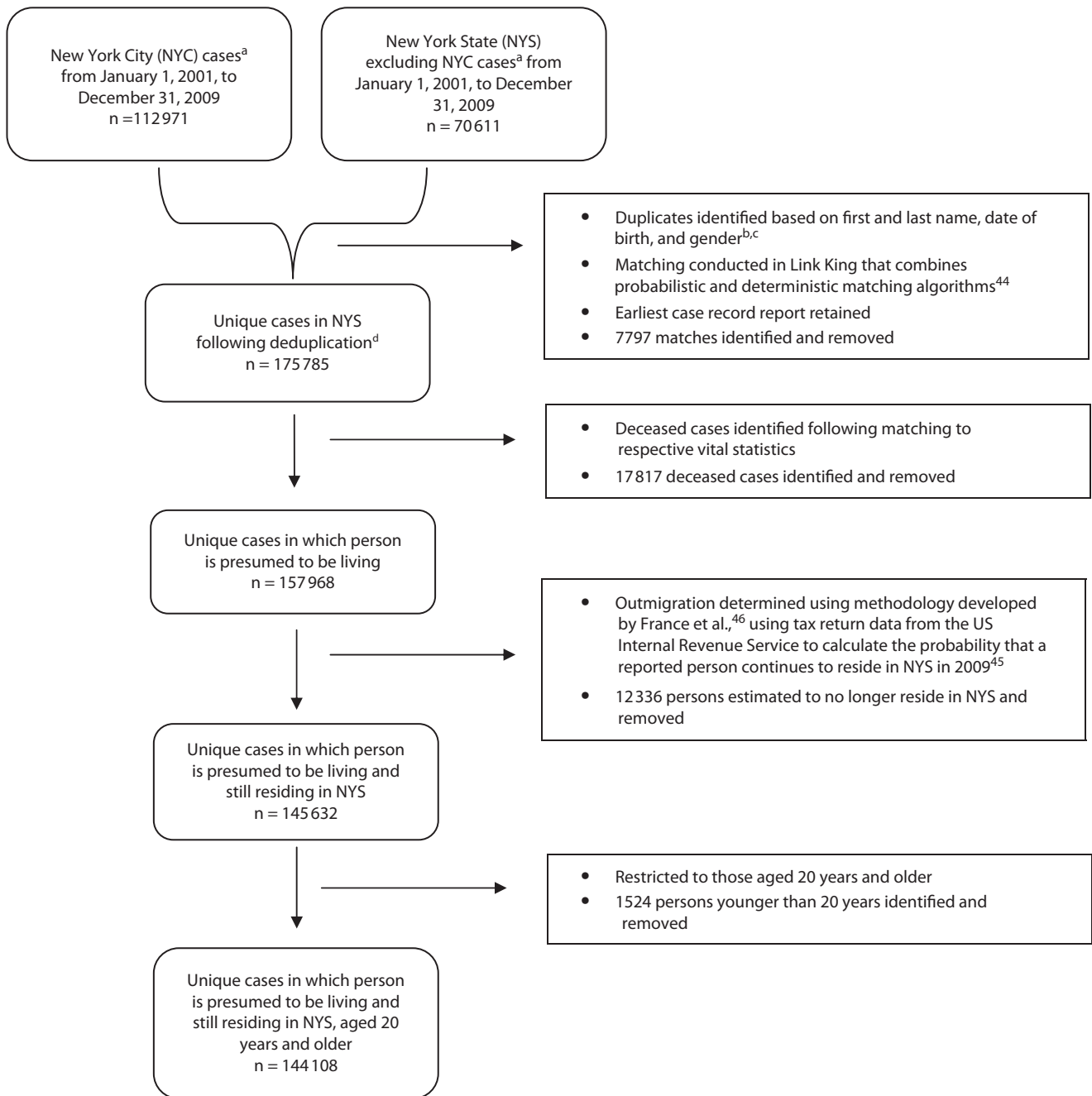
RESULTS

The estimated prevalence of cases in the general population was 1.64% (range = 0.77%–2.55%), or 235 128 (range = 109 835–365 046; Table 1). We identified another 51 134 (range = 30 941–71 516) cases from the excluded populations, resulting in an overall prevalence estimate of 1.95% (range = 0.96%–2.98%), or 286 262 cases among persons aged 20 years and older (Table 1). Deduplicating, matching to vital statistics, accounting for out-migration, and restricting surveillance cases to the population aged 20 years and older yielded a prevalence of 0.98%, or 144 015 reported cases (Figure 1). This equates to roughly half of the number of cases estimated from survey data.

DISCUSSION

We estimated that twice as many cases existed than could be accounted for through surveillance reports (286 262 vs 144 015). Surveillance systems may not capture cases because of undiagnosed infection, diagnoses that are not reported by providers, or insufficient follow-up of reported information to establish infection status. In New York State, determining the extent of HCV screening is not possible from surveillance because reporting of negative test results is not required. Moreover, persons diagnosed prior to the establishment of the registries may not have been captured by surveillance. Although laboratory reporting is robust, staff resources for follow-up have been limited.

A limitation of the estimation method is the inability to incorporate prevalence of injection drug use, the strongest behavioral risk factor for HCV.²⁰ New York State may have a higher prevalence of persons with injection drug history than other states, potentially broadening the gap between estimated and reported cases.^{10,48} Another limitation is the inability to directly compare subpopulations (i.e., general and excluded) among the reported cases to



Note. NYC = New York City; NYS = New York State.

^aCases were defined by Centers for Disease Control and Prevention criteria as a confirmed past or present case for the year in which it was reported, because this definition has had several iterations. For our study, we defined cases as ever infected.⁴⁷

^bEach surveillance system performs deduplication on its reported cases; deduplication of the NYC and the NYS excluding NYC registries was performed prior to matching.

^cAdditional identifying information not available or data insufficient for robust matching.

^dDuplicates first identified based on first and last name, date of birth, and gender, then removed.

FIGURE 1—Use of surveillance registry data to determine the number of cases among living persons with HCV antibodies reported to New York State: 2001–2009

TABLE 1—Estimated HCV Antibody Positivity Prevalence Among Persons Aged 20 Years and Older in New York State: 2008

Variable	No. (Range ^a)	% (Range ^a)
Total	286 262 (140 775–436 562)	1.95 (0.96–2.98)
Noninstitutionalized, civilian		
Total	235 128 (109 835–365 046)	1.64 (0.77–2.55)
Region		
New York City	104 501 (46 333–164 878)	1.81 (0.80–2.86)
New York State, excluding New York City	130 627 (63 502–200 169)	1.52 (0.74–2.33)
Gender		
Female	93 038 (32 899–156 787)	1.24 (0.44–2.08)
Male	142 090 (76 936–208 259)	2.09 (1.13–3.06)
Age at screening, y		
20–29	3411 (0–9056)	0.13 (0.00–0.34)
30–39	20 688 (1719–41 537)	0.79 (0.07–1.59)
40–49	81 294 (41 560–121 029)	2.73 (1.39–4.06)
50–59	98 616 (54 909–142 323)	3.83 (2.13–5.52)
≥ 60	31 118 (11 647–51 102)	0.88 (0.33–1.45)
Race/ethnicity ^b		
Non-Hispanic Black	61 091 (84 789–266 715)	3.07 (1.26–4.94)
All other races/ethnicities	174 037 (25 046–98 331)	1.41 (0.69–2.16)
Family income		
Below poverty	56 646 (20 285–94 717)	2.86 (1.03–4.79)
Above poverty	178 482 (89 550–270 329)	1.44 (0.72–2.19)
Institutionalized, noncivilian and homeless		
Total	51 134 (30 941–71 516)	16.47 (9.97–23.04)
Incarcerated	18 774 (14 835–22 713)	31.25 (24.69–37.80)
Nursing home resident	5020 (2343–9370)	4.50 (2.10–8.40)
Homeless	21 088 (10 410–30 569)	34.50 (17.00–50.00)
Active military	199 (130–268)	0.48 (0.31–0.64)
Hospitalized	6053 (3224–8596)	16.90 (9.00–24.00)

Note. HCV antibody prevalence estimates used in extrapolation for the noninstitutionalized, civilian population were determined from aggregated National Health and Nutrition Examination Survey (NHANES) data for 1999 to 2008 in which age was modified to reflect the respondents' expected age in 2008.

Source. Data are available for the noninstitutionalized, civilian estimates via NHANES.¹¹

^aRanges for the general population were determined following extrapolation of the 95% confidence intervals (CIs) for HCV antibody prevalence from NHANES; ranges for the excluded populations determined following extrapolation of the 95% CIs from the calculated pooled prevalence.

^bRace/ethnicity was restricted to these categories on the basis of predictive modeling conducted on the NHANES data to determine significant independent risk factors for HCV antibody positivity.

the estimated seroprevalence cases, because these subpopulations are not reliably identified in surveillance data. Also, neither method addresses the frequency of chronic versus resolved infection among persons ever infected.

Our results suggest that existing surveillance systems are inadequate for establishing disease burden and resource needs. These findings support the growing advocacy for strengthening existing HCV surveillance systems in the United States.^{2,6,49–51} Future studies at the

state and national level to identify cases not captured in surveillance are needed to better define screening needs and surveillance infrastructure improvements that would give more accurate estimates of disease burden. ■

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Contributors

All authors helped conceptualize the study and write and edit the article. R. Hart-Malloy was the principal investigator and led all aspects of the study. A. Carrascal, A. G. DiRienzo and K. McClamroch helped refine the methodology. K. McClamroch helped analyze data. A. Carrascal, L. Smith, and C. Flanigan helped interpret results.

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Human Participant Protection

The institutional review board of the New York State Department of Health determined that this study did not meet the federal common rule definition of human participant research.

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