Indications for Testing Among Reported Cases of HCV Infection From Enhanced Hepatitis Surveillance Sites in the United States, 2004–2010

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Objectives. Centers for Disease Control and Prevention has recommended a 1-time HCV test for persons born from 1945 through 1965 to supplement current risk-based screening. We examined indications for testing by birth cohort (before 1945, 1945–1965, and after 1965) among persons with past or current HCV.

Methods. Cases had positive HCV laboratory markers reported by 4 surveillance sites (Colorado, Connecticut, Minnesota, and New York) to health departments from 2004 to 2010. Health department staff abstracted demographics and indications for testing from cases' medical records and compiled this information into a surveillance database.

Results. Of 110 223 cases of past or current HCV infection reported during 2004–2010, 74 578 (68%) were among persons born during 1945–1965. Testing indications were abstracted for 45 034 (41%) cases; of these, 29 544 (66%) identified at least 1 Centers for Disease Control and Prevention–recommended risk factor as a testing indication. Overall, 74% of reported cases were born from 1945 to 1965 or had an injection drug use history.

Conclusions. These data support augmenting the current HCV risk-based screening recommendations by screening adults born from 1945 to 1965. (*Am J Public Health.* 2013;103:1445–1449. doi:10.2105/AJPH.2013.301211)

In the United States, an estimated 3.2 million persons are chronically infected with HCV,[1] and of these, 45% to 85% are unaware of their infection.[2–5] Of those infected, most were born from January 1, 1945, through December 31, 1965.[6] Previous Centers for Disease Control and Prevention (CDC) screening recommendations for hepatitis C were risk-based and included testing of injection drug users, hemodialysis recipients, those with persistently abnormal alanine aminotransferase levels, blood transfusion or organ transplant recipients before 1992, health care workers exposed to HCV, and children born to HCV-positive women.[7] However, research has shown that physicians are often hesitant to elicit a risk history for hepatitis; when this is combined with underreporting of risk factors by patients, there is a lack of identification and underdiagnosis in the primary care setting.[8–10] A recent study that used data from the National Health and Nutrition Examination Survey showed that less than 5% of patients who knew that they were HCV-positive had been tested because of physician-identified risk factors.[11]

As the number of persons with complications and mortality related to hepatitis C continues to increase because of undiagnosed and untreated hepatitis C infection,[12–14] CDC has recently recommended a birth cohort–based screening strategy.[15] Using the Grading of Recommendations Assessment, Development, and Evaluation framework,[16–24] CDC recently released a recommendation for 1-time testing for HCV for persons born during 1945–1965 without previous ascertainment of HCV risk.[15] The framework's approach defines a research question, conducts systematic reviews, determines the overall quality of evidence, and provides strength of the recommendations.[16–24] Recent data suggest that, compared with risk-based screening strategies, routine 1-time HCV screening of persons in the 1945–1965 birth cohort is cost-effective and could prevent 120 000 deaths when combined with direct-acting antiviral treatments.[25] Other economic models have also been utilized and support birth cohort screening of this age group.[26,27] In this study, we describe indications for testing by birth cohort among reported HCV cases from 4 enhanced hepatitis surveillance jurisdictions.

METHODS

CDC provides supplemental funding under the Emerging Infections Program (EIP), a national resource for population-based surveillance prevention,[28] to conduct more active investigation of viral hepatitis cases in 6 jurisdictions across the United States. The EIP was established in 1995 to address emerging infections, and viral hepatitis surveillance was added as a component in 2004.[28] Compared with the passive data collection from the National Notifiable Diseases Surveillance System, enhanced viral hepatitis surveillance through the EIP sites has shown greater accuracy and timeliness of reporting particularly for acute hepatitis C.[29]

In all EIP jurisdictions, all positive HCV markers (e.g., antibodies against HCV, an HCV recombinant immunoblot assay, or HCV nucleic acid test) are routinely reported to state or local health departments by laboratories.[30] Health department follow-up varies markedly by site, depending on available resources in each health jurisdiction. Using a surveillance database, health department staff at EIP-funded sites check cases with patients' names and dates of birth from each report to exclude cases that have been previously reported.[30] Once a new case is identified, health department staff abstract the patient's medical record for demographic information and indications for testing by using standardized CDC case

report forms. Health department staff receive training on use of the forms, which differs somewhat by site. Because data collection follows case reporting, abstracted information is based on the provider's documentation of demographic information and indications for testing in the chart. Each month, the deidentified data set from each site is sent to CDC through a secure electronic file transfer protocol.[31]

We analyzed cases of HCV infection reported from 2004 to 2010 from 4 EIP-funded hepatitis surveillance jurisdictions in all counties of Colorado, Connecticut, and Minnesota, and 34 counties of New York, not including New York City. The combined population of these 4 sites is 25.1 million.[32] We chose these 4 sites because they had provided hepatitis C cases during this time period and attempted follow-up with all cases. We defined a hepatitis C case as a person who from January 1, 2004, through December 31, 2010, had at least 1 of the following reported in any of these 4 surveillance sites: a positive result for HCV recombinant immunoblot assay, positive HCV nucleic acid test, or a positive screening test for antibodies against HCV with a signal-to-cutoff ratio predictive of a true positive result for the given assay.[30] Because a confirmed positive HCV antibody assay only indicates previous infection and includes about 20% of persons who resolved their infections, analyzed cases represent "past or present" HCV infection.

Health department staff recorded indications for testing data, which included factors such as a history of injection drug use (IDU), elevated liver enzymes, transfusion or transplant history before 1992 (when HCV antibody testing became available), mother-to-child transmission, chronic hemodialysis, or health care exposure.[7] Also, there were several other possible risk factors that could be noted, including history of incarceration, risk associated with sexual contact (including through a known exposure, having multiple sexual partners, being a man who has sexual intercourse with men, or reporting a history of sexually transmitted diseases), medical facility or health care employment screening, or having symptoms associated with infection (including but not limited to nausea, vomiting, malaise, jaundice, or abdominal distention or pain). In this report, we provide a descriptive analysis of all HCV cases from 4 hepatitis surveillance sites focusing upon birth cohort and indications for testing.

RESULTS

From 2004 to 2010, there were 110 223 cases of past or present HCV infection at the 4 enhanced hepatitis surveillance sites; of these, 66% (73 298) were men and 50% (55 472) were White. Sixty-eight percent of all cases (74 578) were born from 1945 through 1965, 25% (27 312) after 1965, and 7% (8066) before 1945. Among those born from 1945 to 1965, and similar to all cases, 69% were men and 50% were White. Of the total cases, 41% (45 034) had indications for testing checked on the report form. Demographic information for those with and without a risk indication were similar, although 21% of those with no risk indication had unknown race information (Table 1).

Of those with a risk indication, 66% (29 544) had at least 1 CDC-recommended reason for testing. Among the 29 544 cases with a reported CDC risk indication for testing, 8% (2283) were born before 1945, 65% (19 074) were born between 1945 and 1965, and 28% (8172) were born after 1965 (Table 2). For those cases with a CDC risk indication for testing, 62% (18 352) reported history of IDU, 39% (11 616) had been tested because of elevated liver enzymes, and 13% (3941) had a history of receipt of blood transfusion or organ or tissue transplant before 1992 (Table 2). Main risk indications varied somewhat by birth cohort; for those born after 1965 and those born from 1945 to 1965, IDU was the primary risk (80% and 60%, respectively). For those born before 1945, elevated liver enzyme (s) was the primary risk indicated (54%) with transfusion or transplant receipt before 1992 as the second most common risk (38%; Table 2). Across the 4 EIP sites, 9% to 33% of cases reported a CDC risk indication (data not shown). Testing those in the 1945–1965

TABLE 1—Characteristics of HCV Cases by 1945–1965 Birth Cohort From 4 US Hepatitis Surveillance Sites: Colorado, Connecticut, Minnesota, and New York, 2004–2010

Characteristic	Total (n = 110 223), No. (%)	Age[a] (n = 74 578), No. (%)	Any Risk Indication (n = 45 034), No. (%)	No Risk Indication (n = 65 189), No. (%)
Gender				
Male	73 298 (66)	51 708 (69)	31 365 (70)	41 933 (64)
Female	36 653 (33)	22 704 (30)	13 562 (30)	23 091 (35)
Missing	272 (< 1)	166 (< 1)	107 (< 1)	165 (< 1)
Race				
White	55 472 (50)	37 058 (50)	25 206 (56)	30 266 (46)
Black	19 843 (18)	15 383 (21)	9152 (20)	10 691 (16)
Hispanic	16 060 (15)	9593 (13)	7860 (17)	8200 (13)
Asian/Pacific Islander	1708 (2)	998 (1)	570 (1)	1138 (2)
American Indian/Alaska Native	1489 (1)	915 (1)	720 (2)	769 (1)
Multiple	927 (1)	579 (1)	296 (1)	631 (1)
Unknown	14 724 (13)	10 052 (13)	1230 (3)	13 493 (21)

[a]Males and females born between 1945 and 1965.

TABLE 2—CDC Indications Among HCV Cases by Birth Cohort From 4 Hepatitis Surveillance Sites: Colorado, Connecticut, Minnesota, and New York, 2004–2010

Variable	Total[a] (n = 29 544), No. (%)	Born Before 1945 (n = 2283), No. (%)	Born From 1945 to 1965 (n = 19 074), No. (%)	Born After 1965 (n = 8172), No. (%)
Injection drug use	18 352 (62)	477 (21)	11 350 (60)	6516 (80)
Elevated liver enzyme(s)	11 616 (39)	1238 (54)	8255 (43)	2119 (26)
Receipt of blood or blood products before 1992	3793 (13)	851 (37)	2508 (13)	432 (5)
Hemodialysis	630 (2)	149 (7)	425 (2)	55 (1)
Transplant history before 1992	148 (1)	20 (1)	95 (< 1)	33 (< 1)
Mother-to-child transmission	6 (< 1)	0 (0)	0 (0)	6 (< 1)
Health care exposure	136 (< 1)	17 (1)	84 (< 1)	35 (< 1)
> 1 CDC risk indicator	4889 (17)	455 (20)	3438 (18)	995 (12)

Note. CDC = Centers for Disease Control and Prevention. The variables were obtained from Centers for Disease Control and Prevention.[7]
[a]Birth year data missing for 15 cases. Indications may add up to greater than 100% because more than 1 risk indication may be specified.

cohort in addition to injection drug users from the other 2 birth cohorts (those born before 1945 and after 1965) would account for 74% of cases (81 571 of 110 223) from these 4 sites; this increases to 77% if we combine those in the 1945–1965 birth cohort with those with any CDC risk indication (85 033 of 110 223).

Reasons for testing also included other selected risk indications. Overall, 59% (65 189) had no risk indication reported. Among the 45 034 cases with any risk indication, 40% (17 887) had a history of incarceration, 11% (4849) reported risk associated with sexual contact (history of sexually transmitted disease, multiple sexual partners, or men who have sexual intercourse with men), 4% (1800) were tested because of medical employment, and 2% (974) reported symptoms of infection (Table 3). Of all cases with a risk indicated (45 034), 4% (1644) reported multiple sexual partners specifically (data not shown). For those with a history of incarceration (17 887), 395 (2%) were born before 1945; 10 983 (61%) were born between 1945 and 1965; and 6487 (36%) were born after 1965. Testing of persons in the 1945–1965 cohort and those with a history of incarceration in the other 2 birth cohorts would account for 74% (81 460 of 110 223) of cases.

DISCUSSION

This analysis of reports of HCV infection to CDC showed that for those individuals from 4 surveillance sites with reported risk factor data, 77% would be tested under a policy of screening persons in the 1945–1965 birth cohort and those with any CDC risk indication. In addition, our analysis indicates that 68% would have been tested by meeting the 1945–1965 birth cohort criteria whereas only 27% would be screened with the current risk-based criteria. Thus, almost three quarters of individuals with hepatitis C would have been missed if only documented risk criteria had been used.

Examination of risk factors demonstrates that IDU was the primary risk indication cited for persons born after 1945 and reiterates the importance of identifying those with a history of risk behaviors. Research shows that injection drug users who are known to be HCV-positive engage in fewer high-risk behaviors,[33] which is true of HCV-negative younger injection drug users who had partners perceived to be HCV-positive.[34] Also similar to previous research, sexual transmission, including having multiple sexual partners, was not a primary risk identified in this analysis.[35]

In addition, for those individuals with selected risk indication data, 40% would report previous incarceration; this number increases to 49% for those born after 1965. Estimates have shown that 29% to 43% of HCV-infected

TABLE 3—Selected Risk Indications Among HCV Cases by Birth Cohort From 4 Hepatitis Surveillance Sites: Colorado, Connecticut, Minnesota, and New York, 2004–2010

Variable	Total[a] (n = 45 034), No. (%)	Born Before 1945 (n = 2769), No. (%)	Born From 1945 to 1965 (n = 29 074), No. (%)	Born After 1965 (n = 13 191), No. (%)
History of incarceration	17 887 (40)	395 (14)	10 983 (38)	6487 (49)
Sexual contact (STD, MSM, multiple sexual partners)	4849 (11)	197 (7)	3066 (11)	1583 (12)
Medical employment	1800 (4)	155 (6)	1316 (5)	329 (2)
Symptoms of infection	974 (2)	60 (2)	622 (2)	292 (2)

Note. MSM = men who have sexual intercourse with men; STD = sexually transmitted disease.
[a]Birth year data missing for 38 cases. Indications may add up to greater than 100% because more than 1 risk indication may be specified.

individuals pass through the correctional system and our data further support the potential opportunity for screening within this setting.[36] Ultimately, testing all persons born from 1945 through 1965 and those with any risk indication would improve on capturing HCV-infected persons in the population who are not aware of their infection.

There were a number of limitations to this study. Our analysis was based upon reported cases of HCV infection, so use for screening must be interpreted cautiously. Data collected from these 4 enhanced hepatitis surveillance sites may not be nationally representative and follow-up data regarding demographic information and risk may be missing for some cases. In addition, we grouped missing, unknown, and no risk indication data together for this analysis; as 59% did not have risk indication data, there is a bias toward underreporting. If risk information for the 59% who have missing information were known, it would likely capture a greater percentage than the 27% of cases we have estimated from our data. This would further support doing birth cohort and risk-based testing. Lastly, we used evidence of risk indication as a marker for reason for testing, which may not be the provider's reason for documenting this information.

From our analysis, almost half of cases did not have a documented reason for testing indicating either missing data, lack of risk, or underreporting of risk factors by the patient or the provider. Many clinicians are reluctant to ask their patients about risk behaviors such as IDU,[8–10] and patients may hesitate to disclose high-risk behaviors because of fear of stigmatization. CDC has recently released recommendations for a 1-time test for HCV infection for individuals born from 1945 to 1965[15]; at this point, it is still not known how widely a birth-cohort approach to screening will be adopted if implemented.[25] Based upon our findings, HCV screening of adults in the 1945–1965 birth cohort in addition to risk-based screening would represent a substantial improvement over use of a risk-based screening strategy alone. ■

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This article was accepted January 2, 2013.

Contributors

R. Mahajan led the study, assisted with the analyses, and drafted and revised the article. S. J. Liu conducted the analyses. R. M. Klevens conceptualized and designed the study, and helped interpret findings. S. D. Holmberg supervised the study and edited drafts of the article.

Acknowledgments

The authors would like to thank the Colorado Department of Public Health and Environment, Connecticut Department of Public Health, Minnesota Department of Health, and the New York State Department of Health for their contribution of data. Without their assistance, this study would not have been possible.

Human Participant Protection

The analyses conducted for this article used Centers for Disease Control and Prevention surveillance data, which do not require institutional review board approval.

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