Hepatitis C Virus Infection Screening Within Community Health Centers

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Context: Approximately 2.7 million people in the United States currently live with chronic hepatitis C virus (HCV) infection, and many are unaware that they have the disease. Community health centers (CHCs) serve as the primary care safety net for more than 22 million patients who are at risk for health inequities and represent an important frontline resource for early screening and treatment for HCV infection.

Objective: To understand HCV infection screening rates among CHC patients, and to quantify the screening gap by demographic characteristics.

Methods: The authors analyzed a deidentified dataset obtained through electronic health records from a large national network of CHCs. All adults at risk for HCV infection, according to the US Preventive Services Task Force (USPSTF) birth cohort screening guidelines for HCV infection, were considered eligible if they had a patient office visit between January 1, 2013, and December 31, 2013. Data were reviewed to determine the documentation of HCV infection screening from January 1, 2010, to December 31, 2013, and HCV infection screening rates were analyzed by age, race/ethnicity, and sex.

Results: Among 60,722 eligible patients, 5033 (8.3%) had an HCV infection screen in accordance with USPSTF birth cohort screening guidelines. Women were less likely to be screened than men in every race/ethnic group, including white Hispanic (9.3% in women vs 5.4% in men), black Hispanic (15.1% in women vs 9.0% in men), white non-Hispanic (13.6% in women vs 8.1% in men), black non-Hispanic (14.9% in women vs 8.9% in men), Caribbean Islander or Haitian (6.5% in women vs 3.7% in men), and other races/ethnicities (6.3% in women vs 3.6% in men).

Conclusion: To the authors' knowledge, this is the first large-scale study among CHCs to assess the screening gap of the USPSTF birth cohort screening guidelines for HCV infection. This study suggests that CHCs should consider opportunities to improve HCV infection screening, thereby contributing to the reduction of health inequities resulting from untreated HCV infection.

Approximately 2.7 million people in the United States currently have chronic hepatitis C virus (HCV) infection,[1] and approximately 17,000 new cases of HCV infection each year are unreported.[2] Often termed the "silent epidemic," HCV infection frequently goes unnoticed because many people with the disease exhibit no obvious symptoms.[3]

In persons with HCV infection, cirrhosis will develop in 20% to 25% (approximately 800,000 people) within 20 to 30 years; some cases will progress to hepatocellular carcinoma, end-stage liver disease, and death. Costs linked to HCV-related liver morbidity and mortality during the next 20 years are expected to increase by $55 billion.[4] Efforts to improve the identification and early treatment of patients with HCV infection in the United States are supported by the Healthy People 2020 national health objectives,[5] the US Department of Health and Human Services' Action Plan for the Prevention, Care & Treatment of Viral Hepatitis,[6] and the birth cohort screening guidelines issued by the US Preventive Services Task Force (USPSTF) in June 2013.[7] Before these guidelines were issued, HCV infection screening was recommended for patients at high-risk, including those who had large or repeated percutaneous exposures, such as injection drug users and persons who received donated blood before blood bank screening for HCV infection was implemented. The 2013 release of the USPSTF birth cohort screening guidelines for HCV infection recommends a 1-time screening for HCV infection for all adults born between 1945 and 1965.[7]

Community health centers (CHC) provide affordable and accessible health care services (including screenings and preventive care to reduce health disparities), improve management of chronic diseases, and decrease unnecessary hospitalizations.[8,9] Nationally, CHCs provide primary care to more than 22 million people annually, including the working poor, uninsured, unemployed, and homeless populations,[8] and therefore present a frontline opportunity for early identification and treatment of patients with chronic diseases such as HCV infection.

The purpose of the present study was to determine the prevalence of HCV infection screening according to the new USPSTF birth cohort screening guidelines among a large CHC population and to describe screening disparities across demographic characteristics.

Methods

Study Population

Fourteen CHCs were included in this study. Inclusion criteria were use of an electronic health record (EHR) system for at least 4 full years and the availability of complete laboratory data received electronically. Of the 14 CHCs included in the study, 8 were from Florida, 3 from Utah, 1 from California, 1 from Kansas, and 1 from New Mexico. Inclusion criteria for patients in the study were birth between January 1, 1945, and December 31, 1965, and a documented established patient visit at 1 of the 14 CHCs between January 1, 2013, and December 31, 2013. Exclusion criteria were previous diagnosis of HCV infection based on the *International Classification of Diseases, Ninth Revision, Clinical Modification*, inactive medical record, and death.

Data Collection

Confirmation of an HCV infection screen was determined by the presence of a structured data code indicating an HCV infection screen in patients' EHR from January 1, 2010, to December 31, 2013. The list of structured data codes (Logical Observation Identifiers Names and Codes or laboratory test codes) representing a recommended HCV antibody test per USPSTF birth cohort screening guidelines[7] was reviewed by 3 of the authors (N.C., E.P.T., and S.A.A.) and a practicing gastroenterologist. Patients who had an HCV infection screen in their EHR record in the past 3 years were coded with a "yes" on the final file for data analysis. Patient demographic variables, including race/ethnicity and sex, were also extracted

from the EHR. Race/ethnic groups included in the analysis were white Hispanic, black Hispanic, white non-Hispanic, black non-Hispanic, Caribbean Islander or Haitian, and other (ie, other races/ethnicities and unreported race/ethnicity).

The dataset was extracted and deidentified. The data file included 61,054 records of 60,722 unduplicated patients. This study was approved by the institutional review board at Nova Southeastern University and was deemed exempt.

Statistical Analysis

We used SPSS software (version 21; IBM) and R-3.1.2 for statistical analysis. Descriptive statistics were used to estimate the prevalence of birth cohort screening guidelines for HCV infection among eligible patients who had an established visit between January 1, 2013, and December 31, 2013, by age, race/ethnicity, and sex groups. To determine whether the number of HCV infection screenings differed by race/ethnicity and sex, χ^2 tests of independence ($P<.05$) were conducted. A nested logistic regression model was created and tested using age, race/ethnicity, and sex as predictors of HCV infection screening. The dependent variable, which measures whether a patient was screened for HCV infection, was equal to 1 if the respondent was screened and 0 otherwise. Various models were compared using the Akaike information criterion, and the model with the lowest Akaike information criterion value was retained. Multicollinearity and outliers were assessed using the variance inflation factor and an examination of the residual plot. No offending variables were found. The final model included age, race/ethnicity, and sex and controlled for the correlation within individual CHCs. The le Cessie-van Houwelingen-Copas test supported the final model ($P=.11$), and the model correctly predicted screening 92% of the time.

Results

In a CHC population of 60,772 eligible patients, 5033 (8.3%) had an HCV infection screen. Of 5033 patients, 2450 women (48.7%) and 2583 men (51.3%) were screened (*Table 1*; 6.5% vs 11.1%, respectively; $P\leq.01$). Between both sexes, patients categorized as Caribbean Islanders or Haitian or other had a significantly lower predicted probability of being screened (*Table 2*; $P<.01$). Conversely, black Hispanics, white non-Hispanics, and black non-Hispanics had the highest predicted probability of being screened ($P<.01$). Results from the final model also indicate that as a patient's age increased by 1 year, the probability of being screened decreased by 4.2% (95% CI, 3.9-5.2). Model parameter estimates (*Table 3*) indicated that black Hispanic patients were 1.73 times more likely to be screened than white Hispanic patients (95% CI, 1.26-2.20) and that men were 1.79 times more likely to be screened than women (95% CI, 1.30-2.47). The probability of screening was found to differ by age, race/ethnicity, and sex.

Discussion

To our knowledge, the present study is the first large-scale multistate study assessing the gap in HCV infection screening among a CHC patient population in accordance with current USPSTF birth cohort screening guidelines for HCV infection, in addition to identifying screening gaps by demographic characteristics. Overall, the low screening rates suggest that less than 9% of all patients were screened. This finding is important because it highlights the need to improve HCV infection screening among patients receiving care in CHCs, the nation's primary care safety net. In addition, the present study highlights that some populations, including blacks and men, are more likely to be screened than other race/ethnic groups or women. These populations are more likely to be screened possibly because of provider bias in terms of offering the screening test or the

unwillingness of certain races/ethnicities or sexes to be screened.[9] Other reasons may include knowledge regarding HCV infection screening (eg, use of a USPSTF-recommended HCV antibody test vs other laboratory tests) and the cost of screening.

Fostering discussions on how to improve HCV infection screening rates, particularly among underserved populations, is important for future cost savings[11-13] and optimal patient care. Early identification of infected patients allows for earlier treatment, thereby potentially reducing costly health care expenses associated with advanced disease.[14]

Numerous opportunities exist for increasing HCV infection screening in primary care. Educating health care professionals on the new USPSTF birth cohort screening guidelines is vital to support adherence of screening practices. Education regarding new treatment options and referrals to appropriate health care for patients with HCV infection is also necessary to ensure that the overall screening program is cost-effective and will contribute to decreasing disease prevalence. New opportunities for integrating point-of-care reminders supported by EHR implementations have also shown promise in improving screening rates.[15] Similarly, incorporating HCV infection screening into national policies and accreditation requirements that are designed to improve patient health outcomes, such as the Healthcare Effectiveness Data and Information Set and meaningful use, can also help to establish clinical practice guidelines for early detection and treatment.[16]

Limitations

A number of reasons exist for low screening rates that are suggested in the literature but were not assessed directly in this study.

Limited awareness of USPSTF birth cohort screening guidelines for HCV infection, prioritization of birth cohort HCV infection screening vs screening on the basis of specific risk factors such as injection drug use, communication barriers, and limited treatment options for low-income patients are some of the limiting factors.[13] Other limitations of this study include possible misclassification bias of patients who received screening outside the CHC that was either not reported in their CHC EHR or was captured in the EHR in a field not extracted for this study (eg, using a free-text note), which would result in higher screening rates among the population than reported in the current study.

Table 1.
Characteristics of Patients by Race/Ethnicity and Sex (N=60,722)

Variable	Patients, No. (%)	Screened for Hepatitis C Virus Infection	
		No. (%)	Mean (SD), Age, Y
Race/Ethnicity (*P*<.01)			
White Hispanic	18,605 (30.6)	1263 (6.8)	57.7 (5.5)
Black Hispanic	453 (0.7)	50 (11.0)	57.2 (5.4)
White non-Hispanic	17,089 (28.1)	1808 (10.6)	57.3 (5.4)
Black non-Hispanic	12,153 (20.0)	1350 (11.1)	58.1 (5.7)
Caribbean Islander or Haitian	2498 (4.1)	113 (4.5)	58.1 (5.7)
Other	9915 (16.3)	449 (4.5)	57.6 (5.6)
Sex (*P*<.01)			
Female	37,860 (62.3)	2450 (6.5)	57.3 (5.5)
Male	22,862 (37.7)	2583 (11.3)	57.4 (5.4)

Table 2.
Predicted Probabilities of Having Received a Hepatitis C Virus Infection Screen (N=60,722)

Race/Ethnicity	Female, Mean (95% CI)	Male, Mean (95% CI)
White Hispanic	5.4 (2.8-8.1)	9.3 (4.0-14.7)
Black Hispanic	9.0 (5.8-12.3)	15.1 (8.7-21.6)
White non-Hispanic	8.1 (3.3-12.9)	13.6 (3.0-24.3)
Black non-Hispanic	8.9 (7.5-10.3)	14.9 (9.6-20.2)
Caribbean Islander or Haitian	3.7 (1.5-6.0)	6.5 (2.2-10.8)
Other race/ethnicity	3.6 (1.6-5.6)	6.3 (2.1-10.4)

Table 3.
Model Parameter Estimates of Having Received a Hepatitis C Virus Infection Screen (N=60,722)

Characteristic	Correlation Coefficient	SE	OR (95% CI)	P Value
Race/Ethnicity[a]				
Black Hispanic	0.55	0.12	1.73 (1.36-2.20)	<.01
White non-Hispanic	0.43	0.43	1.53 (1.04-2.78)	.33
Black non-Hispanic	0.53	0.25	1.70 (1.04-2.78)	.03
Caribbean Islander or Haitian	−0.40	0.35	0.67 (0.33-1.34)	.26
Other race/ethnicity	−0.43	0.39	0.65 (0.30-1.40)	.27
Male	0.59	0.16	1.79 (1.30- 2.47)	<.01
Age	−0.04	0.01	0.95 (0.94-0.96)	<.01

[a] Reference for race/ethnicity was white Hispanic.

The CHCs included in this study were all early adopters of EHR systems. Although EHRs have been shown to be a valuable tool for conducting surveillance among underserved populations and hold promise for ongoing study among underserved patients who are typically underrepresented in research, data quality is an ongoing improvement initiative.[17] Misclassification bias may have been introduced by patients who were classified as not having been screened but who received screening before the 3-year "look-back" period used in the current study or among patients with previous diagnosis of and treatment for HCV infection. Although initiatives to improve interoperability of EHR data are still in their infancy, health care professionals can help to reduce misclassification bias and support understanding of HCV infection screening and the effectiveness of treatment modalities in future studies.

Another limitation of the current study is that it sought to determine HCV infection screening among all patients who had a primary care visit from January 1, 2013, to December 31, 2013, according to the new USPSTF birth cohort screening guidelines for HCV infection, which were released in June 2013. Before the USPSTF guidelines, high-risk populations were eligible for screening. Therefore, most patients included in the current study who were seen before June 2013 were not recommended for screening according to the USPSTF guidelines in place at that time. Although changes in screening practices may have been notable after the release of the USPSTF birth cohort screening guidelines, we could not assess HCV infection screening rates separately before and after the USPSTF guidelines change because of the timeframe of the study. Future studies should take this point into consideration and, in addition to understanding the screening gap, should assess the change in screening practices as a result of the 2013 USPSTF birth cohort screening guidelines.

Conclusion

The present study demonstrated that opportunities exist to promote implementation of the current USPSTF birth cohort screening guidelines and improve overall HCV infection screening rates across the CHC population. Strategies are needed to improve screening and treatment, particularly for underserved patients. Further research should include identifying and assessing testing

strategies to improve screening in primary care, as well as understanding barriers to implementation of USPSTF birth cohort screening guidelines for HCV infection. As CHCs are the frontline of primary care for populations that may be at increased risk of HCV infection, improving screening rates in CHCs can support earlier treatment for patients with HCV infection, which can contribute to reducing the burden of morbidity and mortality caused by the disease.

Acknowledgments

Author Contributions

Drs Cook, Turse, and Hardigan provided substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; Drs Garcia and Amofah drafted the article or revised it critically for important intellectual content; all authors gave final approval of the version of the article to be published; and all authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

References

1. Hepatitis C FAQ for health professionals. Centers for Disease Control and Prevention website. http://www.cdc.gov/hepatitis/hcv/hcvfaq.htm. Accessed November 11, 2015.

2. Office of Population Affairs. *Hepatitis C: The Facts.* Washington, DC: US Dept of Health and Human Services, Office of Population Affairs; 2012. http://www.hhs.gov/opa/pdfs/hepatitis-c-fact-sheet.pdf. Accessed November 11, 2015.

3. Racanelli V, Rehermann B. Hepatitis C virus infection: when silence is deception. *Trends Immunol.* 2003;24(8):456-464.

4. Tomaszewski KJ, Deniz B, Tomanovich P, Graham CS. Comparison of current US risk strategy to screen for hepatitis C virus with a hypothetical targeted birth cohort strategy [published online July 19, 2012]. *Am J Public Health.* 2012;102(11):e101-e106. doi:10.2105/AJPH.2011.300488.

5. Immunization and infectious diseases. Health People 2020 website. http://www.healthypeople.gov/2020/topics-objectives/topic/immunization-and-infectious-diseases/objectives. Accessed November 11, 2015.

6. Centers for Disease Control and Prevention. *Action Plan for the Prevention, Care & Treatment of Viral Hepatitis.* Atlanta, GA: US Dept of Health and Human Services, Centers for Disease Control and Prevention; 2014. https://aids.gov/pdf/viral-hepatitis-action-plan.pdf. Accessed November 17, 2015.

7. Hepatitis C: screening. US Preventive Services Task Force website. http://www.uspreventiveservicestaskforce.org/Page/Document/UpdateSummaryFinal/hepatitis-c-screening. Accessed November 17, 2015.

8. Program requirements. US Dept of Health and Human Services Health Center Program website. http://bphc.hrsa.gov/programrequirements/index.html. Accessed November 11, 2015.

9. Rigal L, Rouessé C, Collignon A, Domingo A, Deniaud F. Factors associated with the lack of proposition for HIV-AIDS and hepatitis B and C screening to underprivileged immigrants [in French] [published online July 2, 2011]. *Rev Epidemiol Sante Publique.* 2011;59(4):213-221. doi:10.1016/j.respe.2011.01.007.

10. Galbraith JW, Franco RA, Donnelly JP, et al. Unrecognized chronic hepatitis C virus infection among baby boomers in the emergency department [published online January 28, 2015]. *Hepatology.* 2015;61(3):776-782. doi:10.1002/hep.27410.

11. Coretti S, Romano F, Orlando V, et al. Economic evaluation of screening programs for hepatitis C virus infection: evidence from literature. *Risk Manag Health Policy.* 2015;8:45-54. doi:10.2147/RMHP.S56911.

12. Joshi SN. Hepatitis C screening. *Ochsner J.* 2014;14(4):664-668.

13. Rein DB, Wittenborn JS, Smith BD, Liffmann DK, Ward JW. The cost-effectiveness, health benefits, and financial costs of new antiviral treatments for hepatitis C virus [published online March 16, 2015]. *Clin Infect Dis.* 2015;61(2):157-168. doi:10.1093/cid/civ220.

14. McEwan P, Ward T, Yuan Y, Kim R, L'Italien G. The impact of timing and prioritization on the cost-effectiveness of birth cohort testing and treatment for hepatitis C virus in the United States [published online May 27, 2013]. *Hepatology.* 2013;58(1):54-64. doi:10.1002/hep.26304.

15. Sidlow R, Msaouel P. Improving hepatitis C virus screening rates in primary care: a targeted intervention using the electronic health record. *J Healthc Qual.* 2015;37(5):319-323. doi:10.1097/JHQ.0000000000000010.

16. MGMA Government Affairs Department. CMS defines 'meaningful use': proposed rule outlines requirements for EHR incentive payments. *MGMA Connex.* 2010;10(3):10-13.

17. DeVoe JE, Gold R, Cottrell E, et al. The ADVANCE network: accelerating data value across a national community health center network [published online May 12, 2014]. *J Am Med Inform Assoc.* 2014;21(4):591-595. doi:10.1136/amiajnl-2014-002744.