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Hepatocellular Carcinoma Screening Practices in the Department of Veterans Affairs: Findings from a National Facility Survey

Hashem B. El-Serag,

Houston HSR&D Center of Excellence, Michael E. DeBakey Veterans Affairs Medical Center, 2002 Holcombe Blvd. (152), Houston, TX 77030, USA, Section of Gastroenterology and Hepatology, Michael E. DeBakey VA Medical Center, Houston, TX, USA, Department of Medicine, Baylor College of Medicine, Houston, TX, USA

Abeer Alsarraj,

Houston HSR&D Center of Excellence, Michael E. DeBakey Veterans Affairs Medical Center, 2002 Holcombe Blvd. (152), Houston, TX 77030, USA, Department of Medicine, Baylor College of Medicine, Houston, TX, USA, Section of Health Services Research, Michael E. DeBakey VA Medical Center, Houston, TX, USA

Peter Richardson,

Houston HSR&D Center of Excellence, Michael E. DeBakey Veterans Affairs Medical Center, 2002 Holcombe Blvd. (152), Houston, TX 77030, USA, Department of Medicine, Baylor College of Medicine, Houston, TX, USA, Section of Health Services Research, Michael E. DeBakey VA Medical Center, Houston, TX, USA

Jessica A. Davila,

Houston HSR&D Center of Excellence, Michael E. DeBakey Veterans Affairs Medical Center, 2002 Holcombe Blvd. (152), Houston, TX 77030, USA, Department of Medicine, Baylor College of Medicine, Houston, TX, USA, Section of Health Services Research, Michael E. DeBakey VA Medical Center, Houston, TX, USA

Jennifer R. Kramer,

Houston HSR&D Center of Excellence, Michael E. DeBakey Veterans Affairs Medical Center, 2002 Holcombe Blvd. (152), Houston, TX 77030, USA, Department of Medicine, Baylor College of Medicine, Houston, TX, USA, Section of Health Services Research, Michael E. DeBakey VA Medical Center, Houston, TX, USA

Janet Durfee, and

Department of Veterans Affairs, Office of Public Health, Washington, DC, USA

Fasiha Kanwal

Houston HSR&D Center of Excellence, Michael E. DeBakey Veterans Affairs Medical Center, 2002 Holcombe Blvd. (152), Houston, TX 77030, USA, Section of Gastroenterology and Hepatology, Michael E. DeBakey VA Medical Center, Houston, TX, USA, Department of Medicine, Baylor College of Medicine, Houston, TX, USA

Hashem B. El-Serag: hasheme@bcm.edu

Abstract

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Correspondence to: Hashem B. El-Serag, hasheme@bcm.edu.

Conflict of interest None.

Background—Previous studies suggest low rates of hepatocellular carcinoma (HCC) screening in clinical practice. There is little information on the provider- and healthcare-facility-related factors that explain the use of HCC screening.

Aims—We used data from the 2007 Survey to Assess Hepatitis C Care in Veterans Health Administration that collected information regarding the care of patients with hepatitis C virus (HCV) from 138 of 140 Veterans Administration healthcare facilities nationwide.

Methods—All providers caring for veterans with HCV were invited to respond. In addition, each facility was asked to identify a lead HCV clinician to respond to facility-specific questions. Our outcome was a response concordant with HCC screening guidelines [HCC screening in patients with cirrhosis or in patients with chronic hepatitis B virus (HBV), and screening every 6 or 12 months].

Results—A total of 268 providers responded (98 % facility participation rate). Of these, 190 respondents (70.9 %) reported recommending HCC screening with guideline-concordant risk groups and frequency. Providers reporting guideline-concordant HCC screening practices were significantly more likely to have expertise in liver disease (MD, gastroenterologists or hepatologists), routinely screen for varices, prescribe HCV treatment, and refer or manage patients with liver transplant. The availability of HCC-specific treatments on site was the main facility factor associated with guideline-concordant HCC screening.

Conclusions—Self-reported rates of guideline-concordant HCC screening are considerably higher than those seen in routine VA practice. Provider expertise in liver disease and the perceived availability of HCC treatment including transplantation in the local facility are important factors driving self-reported HCC screening practices.

Keywords

Viral hepatitis; Epidemiology; Hepatoma; Liver cancer

Background

Screening for hepatocellular carcinoma (HCC) in high-risk groups has been recommended by several practice guidelines in the USA, Europe, and Asia [1]. Despite these recommendations, previous studies suggested low rates of HCC screening among eligible patients in clinical practice [2, 3]. A recent systematic review identified nine studies with a pooled surveillance rate of 18.4 % [95 % confidence interval (CI) 17.8–19.0 %] [2]. HCC screening rates were significantly higher among patients followed in gastroenterology clinics compared with those followed in primary care clinics. Non-Caucasians and patients of low socioeconomic status had lower surveillance rates than their counterparts [2]. However, current studies do not explain why HCC surveillance is not being performed. The reasons for this apparent underutilization are likely to include factors that extend beyond individual patient characteristics. Provider (e.g., knowledge, experience, and specialty), systematic processes in place to ensure screening, and healthcare facility factors (e.g., availability of resources, size, and available treatment options) may be important determinants of HCC screening practices.

There have been a few questionnaire-based survey studies that evaluated HCC screening practices including the type and frequency of screening tests [4]; For example, liver transplant physicians and surgeons mostly from large US transplant centers were surveyed regarding surveillance and diagnosis of HCC and reported a 98 % HCC surveillance rate [5]. Another survey conducted in 2006 assessed gastroenterologists' knowledge of HCC management guidelines established by the American Association for the Study of Liver Diseases (AASLD). A total of 79 % of 160 respondents correctly identified the high-risk

patients who qualify for HCC screening, and most correctly identified the screening methods (88.5 %) and screening interval (98 %). However, none of these studies compared self-report with actual practice or explored in detail the factors that may drive HCC screening behaviors; For example, provider training, expertise in liver disease, availability of HCC treatment or liver transplant, systematic processes and resources in place to ensure screening, or the structure of services that provide care to patients with liver disease may influence the knowledge, perceptions, or implementation of HCC screening in clinical practice. Whether and to what extent these provider and facility factors influence HCC screening remains unknown.

The Department of Veterans Affairs (VA) has the largest integrated healthcare system in the USA with approximately 152 facilities. In 2007, VA had approximately 208,000 veterans with serologic evidence of hepatitis C [6, 7] or approximately 5 % of the estimated 3.2 million hepatitis C virus (HCV)-infected individuals in the USA [8]. Retrospective studies of national VA registries and databases indicated a possible low rate of HCC screening [9, 10], while data from the VA HCV Clinical Case Registry from 2007 reported that 39.8 % of 15,392 veterans in care with cirrhosis and HCV were screened for HCC [11]. There have been no reports of provider and facility factors that may explain the low and varying rates of HCC screening in the VA.

We therefore analyzed data from a national VA survey to determine the extent of self-reported guideline-concordant HCC screening practices, and to identify the provider-and facility-related characteristics that were associated with guideline-concordant HCC screening.

Methods

The survey was initiated by VA's Hepatitis C Resources Centers (HCRC) under the direction of VA's Public Health Strategic Health Care Group. Data were collected using a self-administered online survey tool. All providers caring for veterans with HCV infection were invited to respond through a systematic distribution of the survey under the leadership of VA's Health Care Analysis Information Group. Each VA facility was also asked to identify a lead HCV clinician to respond to a series of an additional eight facility-specific questions. The survey was administered during November and December of 2007. The survey was intended to measure respondent professional credentials and clinical specialties, and awareness of VA HCV products, as well as HCV clinical team characteristics, integration of HCV care in VA, access to liver biopsy, antiviral treatment, and advanced liver disease treatment including liver transplant. The survey contained two questions on HCC surveillance (Appendix 1) that we used to define the main outcome variable in our current analysis.

The outcome variable was a composite of recommending HCC screening in guideline-defined risk groups and performing HCC screening at a guideline-recommended frequency. The guideline considered was that of the AASLD in 2005 (given that the survey took place in 2007). This was a binary variable with one level being an affirmative answer for at-risk groups (consisting of patients with chronic HBV infection as well as patients with cirrhosis) and an affirmative answer for the frequency of HCC screening being 6 and/or 12 months, the other level of the variable being all other negative answers for both questions.

The predictor variables were derived from answers to other select questions in the same questionnaire (Appendix 2). Some of these questions pertained to provider characteristics including professional credentials [MD, Midlevel (PA, NP), Midlevel provider (CNS, RN), other], specialty (gastroenterology, hepatology, infectious disease, primary care, other),

prescribing HCV antiviral therapy (yes or no), providing care for veterans who receive liver transplant, referral of veterans to liver transplant in or outside the VA national program, and routine (>80 %) screening for esophageal varices in patients with cirrhosis. Other questions pertained to facility characteristics including: service under which the HCV program is administered or aligned (gastroenterology, infectious disease, primary care, other), the type of specialties available in the clinic, availability of other personnel providing care for HCV patients (hierarchical definition based on the following order: patient case manager, transplant coordinator, registry coordinator, and clerical support), length of time between referral to specialty clinic and receipt of consult, method of educating newly diagnosed patients about their disease (one-on-one education, formal HCV education, no systematic methods, other), mental health referral, use of standardized screening tools for alcohol, depression, and posttraumatic stress disorder (PTSD), barriers in getting a liver biopsy for HCV, and types of HCC treatments available (surgical resection, ethanol injection, radiofrequency ablation, transplant referral). Some of the categories of answers in these questions were combined where appropriate.

Bivariate comparisons were conducted using chi-square tests (and Fisher exact tests where appropriate) between the outcome variable and all of the predictor variables. We included predictor variables that were significant at $p < 0.05$ in the bivariate analyses as possible predictor variables in the multiple regression models. We subsequently conducted two multiple logistic regression models. The two models were created for provider and facility predictor variables, separately. We avoided the concomitant inclusion of variables representing the same characteristic (e.g., we only included one variable related to referral to liver transplant inside or outside the VA). Multilevel analysis was not possible because we could not link the provider to specific facilities. Parameter estimates and standard error values were used to calculate odds ratios and their accompanying 95 % confidence intervals.

Results

A total of 268 providers from 138 VA healthcare facilities responded to the survey, representing a 98 % facility participation rate (out of 140 facilities). The participating providers included 140 physicians, 65 nurse practitioners, 14 registered nurses, and 11 physician assistants, and the remaining were registered pharmacists, and certified nurse specialists. On average, respondents had been providing HCV care for 8 years. Of the 141 responding lead clinicians, 83 % stated they were prescribing antiviral therapy. Lead clinicians responding on behalf of facilities indicated that their area was gastroenterology (33 %), hepatology (26 %), and primary care (16 %). Approximately 61 % of HCV programs were aligned under gastroenterology, 84 % of the responding facilities had a dedicated HCV management clinic, and 38 % of facilities had transplant coordinators. Approximately 25 % of the facilities did not have any treatment options available for HCC on site.

A total of 190 of 268 (70.9 %) participants in the survey reported recommending HCC screening using guideline-defined high-risk groups and frequency, namely patients with chronic HBV or with cirrhosis and a screening frequency of 6 or 12 months. Of the rest, 25 (9.3 % of the total) reported the correct screening interval but the wrong at-risk group, 36 (13.4 %) reported the right at-risk group but the wrong screening interval, and 17 (6.3 %) were wrong about both issues. If the correct answer to high-risk groups was limited to cirrhosis (not considering HBV), the rate was 79.1 % (212 of 268).

Several provider-specific factors were significantly associated with an increased likelihood of recommending HCC screening in guideline-concordant high-risk groups. Physicians in general, and physicians and nonphysicians within gastroenterology and hepatology

specialties, were more likely to recommend guideline-concordant HCC screening than other groups (Table 1). Similar associations were observed for providers who reported routine screening for varices in patients with cirrhosis or personally managing patients on HCV therapy. Lastly, providers who referred for liver transplant in or outside the VA and provided care to veterans with liver transplant were significantly more likely to recommend HCC screening than other groups (Table 1).

The major facility predictor of guideline-concordant HCC screening by clinicians was the local availability of any of the five listed HCC-specific treatments, excluding sorafenib (Table 2). The reported presence of each of the following treatments: surgical resection, ethanol injection, radiofrequency ablation (RFA), chemoembolization, or transplant referral in the facility was 30–40 % more frequent among providers who self-reported HCC screening (compared with those who did not) (Table 2); however, the presence of any of these treatments was associated with more than twofold higher reporting of guideline-recommended HCC screening. Conversely, lack of availability of all of these treatments at the local facility was significantly associated with a reported absence of guideline-recommended HCC screening. Approximately 68 % (53 out of 78) of those who reported non-guideline-concordant screening practices also self-reported the lack of availability of all of the above modalities at their facilities. Other facility characteristics that were associated with guideline-concordant HCC screening were the presence of a transplant coordinator (89.7 %) and formal HCV group education (78.4 %) (Table 2).

We did not find significant associations between several other examined facility variables and HCC screening in guideline-concordant risk groups (Table 2). These characteristics included the use of standardized screening tools for mental health or substance use, and mental health referral.

In multiple regression analyses of provider factors (Table 3), there was a greater than twofold increase in the likelihood of guideline-concordant HCC screening among providers who were gastroenterologists/hepatologists or ID physicians, were directly involved in HCV treatment, routinely recommended screening for varices, and referred for liver transplant inside VA. The likelihood of guideline-concordant HCC screening was also significantly lower among PA/NP and “other” providers than physicians, and although the likelihood was also lower among CNS/RN, the differences were not significantly different from physicians. Referral for liver transplant outside of the VA or providing care for liver transplant patients was associated with similar odds ratios (OR) in separate models where each of these variables replaced referral inside the VA (data not shown).

In multiple regression analyses of facility factors (Table 4), the availability of any of the listed HCC treatments remained as an independent predictor of knowledge of recommended HCC screening with an adjusted OR of 2.40 (95 % CI 1.27, 4.55). The only other facility factor to retain significance was having a HCV clinic aligned with either gastroenterology or infectious disease. The waiting time variable was not included in the logistic models because, within the 61–120 days stratum, there was 100 % guideline-concordant screening and therefore the OR for this stratum against any other stratum chosen as a reference is positive infinity.

Discussion

This national VA survey identified several provider- and facility-level factors that were associated with self-reported guideline-concordant HCC screening practices (both appropriate high-risk groups and frequency of screening). The strongest provider-related characteristic to be associated with recommending HCC screening was the provider’s

familiarity with liver transplantation referral and HCV antiviral therapy management. In addition, providers who were physicians, gastroenterologists, hepatologists or infectious disease specialists, or those who prescribed antiviral treatment for HCV, were more likely to report HCC screening with guideline-defined high-risk groups and frequency. The perceived availability of HCC-specific treatment at the local VA facility was the main facility characteristic to be associated with guideline-recommended HCC screening practices. In addition, having the HCV clinic affiliated with gastroenterology or infectious disease was associated with guideline-recommended frequency of HCC screening compared with primary-care-aligned HCV clinics.

Previous provider surveys on HCC screening and treatment focused predominantly on the who, how, and when of self-reported HCC surveillance practices and less on potentially modifiable factors that influenced these practices [12]. Our current report provides some insight into the reasons that might explain HCC screening practices reported in several previous studies, in addition to information on self-reported HCC screening rates among VA providers; For example, survey respondents reported 70.9 % compliance with screening recommendations, yet 2007 data from VA Clinical Case Registry reported 39.8 %, which subsequently increased to 57 % in 2011.

The findings indicate that providers' knowledge and or experience of advanced liver disease as well as the facility's ability to treat HCC are the two most important factors predicting guideline-concordant HCC screening knowledge and possibly behavior. Given their specialized training, gastroenterologists or hepatologists are more likely to be experienced in managing patients with chronic liver disease and to be aware of practice guidelines related to HCC screening. The strong association in this study between guideline-concordant HCC screening and providers caring for liver transplant patients or referring patients to liver transplant further supports a role for provider knowledge-driven behavior. Similarly, ID physicians were also more likely (than primary care) to recommend guideline-concordant screening.

The perceived availability of any of five separately described HCC treatments (transplant, resection, alcohol ablation, radiofrequency ablation, and chemoembolization) at the local VA facility was strongly associated with self-reported guideline-recommended HCC screening knowledge, and the perceived absence of all of these treatments was strongly associated with the absence of HCC screening; For example, the VA offers referral for liver transplant from all VA facilities to several regional VA transplant centers. This finding suggests that clinicians may not be performing HCC screening because they might perceive this as wasteful in the absence of effective treatments. One way to make a difference would be to educate all HCV clinics/facilities regarding the available resources for HCC treatment inside the VA.

This finding should also lead to some caution when interpreting previous studies linking surveillance with increased use of HCC treatment [13]; our study here indicates that there may be a reverse association where patients are more likely to be screened in the facilities that have HCC treatments available. Therefore, outcome studies of HCC screening should also examine the appropriateness of treatment receipt and hard outcomes such as cancer-specific or overall survival.

The findings of this study are also potentially important for policy-makers. The VA has invested considerable resources to improve the management and outcomes of patients with HCV. However, the increasing burden of patients with advanced liver disease including HCC that was recently documented in the VA [14] is likely to require different capabilities (e.g., hepatologists, cirrhosis clinics, liver transplant, HCC detection and treatment,

systematic processes in place to ensure screening, multidisciplinary team approaches) than those required for the management of HCV (e.g., detection of HCV, confirmation of diagnosis, and offering antiviral treatment). Therefore, it is not surprising that facility factors that are designed to facilitate care of HCV-infected patients in general such as structure of HCV clinics, methods of education about HCV, and use of standardized screening tools for mental health and substance use disorders were not significantly associated with guideline-concordant HCC screening in this study.

The study has some limitations, which are nevertheless outweighed by its strengths. The reliance on self-reported answers, while the hallmark of survey studies, may reflect perceived rather than actual practices. We did not validate this information against actual practice patterns of the respondents or against actual facility resources. Our analyses pertained to the state of knowledge in 2007, and therefore considered HCC screening at 6- or 12-month intervals to be concordant with the AASLD 2005 HCC screening guideline [3]. The AASLD HCC screening guidelines were updated in 2010 [1], and while the recommended high-risk groups did not change, the frequency of recommended intervals changed from either 6 or 12 months to every 6 months. The survey was conducted among providers with expertise or interest in the management of patients with HCV, and therefore the high reported rates of HCC screening may not be generalizable to other providers in VA hospitals. Indeed, studies in the VA indicate a considerably lower rate of actual utilization of HCC screening than that reported in this survey, even considering the 2011 data of the VA HCV Clinical Case registry which reported that 57 % of 21,747 patients with cirrhosis and HCV were screened for HCC [15]. However, the very high facility response rate for the survey (98 %), the novel emphasis on provider and facility characteristics, and the relatively large sample size are major strengths of this survey. Lastly, this was a secondary analysis of a previously performed survey, whose primary purpose was to characterize HCV practices. The survey was constructed with a HCV conceptual model in mind, and important questions to determine HCC screening predictors were not included; for example, there were no questions assessing attitudes about screening efficacy or perceived barriers to HCC screening. The lack of these questions in the survey limits the ability of this analysis to identify additional new predictors of HCC screening.

In summary, the findings of a national VA survey of providers caring for veterans with HCV indicate that approximately 70 % of providers report recommending guideline-concordant HCC screening practices among high-risk groups. Expertise in the management of liver disease (gastroenterologist, hepatologist, referral to or caring for liver transplant patients) and perceived availability of specific HCC treatments at the local facility are important determinants of guideline-concordant HCC screening practices. Adequate supply of providers trained in the management of liver disease coupled with providing a clear and efficient process for referral to comprehensive HCC treatment programs need to be at the core of HCC screening programs.

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Appendix 1: The Two Survey Questions from the Survey to Assess Hepatitis C Care in Veterans Health Administration That Were Used in This Study to Define the Two Outcomes of Interest

Which patients do you recommend for hepatocellular carcinoma (HCC) screening at your facility/(check all that apply)

All patients with chronic hepatitis C infection

Patients with chronic HBV infection

Patients with cirrhosis

Other patient groups (please specify)

Patients with high risk for hepatocellular carcinoma (HCC) are screened every

3 months

6 months

12 months

Don't screen

Other (please specify)

Appendix 2: The Questions Used in the Current Analysis

What are your professional credentials? (Check all that apply.)

- ☐ MD, DO
- ☐ Nurse Practitioner (NP)
- ☐ Physician Assistant (PA)
- ☐ Certified Nurse Specialist (CNS)
- ☐ Registered Nurse (RN)
- ☐ Pharm D
- ☐ Registered Pharmacist
- ☐ Psychologist (PhD, PsyD)
- ☐ Social Worker (LICSW)
- ☐ Other (Please specify)_____

Which of the following best describes your area of specialty:

- ☐ Gastroenterology
- ☐ Hepatology,
- ☐ Mental health
- ☐ Prime care
- ☐ Infectious disease physician
- ☐ Other

Do you personally prescribe hepatitis C antiviral therapy?

Please indicate the service under which your hepatitis C program is administratively aligned.
(Choose one answer)

- ☐ Gastroenterology
- ☐ Infectious disease
- ☐ Prime care
- ☐ Pharmacy

- ☐ Mental Health
- ☐ Other (please specify)

In addition to clinical specialties directly staffing clinics, please indicate other personnel providing care in support of veterans with hepatitis C (Please check all that apply):

- ☐ Patient case manager
- ☐ Transplant Coordinator
- ☐ Registry coordinator
- ☐ Clerical Support
- ☐ Other (please specify)_____

If a new hepatitis C patient is referred to the Liver/ Hepatitis C/GI Clinic, approximately how long does it typically take to receive an initial consultation?

- ☐ < 15 days
- ☐ 15–30 days
- ☐ 31–60 days
- ☐ 61–120 days
- ☐ >120 days
- ☐ No specialty clinic where hepatitis C can be evaluated

Which of the following best characterizes how the majority of newly diagnosed hepatitis C patients are educated about their disease at your site (choose only one):

- ☐ A Formal HCV group education
- ☐ One on one education counseling with a provider
- ☐ No systematic method
- ☐ Other (please specify)_____

How are mental health assessments performed on patients with hepatitis C at your facility? (Check all that apply.)

- ☐ Most patients are referred to Mental Health for assessment prior to starting treatment
- ☐ Hepatitis C providers use standardized screening tools for most new hepatitis C patients
- ☐ Hepatitis C providers use standardized screening tools for patients for whom antiviral therapy is planned.

If standardized screening tools are used to evaluate for mental health and/or substance use, what is screened for? (Check all that apply.)

- ☐ Depression
- ☐ Alcohol abuse/dependence
- ☐ Drug use
- ☐ PTSD
- ☐ Other (please specify)_____

What barriers, if any, exist at your facility in getting a liver biopsy done for a patient with hepatitis C? (check all that apply)

- ☐ We do not have barriers
- ☐ Liver biopsy is not available at my facility
- ☐ Limited provider availability to do liver biopsies
- ☐ Liver biopsy takes > 3 months to get scheduled once ordered
- ☐ Other (Please specify)_____

Do you or your team routinely (80% or more of the time) recommend screening for varices in patients with cirrhosis? (Check all that apply.)

- ☐ Yes
- ☐ No
- ☐ Only in selected patients

What treatment options for HCC are available at your facility? (check all that apply)

- ☐ Surgical resection
- ☐ Radiofrequency ablation
- ☐ Transarterial chemoembolization
- ☐ Referral for transplant
- ☐ None of the above are available at my facility
- ☐ Other (Please specify)_____

Do you or your team refer patients to the VA National Liver Transplant Program?

Do you refer patients to non-VA Transplant Programs?

Do you or your team ever provide care to veterans who have received a liver transplant outside the VA?

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Table 1

Comparison of provider characteristics and practice behaviors between providers who reported performing guideline-concordant HCC screening versus those who did not

	Overall	HCC screening in guideline-concordant high-risk groups		p-Value
		Yes (%)	No (%)	
Number of respondents	268	190	78	
What are your professional credentials?				
Physician (MD, DO)	140	110 (78.6 %)	30 (21.4 %)	0.004
Midlevel provider (NP, PA)	27	16 (59.3 %)	11 (40.7 %)	
Midlevel provider (CNS, RN)	86	58 (67.4 %)	28 (32.6 %)	
Other ^a	15	6 (40.0 %)	9 (60.0 %)	
Which of the following best describes your area of specialty?				
Gastroenterology	122	106 (86.9 %)	16 (13.1 %)	<0.0001
Infectious disease				
Other ^b				
Primary care				
NR	146	84 (57.5 %)	62 (42.5 %)	
Do you personally prescribe hepatitis C antiviral therapy?				
Yes	175	148 (84.6 %)	27 (15.4 %)	<0.0001
No	93	42 (45.2 %)	51 (54.8 %)	
Are you involved in management of hepatitis C therapy?				
Yes	199	159 (79.9 %)	40 (21.1 %)	<0.0001
No	69	31 (44.9 %)	38 (55.1 %)	
Do you or your team routinely recommend screening for varices in patients with cirrhosis?				
Yes	190	155 (81.6 %)	35 (18.4 %)	<0.0001
Only in selected patients	28	13 (46.4 %)	15 (53.6 %)	
No	50	22 (44.0 %)	28 (56.0 %)	
Do you refer patients to VA national liver transplant program?				
Yes	219	169 (77.2 %)	50 (22.8 %)	<0.0001
No	49	21 (42.9 %)	28 (57.1 %)	
Do you refer patients to non-VA liver transplant programs?				
Yes	94	74 (78.7 %)	20 (21.3 %)	0.038
No	174	116 (66.7 %)	58 (33.3 %)	
Do you provide care to veterans who receive liver transplant outside VA?				
Yes	219	167 (76.3 %)	52 (23.7 %)	<0.0001
No	49	23 (46.9 %)	26 (53.1 %)	

^aPharmD, registered pharmacist, psychologist, social worker

^bMental health, primary care, infectious disease

Table 2

Comparison of facility features between providers who reported performing guideline-concordant HCC screening versus those who did not

	Overall	Guideline-concordant HCC screening		p-Value
		Yes (%)	No (%)	
Number of respondents	268	190	78	
The service under which the hepatitis C program is administratively aligned				
Gastroenterology	85	75 (88.2 %)	10 (11.8 %)	<0.0001
Infectious disease	20	18 (90.0 %)	2 (10.0 %)	
Other	18	11 (61.1 %)	7 (38.9 %)	
Primary care	18	9 (50.0 %)	9 (50.0 %)	
NR	127	77 (60.6 %)	50 (39.3 %)	
Other personnel providing care for hepatitis C patients				
Patient case manager	22	15 (68.2 %)	7 (31.8 %)	0.002
Transplant coordinator	39	35 (89.7 %)	4 (10.3 %)	
Other ^d	78	61 (78.2 %)	17 (21.8 %)	
NR	129	79 (61.2)	50 (38.8)	
How long does it take to receive an initial consult after referral to specialty clinic				
15–30 days	91	76 (83.5 %)	15 (16.5 %)	0.001
31–60 days	21	15 (71.4 %)	6 (28.6 %)	
61–120 days	6	6 (100 %)	0 (0 %)	
<15 days	19	15 (79.0 %)	4 (21.0 %)	
NR	131	78 (59.4 %)	53 (40.6 %)	
How are the majority of newly diagnosed patients educated about the disease?				
No systematic method	17	8 (47.1 %)	9 (53.9 %)	0.007
One-on-one education	132	95 (72.0 %)	37 (28.0 %)	
Formal HCV group education	97	76 (78.4 %)	21 (21.6 %)	
Other	22	11 (50.0 %)	11 (50.0 %)	
Most patients are referred to mental health for assessment prior to starting antiviral treatment				
Yes	163	117 (71.8 %)	46 (28.2 %)	0.692
No	105	73 (69.5 %)	32 (30.5 %)	
Provider using standardized screening tools for mental health or substance use				
Yes	82	56 (68.3 %)	26 (31.7 %)	0.533
No	186	134 (72.0 %)	52 (28.0 %)	
Barrier, if any, at your facility in getting a liver biopsy done for HCV				
No barrier	160	122 (76.3 %)	38 (23.7 %)	0.038
Biopsy not available	34	19 (55.9 %)	15 (44.1 %)	
Limited provider availability	37	28 (75.7 %)	9 (24.3 %)	
30-Day wait	13	8 (61.5 %)	5 (38.5 %)	
Other response	24	13 (54.2 %)	11 (45.8 %)	
HCC treatments available at facility				
Surgical resection				

	Overall	Guideline-concordant HCC screening		<i>p</i> -Value
		Yes (%)	No (%)	
Yes	110	89 (80.9 %)	21 (19.1 %)	0.003
No	158	101 (63.9 %)	57 (36.1 %)	
Ethanol injection				
Yes	48	37 (77.1 %)	11 (22.9 %)	0.298
No	220	153 (69.6 %)	67 (30.4 %)	
Radiofrequency ablation				
Yes	92	73 (79.4 %)	19 (20.6 %)	0.028
No	176	117 (66.5 %)	59 (33.5 %)	
Chemoembolization				
Yes	100	80 (80.0 %)	20 (20.0 %)	0.011
No	168	110 (65.5 %)	58 (34.5 %)	
Any of the above treatments available				
Yes	132	107 (81.1 %)	25 (18.9 %)	0.0003
No	136	83 (61.0 %)	53 (39.0 %)	
Liver transplant referral				
Yes	157	129 (82.2 %)	28 (17.8 %)	<0.0001
No	111	61 (55.0 %)	50 (45.0 %)	

NR response not available

^aRegistry coordinator, clerical support

Table 3

Results of a multiple logistic regression model examining the association between provider characteristics and self-reported guideline-concordant HCC screening

	Adjusted odds ratio	95 % confidence interval	p-Value
Professional credentials			
Midlevel provider (PA, NP)	0.28	0.12, 0.64	0.002
Midlevel provider (CNS, RN)	0.61	0.21, 1.81	0.376
Other ^a	0.22	0.06, 0.88	0.032
Physician	1.00	Reference	–
Area of specialty			
Gastroenterology/hepatology	2.78	1.10, 7.04	0.031
Infectious disease	4.09	1.29, 13.00	0.017
Other ^b	1.07	0.42, 2.76	0.889
Primary care	1.00	Reference	
Personally prescribe hepatitis C antiviral therapy			
Yes	4.07	1.77, 9.37	0.001
No	1.00	Reference	–
Provider routinely recommends screening for varices in patients with cirrhosis			
Only in select patients	0.83	0.26, 2.63	0.756
Yes	2.54	1.09, 5.93	0.031
No	1.00	Reference	–
Refer patients to the VA national liver transplant program			
Yes	3.00	1.30, 6.89	0.010
No	1.00	Reference	–

^aPharmD, registered pharmacist, psychologist, social worker

^bMental health, primary care

Table 4

Results of a multiple logistic regression model examining the association between facility characteristics and self-reported guideline-concordant HCC screening

	Adjusted odds ratio	95 % confidence interval	p-Value
Service under which hepatitis C program is administratively aligned			
Gastroenterology	4.36	1.20, 15.86	0.026
Infectious disease	7.43	1.22, 45.13	0.029
NR	0.96	0.28, 3.28	0.948
Other	1.63	0.39, 6.84	0.508
Primary care	1.00	Reference	–
Other personnel providing care for veterans with HCV			
NR	1.98	0.48, 8.15	0.342
Other ^a	1.97	0.55, 6.99	0.295
Transplant coordinator	2.88	0.65, 12.6	0.162
Patient case manager	1.00	Reference	–
Barriers in getting liver biopsy			
Limited provider availability	1.11	0.46, 2.72	0.816
NR	0.48	0.19, 1.24	0.129
Not available	0.71	0.28, 1.76	0.458
Wait 30 days	0.97	0.28, 3.41	0.963
No barriers	1.00	Reference	–
HCC treatments available at facility			
At least one treatment available	2.40	1.27, 4.55	0.007
None of the treatments available	1.00	Reference	–

NR no response

^aRegistry coordinator, clerical support