Hepatitis C Screening: Before and After Study of Hepatitis C Risk Score Alerts in CHORUS

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Background

- An estimated 2.4 million people in the US (1% of adults) had an active HCV infection during 2013-2016[1]
- There is no HCV vaccine; screening and treatment with DAAs are the primary approaches to decreasing transmission of HCV and preventing long-term morbidity (e.g., cirrhosis, ESLD, HCC) and mortality
- HCV screening rates remain low despite recommendations of one-time screening for all asymptomatic adults and annual screening for people at higher risk of HCV acquisition

Objective

Assess whether providing alerts through CHORUS, a CDSS, could improve the HCV screening to diagnosis ratio

Methods

Study Population

- OPERA® observational cohort
  - Prospectively captured, routine clinical data from the EHRs of individuals at selected clinics across the US
- CHORUS™ clinical decision support system
  - Web- and mobile application-based CDSS that translates, transforms, and organizes EHR data into useful reports for healthcare providers
- Screening-eligible individuals
  - ≥ 18 years of age
  - Never screened for HCV *or* previously HCV negative but high-risk for HCV infection (HIV-infected MSM, PWID)

Study Design

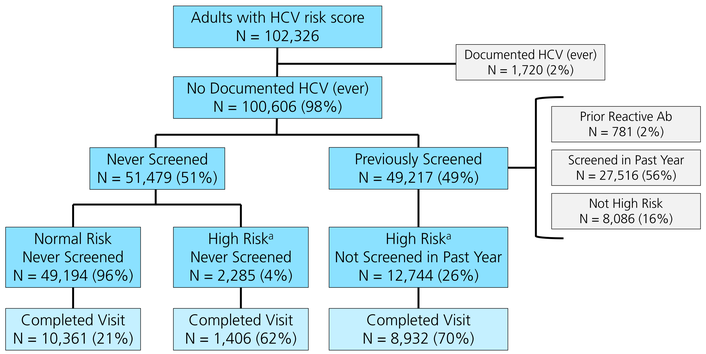
- Before and after study design
  - **Before period (2022)**:16JAN2022-16AUG2022; follow-up through 17OCT2022
  - **After period (2023)**:16JAN2023-16AUG2023; follow-up through 17OCT2023
- Alerts identifying HCV screening-eligible individuals were disseminated to clinics via CHORUS ahead of scheduled visit in the **after** period only; alerts included:
  - Risk score estimated by a machine learning-based model: Percent chance of returning positive HCV test
  - List of demographic, clinical, and social determinant of health factors that contributed to the risk score

Descriptive Analyses

- HCV testing and diagnosis were described among individuals who completed a clinic visit
- Proportions of individuals who received a VL test after a reactive antibody test and the proportions of those with active HCV infection were calculated

Results

Figure 1. HCV screening-eligible adults who completed a visit at selected OPERA clinics in the BEFORE period (16JAN2022 – 16AUG2022)



[a] High-risk individuals are defined by the AASLD and the IDSA screening guidelines as being (a) HIV-infected MSM and (b) PWID

Figure 2. HCV screening-eligible adults who completed a visit at selected OPERA clinics in the AFTER period (16JAN2022 – 16AUG2022)

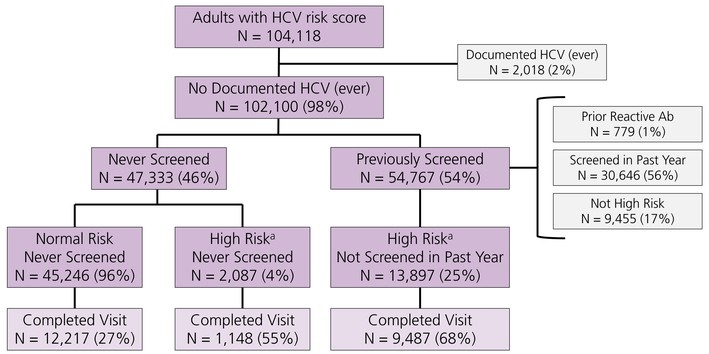


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Table 1. Baseline characteristics of HCV screening-eligible individuals who visited selected OPERA clinics, received HCV testing, and had active HCV infection

Baseline Characteristic	Visited		Tested		Diagnosed	
	Before N = 20,699	After N = 22,852	Before N = 4,930	After N = 5,249	Before N = 36	After N = 40
Age, median (IQR)	34 (27, 48)	33 (27, 45)	37 (30, 51)	36 (30, 48)	32 (27, 38)	33 (30, 42)
Male sex, n (%)	16,725 (81)	18,160 (79)	4,699 (95)	4,952 (94)	36 (100)	40 (100)
Black race, n (%)	8,850 (43)	9,544 (42)	2,020 (41)	2,207 (42)	19 (53)	21 (53)
Hispanic, n (%)	5,599 (27)	6,475 (28)	1,405 (29)	1,647 (31)	10 (28)	10 (25)
US South, n (%)	13,255 (64)	14,316 (63)	3,244 (66)	3,365 (64)	32 (89)	30 (75)
HIV infection, n (%)	11,010 (53)	11,187 (49)	4,297 (87)	4,203 (80)	34 (94)	37 (93)
HBV infection, n (%)	582 (3)	655 (3)	232 (5)	238 (5)	0 (0)	≤5[a]

[a] HIPAA regulations require the masking of cells with 1 to 5 individuals

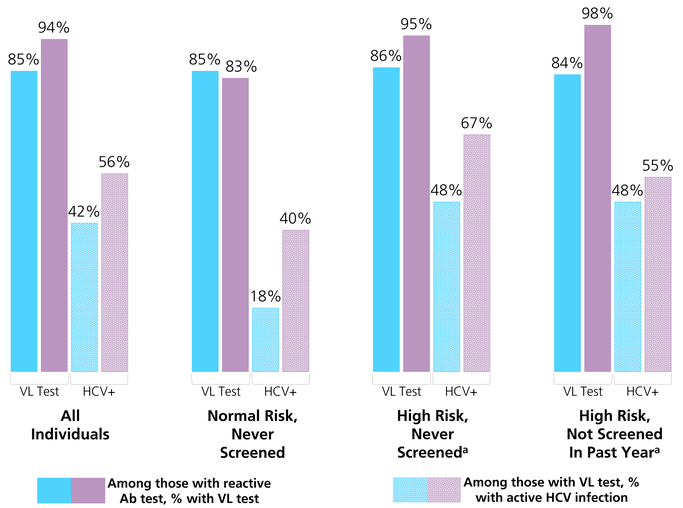
Table 2. HCV testing of HCV screening-eligible individuals who visited selected OPERA clinics over follow-up

HCV Testing Over Follow-Up, n (%)	Before Period N = 20,699	After Period N = 22,852
Received any HCV test (Ab, VL)	4,930 (24)	5,249 (23)
Received Ab test	4,871 (99)	5,198 (99)
Reactive Ab (see **Figure 3** for subsequent VL testing results)	99 (2)	72 (1)
Received VL test[a]	185 (4)	149 (3)
Detectable VL (i.e., active HCV infection)[b]	36 (19)	40 (27)

[a] It is recommended that individuals are first screened with an Ab test and if reactive, then given the VL test. However, there were 59 and 51 individuals in the before and after periods, respectively, who received only VL testing. There were also 42 and 30 individuals in the before and after periods, respectively, who received VL testing despite a nonreactive Ab test result.

[b] There were 1 and 2 individuals with a detectable VL in the before and after periods, respectively, who did not receive an Ab test and are not reflected in Figure 3.

Figure 3. Cascade of viral load testing and diagnosis of active HCV infection after receiving a reactive HCV antibody test among HCV screening-eligible individuals in the BEFORE (turquoise; n=99) and AFTER (purple; n=72) periods



[a] High-risk individuals are defined by the AASLD and the IDSA screening guidelines as being (a) HIV-infected MSM and (b) PWID

Abbreviations

AASLD, American Association for the Study of Liver Diseases; **Ab**, antibody; **CDSS**, clinical decision support system; **CHORUS**, Clinical Health Outcomes Reporting & Utilization Service; **DAA**, direct acting antivirals; **EHR**, electronic health record; **ESLD**, end-stage liver disease; **HBV**, hepatitis B virus; **HCC**, hepatocellular carcinoma; **HCV**, hepatitis C virus; **HIPAA**, Health Insurance Portability and Accountability Act; **HIV**, human immunodeficiency virus; **IDSA**, Infectious Diseases Society of America; **IQR**, interquartile range; **MSM**, men who have sex with men; **n**, number; **OPERA**, Observational Pharmaco-Epidemiology Research & Analysis; **PWID**, people who inject drugs; **US**, United States; **VL**, viral load

Discussion

- A total of 20,699 (before period; **Figure 1**) and 22,852 (after period; **Figure 2**) HCV screening-eligible individuals visited a clinic over follow-up. In both study periods:
  - Most individuals who had never been screened were at normal risk of HCV acquisition
  - A greater proportion of individuals at high risk of HCV acquisition completed a visit over follow-up
- Characteristics of individuals were similar across periods (**Table 1**)
  - Compared to the larger groups of individuals who visited the clinic and received HCV testing, the subset diagnosed with active HCV infection over follow-up were more likely to be male, Black, from the US South, and have HIV
- The proportions of individuals with active HCV infection among those who received an HCV Ab and/or VL test were 1% in both the before and after periods (**Table 2**)
  - The recommended sequence of testing (Ab followed by VL) was not always observed; some individuals received only VL testing (before period: 59; after period: 51)
- The proportion of individuals receiving a VL test after a reactive Ab test and of those, the proportion with active HCV infection, was higher in the after period (94% & 56%) than in the before period (85% & 42%) (**Figure 3**)
  - Not all individuals with a reactive Ab test received subsequent VL testing
- Alerts were disseminated for all 22,852 individuals ahead of their visits (after period); alert fatigue may have occurred
- Providers may be cautious in following machine learning-guided alerts

Key Findings

- After a reactive Ab result, the proportion of VL tests with detectable HCV was higher with alerts
- Alerts may have increased awareness of an individual's HCV risk factors, potentially leading to more targeted screening
- Future studies may consider alerting for only individuals with a high percent chance of infection

Reference

1. Hofmeister MG, Rosenthal EM, Barker LK, Rosenberg ES, Barranco MA, Hall EW, et al. Estimating Prevalence of Hepatitis C Virus Infection in the United States, 2013-2016. *Hepatology* 2019; 69(3):1020-1031.

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