PRACTICE MANAGEMENT: THE ROAD AHEAD

# Implementation of a Population-Based Cirrhosis Identification and Management System

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Cirrhosis-related morbidity and mortality is potentially preventable. Antiviral treatment in patients with cirrhosis-related to hepatitis C virus (HCV) or hepatitis B virus can prevent complications.[1–3] Beta-blockers and endoscopic treatments of esophageal varices are effective in primary prophylaxis of variceal hemorrhage.[4] Surveillance for hepatocellular cancer is associated with increased detection of early stage cancer and improved survival.[5] However, many patients with cirrhosis are either not diagnosed in a primary care setting, or even when diagnosed, not seen or referred to specialty clinics to receive disease-specific care,[6] and thus remain at high risk for complications.

Our goal was to implement a population-based cirrhosis identification and management system (P-CIMS) to allow identification of all patients with potential cirrhosis in the health care system and to facilitate their linkage to specialty liver care. We describe the implementation of P-CIMS at a large Veterans Health Administration (VHA) hospital and present initial results about its impact on patient care.

## Population-Based Cirrhosis Identification and Management System Intervention

P-CIMS is a multicomponent intervention that includes a secure web-based tracking system, standardized communication templates, and care coordination protocols.

## Web-Based Tracking System

An interdisciplinary team of clinicians, programmers, and informatics experts developed the P-CIMS software program by extending an existing comprehensive care tracking system.[7] The P-CIMS program (referred to as cirrhosis tracker) extracts information from VHA's national corporate data warehouse. VHA corporate data warehouse includes diagnosis codes, laboratory test results, vital status, and pharmacy data for each encounter in the VA since October 1999. We designed the cirrhosis tracker program to identify patients who had outpatient or inpatient encounters in the last 3 years with either $\geq$1 cirrhosis diagnosis (defined as any instance of previously validated International Classification of Diseases-9 and -10 codes)[8]; or possible cirrhosis (defined as either aspartate aminotransferase to platelet ratio index $>$2.0 or Fibrosis-4 $>$3.24 in patients with active HCV infection[9] [defined based on positive HCV RNA or genotype test results]).

The user interface of the cirrhosis tracker is designed for easy patient lookup with live links to patient information extracted from the corporate data warehouse (recent laboratory test results, recent imaging studies, and appointments). The tracker also includes free-text fields that store follow-up information and alerting functions that remind the end user when to follow up with a patient. Supplementary Figure 1 shows screenshots from the program.

We refined the program through an iterative process to ensure accuracy and completeness of data. Each data element (eg, cirrhosis diagnosis, laboratory tests, clinic appointments) was validated using the full electronic medical record as the reference standard; this process

*Abbreviations used in this paper:* APP, advanced practice providers; HCV, hepatitis C virus; IF, implementation facilitation; MEDVAMC, Michael E. DeBakey VA Medical Center; P-CIMS, population-based cirrhosis identification and management system; PCP, primary care providers; VHA, Veterans Health Administration.


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occurred over a period of 9 months. The program can run to update patient data on a daily basis.

## Standardized Communication Templates and Care Coordination Protocols

Our interdisciplinary team created chart review note templates for use in the VHA electronic medical record to verify diagnosis of cirrhosis and to facilitate accurate communication with primary care providers (PCP) and other specialty clinicians. We also designed standard patient letters to communicate the recommendations with patients. We established protocols for initial clinical reviews, patient outreach, scheduling, and follow-ups. These care coordination protocols were modified in an iterative manner during the implementation phase of P-CIMS.

### *Setting and Patients*

Michael E. DeBakey VA Medical Center (MEDVAMC) in Houston provides care to more than 111,000 Veterans, including more than 3800 patients with cirrhosis. At the time of P-CIMS implementation, there were 3 hepatologists and 4 advanced practice providers (APP) who provided liver-related care at the MEDVAMC.

The primary goal of the initial phase of implementation was to link patients with cirrhosis to regular liver-related care. Thus, the sample was limited to patients who did not have ongoing specialty care (ie, no liver clinic visits in the last 6 months, including patients who were never seen in liver clinics).

### *Implementation Strategy*

We used implementation facilitation (IF), an evidence-based strategy, to implement P-CIMS.[10] The IF team included facilitators (F.K., D.S.), local champions (S.M., K.H.), and technical support personnel (eg, tracker programmers). Core components of IF were leadership engagement, creation of and regular engagement with a local stakeholder group of clinicians, educational outreach to clinicians and support staff, and problem-solving. The IF activities took part in 2 phases: pre-implementation and implementation.

### *Preimplementation Phase*

We interviewed key stakeholders to identify facilitators and barriers to P-CIMS implementation. One of the implementation facilitators (F.K.) obtained facility and clinical section's leadership support, engaged key stakeholders, and devised a local implementation plan. Stakeholders included leadership in several disciplines: hepatology, infectious diseases, and primary care. We developed a map of clinical workflow processes to describe optimal integration of P-CIMS into existing workflow (Supplementary Figure 2).

### *Implementation Phase*

The facilitators met regularly (bi-weekly for the first year) with the stakeholder group including local champions and clinical staff. One of the facilitators (D.S.) served as the liaison between the P-CIMS team (F.K., A.M., R.M., T.T.) and the clinic staff to ensure that no patients were getting missed and to follow through on patient referrals to care. The programmers troubleshot technical issues that arose, and both facilitators worked with clinical staff to modify workflow as needed. At the start of IF, the facilitator conducted an initial round of trainings through in-person training or with the use of screen-sharing software. The impact of P-CIMS on patient care was tracked and feedback was provided to clinical staff on a quarterly basis.

### *Implementation Results: Linkage to Liver Specialty Care*

P-CIMS was successfully implemented at the MEDVAMC. Patient data were first extracted in October 2015 with 5 updates through March 2017. In total, 4 APP, 1 MD, and the facilitator used the cirrhosis tracker on regular basis. The clinical team (APP) conducted the initial review, triage, and outreach. It took on average 7 minutes (range, 2–20 minutes) for the initial review and outreach. The APPs entered each follow-up reminder in the tracker. For example, if they negotiated a liver clinic appointment with the patient, then they entered a reminder to follow up with the date by which this step (patient seen in liver clinic) should be completed. The tracker has a built-in alerting function. The implementation team was notified (via the tracker) when these tasks were due to ensure timely receipt of recommended care processes.

We identified 2065 patients who met the case definition of cirrhosis (diagnosed and potentially undiagnosed) and were not in regular liver care. Based on initial review, 1507 patients had an indication to be seen in the liver clinic. Among the remaining 558, the most common reasons for not requiring liver clinic follow-up were: being