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Cost-Effectiveness of Access Expansion to Treatment of Hepatitis C Virus Infection Through Primary Care Providers

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BACKGROUND & AIMS: Chronic hepatitis C virus (HCV) infection is a major burden on individuals and health care systems. The Extension for Community Healthcare Outcomes (Project ECHO) enables primary care providers to deliver best-practice care for complex conditions to underserved populations. The US Congress passed the ECHO Act in late 2016, requiring the Department of Health and Human Services to investigate the model. We performed a cost-effectiveness analysis to assess diagnosis and treatment of HCV infection in a primary care patient panel with and without the implementation of Project ECHO. **METHODS:** We used Markov models to simulate disease progression, quality of life, and life expectancy among individuals with HCV infection and for the general population. Data from the University of New Mexico's ECHO operation for HCV show an increase in treatment rates. Corresponding increases in survival, quality-adjusted life years (QALYs), costs, and resulting budget impact between ECHO and non-ECHO patients with HCV were then compared. **RESULTS:** Project ECHO increased costs and QALYs. The incremental cost-effectiveness ratio of ECHO was $10,351 per QALY compared with the status quo; >99.9% of iterations fell below the willingness-to-pay threshold of $100,000 per QALY. We were unable to confirm whether the increase in rates of treatment associated with Project ECHO were due to increased or more targeted screening, higher adherence, or access to treatment. Our sensitivity analyses show that the results are largely independent of the cause. Budget impact analysis shows payers would have to invest an additional $339.54 million over a 5-year period to increase treatment by 4446 patients, per 1 million covered lives. **CONCLUSION:** Using a simulated primary care patient panel, we showed that Project ECHO is a cost-effective way to find and treat patients with HCV infection at scale using existing primary care providers. This approach could substantially reduce the burden of chronic HCV infection in the United States, but high budgetary costs suggest that incremental rollout of ECHO may be best.

Keywords: Incremental Cost-Effectiveness Ratio; Willingness-to-Pay; Health Care Costs; Telementoring; Community Health Services.

New interferon-free, oral-only direct-acting antivirals can cure more than 95%[1] of those infected with chronic hepatitis C (HCV) and, importantly, are cost-effective.[2–4] Although therapy costs and clinical outcomes attract media attention, patient access and the provision of care (assessing patients; planning, providing, and coordinating the delivery of care) remain suboptimal. New therapies do not change this underlying infrastructure and can exacerbate access issues.[5] Admirably, some major players, including the US Department of Veterans Affairs, are taking steps to improve.

Telemedicine, where a specialist provides clinical services directly to a patient remotely, has often been heralded as a panacea. The flaw with this model is that it addresses only geographic access barriers, not widespread resource constraints: there are only so many specialists to go around. For example, there are an estimated 3.5 million patients with chronic HCV in the United States but only 13,000 gastroenterologists.[6,7] Of course, not every patient with chronic HCV must be served by these specialists, but the comprehensive management needed to treat these patients requires experienced experts.[8]

Telehealth, providing a suite of remote services such as provider training and continuing medical education, provides an alternative approach that can expand primary care providers' capacity to care for complex patients while ensuring specialist-level quality. Project ECHO (Extension for Community Healthcare Outcomes), for example, enables primary care providers to deliver best-practice complex care to underserved populations.[9] The ECHO model started with hepatitis C care in New Mexico, addressing the issues surrounding access to care for patients with HCV: expanding the reach of chronic hepatitis C diagnosis and treatment, which were traditionally limited to specialist practices and hospitals.

In ECHO, a multidisciplinary team of specialists (generally from an academic medical center) is linked to community practitioners (ie, physicians and nurse practitioners) through a "hub and spoke" model. Through weekly video conferences ("teleECHO sessions"), the hub provides teaching and mentoring to the community practitioners.

Abbreviations used in this paper: **DC, decompensated cirrhosis; DC1, decompensated cirrhosis, first year in that stage; DC2 or DC2+, decompensated cirrhosis, 2 or more years in that stage; ECHO, Project ECHO: Extension for Community Healthcare Outcomes; F#, fibrosis score: any value F0 to F4 (METAVIR scoring system); HCC, hepatocellular carcinoma; HCV, hepatitis C virus, refers in this publication usually to the chronically infected; LTx, liver transplant; METAVIR, scoring system that assesses fibrosis in patients with chronic hepatitis C; QALY, quality-adjusted life year; SVR, sustained viral response.**

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Connecting this ecosystem (ie, instead of simply hosting one-on-one conversations) contextualizes care and builds a dynamic learning community that improves access, ensures clinical effectiveness, ensures quality, and increases primary care provider professional satisfaction.[9–11] Project ECHO brings this model to life in 127 hubs globally (77 in the United States), with support from various foundations, state legislatures, and governmental agencies. Of the domestic hubs, 14 specialize in hepatitis C care.[12] In December 2016, Congress passed the ECHO Act requiring the Department of Health and Human Services to investigate the model.[13]

The replicability of a new model of care delivery, like Project ECHO, depends on financing; however, a scientific review of the cost-effectiveness of Project ECHO has not yet been published. Even with impressive clinical outcomes and powerful partners, Project ECHO cannot endeavor to expand sustainably without an in-depth economic evaluation. Our objective was to assess the cost-effectiveness of Project ECHO in HCV by considering the financial and opportunity costs as well as the program's impact on quality-adjusted life years (QALYs).

Methods

Institutional Review Board Approval

This study was determined as "not regulated" by the University of Michigan Health Sciences and Behavioral Sciences Institutional Review Board. As such, no institutional review board approval was necessary for this publication (ID: HUM00115332).

We used a mathematical model to compare the diagnosis and treatment of chronic HCV infection in a primary care patient panel with and without the implementation of Project ECHO. In ECHO, diagnosis and treatment of patients with HCV is done by the primary care provider. In our comparison group, the "status quo" without Project ECHO, primary care patients with HCV are referred to specialists for treatment when diagnosed. Although Project ECHO was founded and validated in New Mexico, we relied on nationally representative input parameters, whenever applicable, to make the results generalizable. For example, our wide range of travel distances included both rural and urban patient panels.

We created a decision tree and Markov models to simulate Project ECHO's impact on the population (Figure 1). The decision tree represents the path of clinical decision making and allows evaluation of the impact of different rates of risk screening, diagnosis, and treatment between the ECHO and non-ECHO scenarios. The Markov models simulate treated patients with HCV, untreated patients with HCV, and the general population uninfected with HCV. Overall, the tree and Markov models calculated population-level expenditures and QALYs over patient lifetimes. Both diagnosed and treated ECHO and non-ECHO patients received the current standard of care for their genotype, irrespective of level of fibrosis.[14] We used Microsoft Excel 2016 (Microsoft Corporation, Redmond, WA) with PrecisionTree and @RISK add-ins (Palisade Corporation, Ithaca, NY) to create the decision tree and run a Monte Carlo simulation to account for statistical uncertainty. Model parameters related to intervention effect, disease progression, costs, and utilities are in Table 1.

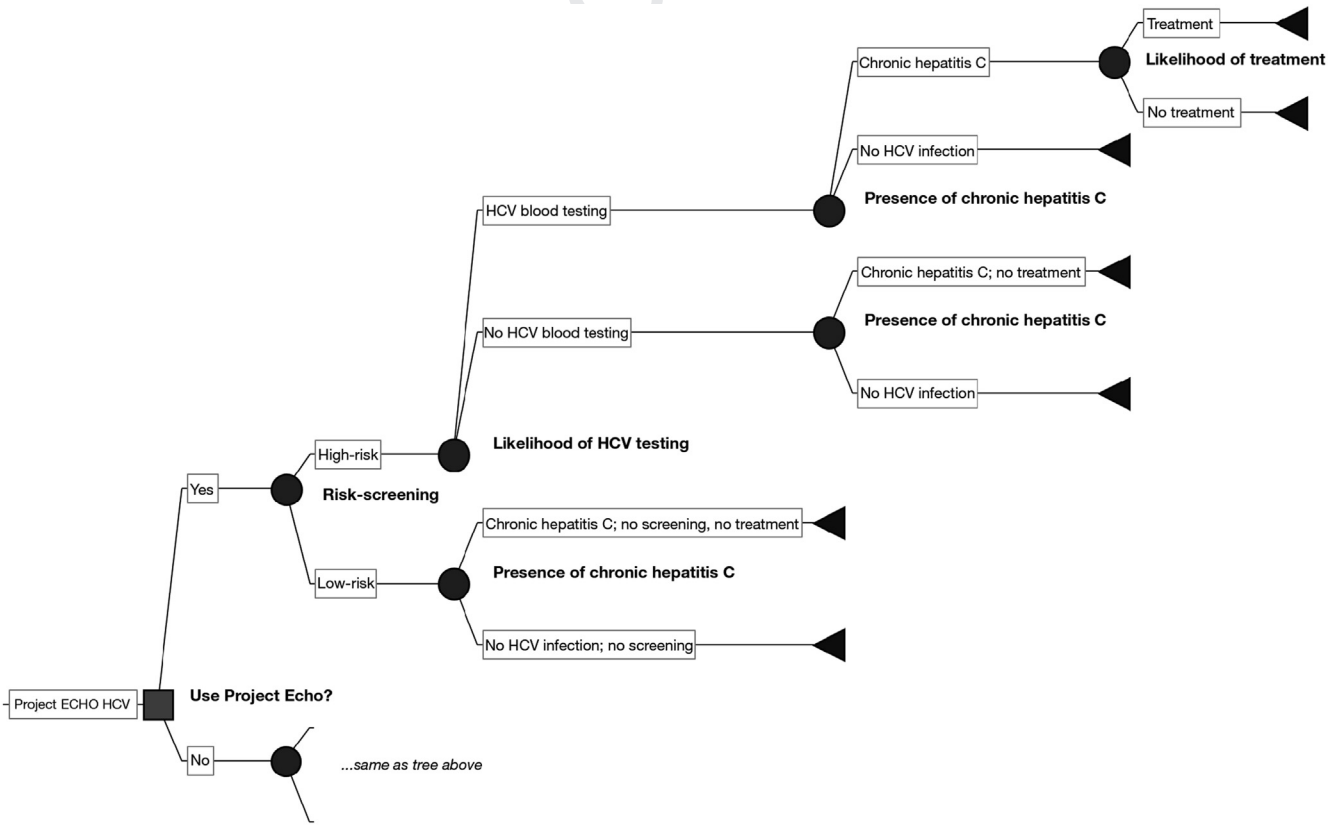

Figure 1. Decision Tree.