Enhancing Electronic Health Systems to End Transmission of Chronic Hepatitis B During COVID-19: A Collaborative Approach

Eric Chak, M.D., M.P.H., * Fresnia Vu, † Julie Dang, Ph.D., M.P.H., ‡ Ulissa Smith, M.P.H., § Susan Stewart, Ph.D., † Karman Tam, M.P.H., ** Amy Beste-Fong, R.N., ** Breanna Phelps, †† Ian Johnson, M.D., † Miguel Suarez, M.D., † Mary Pat Pauly, M.D., ‡‡ and Moon S. Chen, Jr., Ph.D., M.P.H. §§

The essential elements to eliminate hepatitis B virus (HBV) transmission include preventing perinatal HBV transmission, HBV vaccination of newborn and youth, and screening of at-risk adults with linkage to care for those who may be chronically infected. These components are the premise of our federally funded “END B” program:

Abbreviations: CBC, complete blood cell count; CDC, Centers for Disease Control and Prevention; CHB, chronic hepatitis B; CMP, complete metabolic panel; COVID-19, coronavirus disease 2019; EHR, electronic health record; END B, ending the transmission of the HBV from the prenatal period throughout the lifespan; FHx, family history; HALO, Health and Life Organization; HbcAb, hepatitis B core antibody total; HBeAb, hepatitis B e antibody; HBeAg, hepatitis B e antigen; HBlg, hepatitis B immune globulin; HBsAb, hepatitis B surface antibody; HBsAg, hepatitis B surface antigen; HBV, hepatitis B virus; ICD, International Classification of Diseases; INR, international normalized ratio; MA, medical assistant; PCP, primary care provider; Q, quarter; TDF, tenofovir disoproxil fumarate; Tx, transplant; US, ultrasound; USPSTF, US Preventive Services Task Forces; UV, viral load; Y, year.

From the *Division of Gastroenterology and Hepatology, UC Davis School of Medicine, Sacramento, CA; †Sacramento Community Clinics, Health and Life Organization, Inc., Sacramento, CA; ‡Department of Public Health Sciences, UC Davis School of Medicine, Sacramento, CA; §Office of Community Outreach and Engagement, UC Davis Comprehensive Cancer Center, Sacramento, CA; ¶Division of Biostatistics, UC Davis Department of Public Health Sciences, Sacramento, CA; **Sacramento County Department of Health Services, Division of Public Health, Sacramento, CA; ††Meditab Software Inc, Sacramento, CA; ‡‡California Primary Care Association, Sacramento, CA; and §§Division of Hematology and Oncology, UC Davis School of Medicine, Sacramento, CA.

The work described in this paper was funded in part by grant CPIMP191176 (“END B”) from the Office of Minority Health, US Department of Health and Human Services and by grant A18-2016-001 from the Bristol-Meyers Squibb Foundation, “UC Davis-HALO Collaborative.”

Potential conflict of interest: Nothing to report.

Received July 22, 2020; accepted May 25, 2021.

View this article online at wileyonlinelibrary.com

© 2021 by the American Association for the Study of Liver Diseases
“Ending the transmission of the HBV from the prenatal period throughout the lifespan.” The purpose of this paper is to describe how we have built on our prior work and report our preliminary results that have been enabled by electronic health system enhancement, as well as describe the impact of coronavirus disease 2019 (COVID-19) and our response during the implementation of END B.

Chronic hepatitis B (CHB) may affect up to 2.4 million persons in the United States, and about 59% of foreign-born persons living with CHB in 2018 emigrated from Asia.1 Because Asian Americans experience the highest prevalence of past or present HBV infection, 10 times greater (21.1% compared with 2.1%) than non-Hispanic whites,2 we chose to focus our CHB prevention efforts on Asian Americans.

CONTEXT FOR END B

The UC Davis team has conducted randomized controlled studies documenting statistically significant increases in screenings with electronic clinical decision prompts for HBV testing.3,4 These studies revealed how electronic health record (EHR) enhancement together with bilingual/bicultural health care workers outreach increased HBV screenings of underserved populations.

END B provides the opportunity for applying these lessons learned to changing routine practice in community health clinics. First, we partnered with the Health and Life Organization (HALO), a Federally Qualified Health Center Look-Alike, the largest health care provider to Asian Americans in Sacramento County, serving more than 9000 Asian Americans, particularly those born in intermediate-to high-risk areas as defined by the Centers for Disease Control and Prevention (CDC). Of HALO’s six clinics, four offer both primary and prenatal care. All HALO clinics use Intelligent Medical Software (Meditab Software Inc., Sacramento, CA), which is a state-of-the-art, fully customizable EHR. Second, we partnered with the Sacramento County Division of Public Health because of their commitment to preventing perinatal HBV transmission. Third, we enlisted the California Primary Care Association to oversee and evaluate the program.

CONDUCT OF END B INTERVENTIONS

The hallmark of END B is using EHR enhancement to increase screening for CHB, which has been instituted in two phases: (1) universal screening of pregnant women, regardless of race or ethnicity; and (2) high-risk patient screening, particularly among those born in CDC-defined HBV-endemic areas. The workflow for HBV screening is summarized in Fig. 1. To synergize with END B activities, we have held “Academies” (in-services) to train HALO medical assistants (MAs) on using the enhanced EHR and patient-centered HBV educational workshops (Table 1).

Due to the COVID-19 pandemic, a shelter-in-place order was issued in Sacramento County on March 19, 2020. From March to April 2020, HALO clinics saw a decrease of patient encounters by 70% across its health services. HALO did not have telehealth services in place before the pandemic. Bolstered by extramural funding, telehealth services were initiated and by July/August 2020. Patient encounters then began to increase toward baseline levels. HALO interventions were therefore adapted to conform to social distancing protocols.

Universal screening of pregnant women has received a Grade A recommendation from the US Preventive Services Task Forces (USPSTF).5 To screen these women, we created an electronic hepatitis B order set containing orders for hepatitis B surface antigen (HBsAg), hepatitis B core antibody (HBcAb) total, and hepatitis B surface antibody (HBsAb). This series is automatically ordered when medical staff (MAs or primary care providers [PCPs]) enter an International Classification of Diseases (ICD)-10 code for pregnancy into the EHR. The HBV order set will not trigger for patients who have already had these tests in the past 9 months.

High-risk patient screening has received a Grade B recommendation from the USPSTF and is a non-copay preventive service provided by HALO.6 Prior to the COVID-19 pandemic, electronic alerts were used to prompt testing for foreign-born patients from endemic areas who presented in person to clinic. The COVID-19 pandemic decreased in-person visits, and this workflow was modified. We developed an EHR-based registry of high-risk patients (primarily Asian Americans) encompassing all HALO clinics. Beginning in October 2020, we started ordering hepatitis B testing using this registry and informing patients of awaiting laboratory tests by mail. This system was designed to enable completion of hepatitis B testing without being physically present in the clinic.

Because the primary goal of END B is to spare the next generation from CHB, we have used an English/Hmong
bilingual Case Navigator to longitudinally follow each patient found to be HBsAg positive. For pregnant women, if HBV viral load (VL) at 28 weeks is ≥200,000 IU/mL, the mother will be started on tenofovir 300 mg/day to prevent transmission to the newborn. Tenofovir will be stopped at time of breastfeeding, and mothers will be monitored for reinitiation as medically indicated. Newborns will also be given hepatitis B immune globulin and hepatitis B vaccination at birth. All patients found to be HBsAg positive will be linked to the care of a hepatologist to receive standard of care for CHB. For patients found to be susceptible to HBV, bulk EHR clinical reminders to vaccinate have been sent to their PCPs.

**INTERIM RESULTS AND FUTURE DIRECTIONS**

The results of cumulative testing (July 2019 to March 2021) for HBV at HALO are summarized in Table 2.

---

**TABLE 1. INTERVENTIONS USED TO END THE TRANSMISSION OF HEPATITIS B**

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Description</th>
</tr>
</thead>
</table>
| EHR enhancement | 1. Hepatitis B order set that is triggered by pregnancy diagnosis  
2. EHR-based registry to identify “high-risk” patients  
3. Custom reports tailored to identifying HBsAg-positive patients and pertinent demographic information |
| Case Navigator | 1. Bilingual and bicultural Hmong/English to provide culturally competent care  
2. Ensures that HBsAg-positive patients are linked to care of hepatologist  
3. Works with care providers to ensure that HBsAg-positive mothers and their babies receive standard of care to prevent HBV transmission |
| MA training academy | 1. Regular instruction of MAs regarding the burden of HBV and importance of HBV screening among “high-risk” patients  
2. Formal EHR training to properly identify “high-risk” patients and enter the information accurately into the EHR |
| HBV education workshops for patients | 1. Bilingual and bicultural Hmong/English HBV instruction  
2. Introduce the importance of HBV to patients to overcome barriers to screening  
3. “Storytelling” by patients living with HBV to remove stigma and encourage screening |

---

**FIG 1** Pregnancy and “high-risk” hepatitis B screening workflow.
Regarding universal screening of pregnant women for HBV, 345 patients have been tested to date, and 4 have been found to be HBsAg positive (1.1% prevalence rate). All of these patients have been linked to the care of a hepatologist (Fig. 2). As a result of early adoption of telehealth services at HALO, completion of HBV testing among pregnant women at HALO has remained only slightly below pre-pandemic levels.

High-risk patient (nonpregnant Asian Americans) testing also experienced a decrease in completed testing during the pandemic. In response to this, we developed an EHR-based registry of high-risk patients across all HALO clinics, which has led to a large increase in the number of tests completed and new HBV cases detected. For example, 19 new HBV diagnoses were found in the past 6 months compared with 3 in the 6 months prior to initiating registry-based testing (Table 2). The overall prevalence rate of HBV among tested high-risk patients is 8.9%. This high prevalence is due to the fact that 12 of the 24 Asian Americans positive for CHB are of Hmong/Laotian descent. In our previous analysis of Asian origin groups in Sacramento County, the Hmong had the highest CHB prevalence and experienced the most health disparities.9,10 Due to the new influx of positive cases, many have not yet been linked to care, but our Case Navigator is working in earnest to expedite the referral process (Fig. 2).

As a proof of concept, our hepatitis B elimination program END B shows what hepatitis B elimination can look
like when digital tools are harnessed to combat a pandemic. By applying what we learn through partnerships, deploying bilingual/bicultural case navigation, and expanding the role of EHR, while facing the challenges of COVID-19, we can personalize health care to screen appropriate patients. It is our expectation that END B could be a transferable model for HBV elimination nationally.

CORRESPONDENCE

Eric Chak, M.D., M.P.H., Division of Gastroenterology and Hepatology, UC Davis School of Medicine, 4150 V Street, Suite 3500, Sacramento, CA 95817. E-mail: echak@ucdavis.edu

REFERENCES