

# Community-Based Hepatitis B Campaign in Asian Americans

Chul S. Hyun<sup>1\*</sup>, Soonsik Kim<sup>2</sup>, Sarah Hyun<sup>3</sup>, Joseph McMenamin<sup>4</sup>

<sup>1</sup>The Center for Viral Hepatitis, Englewood Cliffs, NJ, USA

<sup>2</sup>Korean Community Services of Metropolitan New York, Bayside, NY, USA

<sup>3</sup>Mailman School of Public Health, Columbia University, New York, NY, USA

<sup>4</sup>Christian & Barton, LLP, Richmond, VA, USA

Email: \*chulhyunmd@gmail.com

**How to cite this paper:** Hyun, C.S., Kim, S., Hyun, S. and McMenamin, J. (2024) Community-Based Hepatitis B Campaign in Asian Americans. *International Journal of Clinical Medicine*, 15, 389-412.

<https://doi.org/10.4236/ijcm.2024.159025>

**Received:** June 27, 2024

**Accepted:** September 16, 2024

**Published:** September 19, 2024

Copyright © 2024 by author(s) and Scientific Research Publishing Inc.

This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

## Abstract

Chronic hepatitis B (CHB) disproportionately affects minority groups in the US, particularly Asian Americans, with numerous factors contributing to this disparity. Of the 2.4 million people living with chronic HBV in the US, 60% are Asian American. Many are unaware of their status and lack access to proper clinical care, with less than ten percent receiving necessary antiviral treatment. Barriers to screening and care include lack of disease awareness, language and cultural barriers, and financial constraints. Additionally, healthcare providers and systems in the US often overlook the importance of CHB, leading to inadequate care. In response, the Center for Viral Hepatitis (CVH) has implemented a community-based outreach program over the past sixteen years, employing a multifaceted approach involving all sectors of society and various organizations to combat health disparities in CHB. This grassroots campaign has proven highly effective, leveraging CVH's leadership in spearheading numerous collaborative activities with community members, healthcare professionals, and policymakers. We have summarized the key points of CVH's efforts and their significance in combating CHB-related health disparities. The CHB Screening and Awareness Campaign, tailored to the Asian American community, serves as a successful model for increasing CHB screening, linkage-to-care, and addressing socio-cultural barriers and health literacy. Insights from these outreach programs have guided the development of culturally relevant resources and education initiatives. These findings suggest that such community-driven approaches are essential for addressing health disparities. The strategies and outcomes of CVH's efforts can inform future health initiatives for other minority communities in the US and globally.

---

## Keywords

Chronic Hepatitis B (CHB), Hepatitis B Virus (HBV), Health Disparity, Health Inequity, Asian Americans, Cultural Competence in Healthcare, Community-Based Screening, Linkage-to-Care (LTC)

---

## 1. Introduction

In the US, ongoing health disparities can result in unequal health outcomes and limited access to healthcare services, impacting minority populations in particular. These disparities are influenced by various barriers: social, economic, environmental, and systemic. A prime example of these challenges is the elevated CHB-related morbidity and mortality among Asian Americans, highlighting the intersection of these disparities [1]-[4].

CHB is a major cause of liver-related illnesses and deaths globally and in the United States. In the US, approximately 2.4 million people live with chronic HBV, with 60% belonging to the Asian American community [10]. Sadly, many are unaware of their infection status and lack access to proper clinical care, with less than ten percent receiving necessary antiviral treatment. Approximately 25% of CHB patients experience severe complications such as liver cirrhosis, liver failure, and primary liver cancer [5]-[7]. There is a significant disparity in CHB prevalence among racial and ethnic groups; Asian Americans are disproportionately affected. While around 4% - 10% of Asian Americans are impacted by Hepatitis B Virus (HBV) infection, only 0.1% of Caucasian Americans are affected [4] [8]. Despite comprising less than 5% of the total U.S. population, Asian Americans account for over 60% of all chronic hepatitis B cases in the country [9] [10]. Alarming, many individuals with CHB are unaware of their status, and vaccination rates among Asian Americans remain low. Moreover, only a tiny fraction of CHB patients in the US currently receive antiviral treatment despite its availability [10]-[12].

CHB remains underdiagnosed and poorly linked to clinical care owing to barriers of several types: Personal (limited disease awareness, linguistic and cultural barriers, and financial constraints); Systemic (the lack of culturally competent care, resulting in communication gaps and inadequate management) [3] [13] [14]; and structural (limited healthcare access, institutional policies, and immigration status) [15] [16]. Racial bias and stigma can also impede HBV care and may inadvertently perpetuate disparities. Healthcare systems often undervalue addressing CHB, hindering intervention effectiveness [17]-[19].

Additionally, underrepresentation in research, mainly from a lack of funding for the management of diseases prevalent among ethnic minorities, limits understanding of health needs and effective interventions. Addressing these issues requires a comprehensive approach, including community engagement, culturally responsive services, policy advocacy, and systemic reforms. Collaboration among

community organizations is vital to empower Asian American communities and overcome these obstacles. This is why we at the CVH have actively sought collaboration with various organizations.

To address structural deficiencies and systemic barriers in HBV care among Asian Americans, we have adopted a comprehensive community-based strategy. This approach enhances health literacy, tackles social determinants of health, promotes cultural competence, advocates for policy changes, and engages communities in culturally relevant initiatives. Cultural competence enables providers to deliver effective care to diverse patients by understanding and respecting cultural differences, recognizing biases, and communicating sensitively to improve outcomes and satisfaction. Our goal is to eliminate health disparities and achieve health equity, ensuring everyone has fair access to healthcare and the opportunity to attain their highest health level regardless of social, economic, or demographic factors. Addressing these challenges improves health outcomes and alleviates economic burdens. The projected rise in the Asian American population underscores the urgency of promoting fair healthcare access and easing the financial strain on national resources [20] [21].

In this review, we have summarized the results of our studies in the 2008-2024 Hepatitis B campaign, along with studies of other investigators, and have grouped the discussions into three separate categories: HBV screening and LTC, health literacy and sociocultural factors, and a tool to enhance communication. We did this to demonstrate that community-based campaign efforts have been effective in identifying critical issues related to CHB disparity in the US, and to further guide future improvements to reduce the burden of CHB to other ethnic populations.

## 2. Community Context

CHB bears several distinct characteristics that distinguish it as a community health problem.

First, it is a community issue as much as a national and global problem. Secondly, CHB disproportionately affects minority immigrant populations and thus is mostly confined to specific demographic groups in the US. Thirdly, there is an urgent need to provide a solution. These characteristics make hepatitis B in the US a community health issue. In this section, we describe the key community demographics, cultural context, and challenges the Asian American community has faced in obtaining equitable CHB care and access. We explain the reasons behind our community's initiative to enhance opportunities in CHB care and how we inspired collaborative action.

For review purposes, we delineate a "community" as a cohesive group unified by shared characteristics, geography, and socio-cultural ties. This definition encompasses population segments with common racial and ethnic backgrounds, such as immigrant ethnic minorities in the US. In this context, "community health" denotes the optimal health status a defined group endeavors to achieve to preserve their well-being. Consequently, a "community-based solution" denotes a

community-instigated initiative, policy, program, or legislation to address local factors influencing health and potentially enhance the community's welfare.

The target community CVH has worked with is the Asian American population in the Greater New York (NY) area, known for its diversity and vibrancy. It showcases a blend of cultures, languages, and traditions from East Asia, South Asia, Southeast Asia, and the Pacific Islands, enriching the region's cultural, social, and economic fabric [20] [21]. The Asian American presence in the Greater NY area is significant and rapidly expanding. According to the U.S. Census Bureau, as of 2022, Asian Americans make up 14.5% of New York City's population, particularly prominent in Queens and Brooklyn [22]. The community comprises individuals with roots in various countries, including China, India, Korea, Myanmar, Pakistan, and the Philippines.

In addition, sizable populations of Asian Americans from various ethnic groups reside in suburban New Jersey and Long Island. The history of Asian Americans in the Greater NY area is marked by waves of immigration, with recent arrivals from South Asia, Southeast Asia, and other regions seeking economic opportunities, escaping political unrest, or reuniting with family [20] [21]. Despite facing challenges such as language barriers and limited access to culturally competent healthcare and education, the Asian American community in the Greater NY area remains resilient and culturally vibrant. Strong social networks, religious institutions, and advocacy groups provide crucial support. Social determinants and structural factors, however, continue to disproportionately impact low-income immigrants, refugees, and those with limited English proficiency, perpetuating poverty and marginalization [23]-[25].

In addressing CHB among Asian Americans, we used community collaboration and culturally sensitive awareness campaigns in a multifaceted approach to reach at-risk populations and reduce the disease burden [3] [26]-[28]. By partnering with leaders, organizations, and healthcare providers, and leveraging a digital platform, we mobilized resources, engaged diverse populations, and enhanced access to testing and treatment services, as explained below in greater detail.

### **3. Multifaceted Grassroots Approach**

#### **3.1. The Center for Viral Hepatitis (CVH)**

The CVH is a non-profit dedicated to heightening HBV awareness within high-risk populations. Its team comprises community leaders, physicians, nurses, volunteers, and medical students. CVH spearheads outreach and education, provides screening and linkage-to-care services, promotes culturally competent healthcare practices, and conducts clinical studies. These efforts address CHB-related barriers and systemic issues in health equity in the US.

From February 2008 to January 2024, CVH and its partners organized over 274 community outreach events in NYC and Bergen County, NJ, targeting HBV screening and education. These events engaged 22,700 Asian American participants, spanning various ethnicities. Forming partnerships with key community

organizations was essential for effectively executing these initiatives, fostering community ownership, and utilizing evidence-based strategies to enhance health outcomes and reduce community-level disparities.

In addition to serologic screening and surveys, CVH conducted workshops, lectures, and general education events at community centers, hospitals, and faith-based organizations. Five hospitals, including three university medical centers, and sixty-eight healthcare providers actively participated. Leading this multicity community-based campaign, CVH played a pivotal role in strategizing, motivating, and forming partnerships with its collaborators to advance hepatitis B awareness. CVH provided public education seminars, offered provider education on specific medical topics, conducted patient focus groups, and developed a mobile communication device for better outreach.

## **3.2. Collaborating Organizations and Their Roles**

### **3.2.1. Community-Based Organizations of Different Asian Ethnic Groups**

CVH teamed up with eight community-based organizations and 23 faith-based groups representing Burmese, Chinese, Indian, Korean, and other ethnicities. Their roles included: 1) Spearheading outreach initiatives to boost hepatitis B awareness, utilizing their community connections; 2) Coordinating workshops, health fairs, and seminars to disseminate information, offer resources, and advocate for preventive measures; 3) Promoting cultural sensitivity and linguistic appropriateness in all awareness campaigns; 4) Assisting CVH, hospitals, and partner organizations in identifying high-risk populations for hepatitis B and crafting tailored messaging and engagement strategies; 5) Bridging access to hard-to-reach community members, including homeless individuals, undocumented immigrants, or those with limited healthcare access; 6) Providing support services and referrals to individuals in need, guiding them towards screening services, health insurance enrollment, or support groups as necessary.

### **3.2.2. Hospitals and Academic Medical Centers**

CVH partnered with five community hospitals and three academic medical centers in New York and New Jersey. CVH was key to establishing the Asian Liver Center at Holy Name Medical Center in Teaneck, NJ, providing culturally competent services. Additionally, CVH secured funding and initiated HBV and Hepatitis C Virus (HCV) screening in the Emergency Departments of Englewood Hospital and Holy Name Hospital, NJ, leveraging grant funds from pharmaceutical companies. Hospitals' roles included: 1) Providing clinical expertise and resources to enhance disease awareness. 2) Offering access to healthcare facilities for screenings, workshops, and support groups. 3) Facilitating patient referrals and care coordination for timely access to services. 4) Collaborating closely to establish partnership agreements and maximize impact. 5) Allocating resources and funding to sustain awareness campaigns and programs.

### **3.2.3. Community HCPs**

CVH collaborated with HCPs to form provider networks dedicated to enhancing

cultural competence in healthcare and addressing disparities in hepatitis B care. Volunteer providers are instrumental in raising disease awareness and applying their medical expertise to engage communities, offer education and support, advocate for enhanced healthcare access, and foster healthier communities. The roles of volunteer HCPs include: 1) Offer medical expertise on diseases and support awareness efforts. 2) Join health education and outreach activities, including workshops, seminars, and health fairs. 3) Provide screening and diagnostic services. 4) Offer counseling and support to those facing health challenges. 5) Advocate for disease prevention and healthcare access. 6) Collaborate with other healthcare professionals and organizations. 7) Mentor healthcare providers and volunteers. 8) Contribute to data collection and research initiatives to understand disease prevalence, risk factors, and health outcomes within the community and collaborate with researchers and public health experts to use evidence-based interventions.

#### **3.2.4. Businesses and Pharmaceutical Companies (Pharma)**

CVH collaborated with pharmaceutical companies and other businesses that are pivotal in supporting community health initiatives through various avenues: 1) Corporate Social Responsibility (CSR) programs: Many businesses allocate resources to support community health initiatives. These can include funding healthcare infrastructure and sponsoring health education programs. 2) Research and Development: Pharma invests in research and development to discover and develop new drugs, vaccines, and treatments for diseases that disproportionately affect communities. These efforts improve health outcomes and reduce disease burdens. 3) Access to Healthcare Products: Pharma has been critical in boosting access to essential healthcare products, such as medications and vaccines, especially in underserved communities. In support of CVH's efforts, they offered discounted or free medications through patient assistance programs. 4) Health Promotion: Pharma and other businesses engaged in health promotion and education activities to raise awareness of CHB.

#### **3.2.5. Policymakers and the Government**

CVH worked with policymakers and agencies, including the NYC and Bergen County Departments of Health, and engaged members of Congress to address health inequalities, particularly hepatitis B in Asian American communities. Collaborating with the Congressional Hepatitis Caucus, co-chaired by Reps. Mike Honda and Bill Cassidy, CVH emphasized early treatment, preventive measures, and the need for a cure. The passage of the Viral Hepatitis Testing Act of 2011 (H.R. 3381) secured funding for prevention programs and raised nationwide awareness. Policymakers supported HBV initiatives by enacting legislation, securing funding, promoting cultural competency, engaging communities, and supporting research efforts.

### **4. Specific Activities and Projects**

We have categorized the important findings from studies conducted by CVH and

other sources into three categories: A. Screening and LTC in Asian populations; B. Health literacy and sociocultural factors; and C. Tools to enhance communication.

## 4.1. Screening and LTC in Asian Populations

### 4.1.1. Korean Americans

The majority of people chronically infected with HBV are unaware of their infection, highlighting significant barriers to screening in the United States. These barriers are multifactorial, including a lack of disease awareness, language and cultural barriers, and financial issues [13] [14]. Additionally, the US healthcare system has historically lacked an understanding of CHB's significance, and there are inadequate public health systems to meet multicultural needs [15] [16]. Poor communication between providers and patients of diverse backgrounds and a lack of cross-cultural training among health professionals exacerbate the issue [17] [18]. Consequently, there are inadequate health access models for minority populations in the US.

Bergen County and its vicinity have a high concentration of Asian American immigrants, many of whom are infected with HBV. Despite the growing population of Korean Americans in the area, the existing HBV screening programs have not adequately reached this community. Between December 2009 and June 2015, CVH spearheaded 128 community outreach HBV screening events in Central and Northern New Jersey. These events provided serologic screening and surveys to 7199 Korean American adults (mean age 52). More than 98% were born in Korea. All participants were tested for hepatitis B surface antigen (HBsAg), hepatitis B surface antibody (anti-HBs), and hepatitis B core IgG antibody (Anti-HBc) [29]. All the participants attended CHB awareness seminars and were asked to participate in these voluntary screenings. These participants were not interviewed before screening and were not selected on the basis of any additional risk factors related to HBV infection.

#### HBV Prevalence and Linkage to Care in Korean Americans

Among the 7157 individuals screened, 171 (2.4%) were HBV-infected, 2736 (38.2%) were susceptible to HBV, and 4250 (59.4%) were immune. The prevalence of chronic HBV varied by age group: 1.18% (21 - 30 years), 2.53% (31 - 40 years), 2.76% (41 - 50 years), 2.90% (51 - 60 years), 2.06% (61 - 70 years), and 1.37% (71 - 100 years). HBV prevalence was higher in males (3.04%) than females (1.93%). Notably, 75% of these HBV-infected individuals had been previously diagnosed but were not engaged in care [29].

#### Historical Trends in HBV Prevalence and Comparison with South Korea

This study suggests that the HBV prevalence in Korean Americans is lower than previously thought [29]. Historical data show a decline in prevalence over the past three decades: 1988-1990: 6.1% HBV prevalence among 6130 Korean Americans in the eastern U.S. 2004-2007 [30]: 4% prevalence among 609 Korean Americans in Colorado [31], and 2009-2010: 3.0% prevalence among 973 Korean Americans

in California [32].

Recent studies in South Korea show a decreasing trend in HBV prevalence. From 1998 to 2010, HBsAg positivity dropped from 4.61% to 2.98% among 50,140 participants. Age-specific declines were notable, with HBV prevalence in individuals aged 10 - 20 decreasing from 2.2% in 1998 to 0.12% in 2010, and from 4.72% to 2.29% in those aged 10 - 39 years [33]. This decline in HBV prevalence among both Korean Americans and Koreans in South Korea is attributed to HBV immunization programs. South Korea's national immunization program for all neonates began in 1995, significantly reducing both vertical and horizontal transmission [34]. Similarly, universal vaccination programs have decreased HBV prevalence among those younger than 20 years worldwide [35].

#### Efficacy of the Community-Based CHB Campaign on LTC

Despite the decline in HBV prevalence, a significant portion of the Korean American population remains susceptible to HBV, with more than one-third lacking immunity across all age groups. A notable percentage of young adults (21 - 30 years) also remains susceptible, with only 59.3% having detectable anti-HBs levels from vaccination. In sum, this study highlights that many HBV-infected individuals are not engaged in care, reflecting poor LTC in the Korean American community [36]. Previous studies have also shown that only a minority of HBV-infected individuals access care [15] [17] [37].

An eight-year follow-up study of 97 HBV-infected participants from our community-based hepatitis B campaign demonstrated successful care linkage and engagement [36]. Among the 66 participants who accessed care after screening, the rate of LTC increased over time: 46% in 2 years, 65% in 4 years, 78% in 6 years, and 86% in 8 years. Notably, 23 of these 66 participants (35%) were started on antiviral medication. These cumulative increases in LTC throughout the 8-year observation suggest the efficacy of ongoing hepatitis B education and screening efforts in this community.

Continued monitoring and management of CHB patients are essential for improving LTC. Current and previous studies indicate significant gaps in LTC for HBV-infected patients, underscoring the need for qualified providers who can offer culturally and linguistically sensitive care. Effective community-based campaigns and education efforts are crucial to addressing these challenges and enhancing LTC for HBV-infected individuals.

#### **4.1.2. Chinese Americans**

Chinese Americans, one of the fastest-growing ethnic groups in the United States, number approximately 5.5 million, making up about 1.7% of the total U.S. population [38]. Since many in this population are immigrants from regions with high CHB endemicity, it's crucial to evaluate the current prevalence of CHB and LTC within the Chinese American community. This is particularly important given the lack of studies since 2010 evaluating hepatitis B prevalence among Chinese Americans.

We carried out community-based screening for Chinese Americans in New

Jersey to determine their current hepatitis B epidemiology and to further probe the issues related to inadequate LTC. The Chinese American targeted campaign consisted of 41 community outreach screenings and education seminars at various locations throughout Northern New Jersey between July 2015 and April 2017 [37]. The sample consisted of Chinese Americans in various community settings such as churches, community centers, and health fairs. All the participants attended CHB awareness seminars and were asked to participate in these voluntary screenings. The participants were not interviewed before screening and were not selected on the basis of any additional risk factors related to HBV infection. All of the 898 participants were Chinese-born immigrants aged between 20 and 79 living in New Jersey.

We evaluated the prevalence of chronic HBV infection, the level of patient awareness of infection, and LTC. Screening 898 Chinese Americans revealed 5.5% HBV infected, 62.7% immune, and 31.8% non-immune. Our study suggests that HBV prevalence among Chinese-American adults may be lower than previously thought, but a large percentage of the population is still at risk for infection. Thirty-one of 49 HBsAg seropositive subjects knew of their infections, but only 5 participants had accessed care for CHB. Within 6 - 20 months after the screening and education, 25 participants were accessing care. These results demonstrated a pressing need to address a possible lack of health education and other important barriers preventing access to care.

#### Decreased HBV Prevalence among Chinese-Americans

Because the methodology employed in the current study differs from epidemiologic methodologies employed in other studies, no direct comparison between prevalence rates can be made. Furthermore, prevalence rates may vary owing to different levels of access to care and hepatitis B vaccination rates in varying regions. It is noteworthy, however, that the HBV prevalence of 5.5% for Chinese Americans is considerably lower than has been reported in previous studies. Between 2001 and 2006, the HBV prevalence rate of Chinese-born Chinese Americans living in the San Francisco Bay Area was reported to be 11.1% [39]. A review of the reports published between 1980 and 2010 showed an HBV prevalence of 12.25% among Chinese-born Chinese Americans [40]. The San Francisco Hep B Free Campaign, which tested 2388 Chinese Americans between 2007 and 2009, revealed an HBV prevalence of 7.2% [41].

A systematic review and meta-analysis conducted from 2018 to 2022 found that the overall HBV prevalence in the general population of mainland China was around 3%, with variations across different regions and demographics [42]. This represents a significant drop compared to a previous meta-analysis, which estimated the HBV prevalence in China between 2013 and 2017 to be 7%. This suggests a potential decrease in prevalence over time, though it's important to note that rates can vary significantly based on geographic and demographic factors, with urban areas having significantly lower rates than rural regions.

Considering these findings, CHB prevalence may be higher among Chinese

Americans than among Chinese residents in China. This disparity probably exists because many Chinese Americans may not have benefited from the nationwide vaccination programs implemented in China as they immigrated to the US.

#### Many Still at Risk and Unaware of the HBV Infection

Community-based outreach was successful in effectively screening large numbers of Chinese Americans with HBV infection in northern New Jersey. Health access is suboptimal as most of the chronically infected participants in our population were not seeing physicians, indicating a strong need to improve health education and LTC. Moreover, 37% of the HBV-infected participants were either unaware or unsure of their infection status. The results of this study may be used to develop evidence-based, community-level strategies to tailor HBV awareness campaigns and LTC.

#### **4.1.3. Indian Americans**

Studies have assessed the prevalence of HBV in various Asian American groups, but research on Indian Americans is limited. The prevalence of HBV in India is 3.7%, and approximately 40 million people are infected, contributing significantly to the global HBV burden [43]. India ranks in the intermediate endemic zone for HBV infection [44] [45]. A recent analysis of 28 publications, comprising 45,608 participants from various regions of India, for instance, found a wide range of HBV prevalence, ranging from 0.87% to 21.4% of the population [46].

With a population of more than 4.8 million in the US, Indian Americans are among the largest groups of Asian Americans. Today, Indian immigrants account for approximately 6 percent of the US foreign-born population, making them the second-largest immigrant group after Mexicans [47] [48]. Metropolitan NY and Central Jersey are the largest and most diverse South Asian ethnic enclaves and cultural hubs in the US, with the highest concentration of Indian Americans [47]. With the continued surge of immigration from India, the burden of CHB is expected to increase unless adequate strategies are implemented.

Between April 2022 and January 2024, we carried out HBV screening and education activities at 19 community screening events at various locations throughout Queens, NY. Of 328 screened and evaluated (246 males and 82 females), 10 (3.0%) were HBV-infected, 222 (67.7%) were susceptible to HBV, and 96 (29.3%) were immune. The prevalence of chronic HBV varied between the age groups: 4.6% (age 20 - 40), 3.4% (age 41 - 60), and 1.7% (age 61 - 80) [49]. Surprisingly, only two of the ten HBV-infected subjects had previously known of their infection status, and none had been linked to adequate care for monitoring and treatment [49].

#### A Vast Reservoir for Infection

The Hepatitis B (HB) vaccination rate among Indian Americans is significantly lower than in Korean and Chinese Americans [29] [36], with only 15.9% having developed protective antibodies from vaccination. This contrasts with a reported 27% - 30% vaccination rate in the latter groups. While a recent report suggests a higher vaccination rate among Indian Americans as compared to the past, it may overestimate immunity as it doesn't differentiate between vaccine-induced

immunity and past infections [50]. National data on adult HB vaccination in India are lacking, but existing data suggest regional disparities, with urban areas showing higher vaccination rates compared to rural areas [51]. Additionally, 67.7% of participants in our study were at risk for infection, mirroring findings from India, indicating a substantial reservoir of infection in the country. India introduced HB vaccination relatively late, and while some studies report its impact in limited areas, there's a lack of national data, highlighting the need for comprehensive serological surveys [51].

#### Community-Based Screening

Despite the small sample size, this study sheds light on the HBV status of the Indian American community, raising crucial points for approaching multi-ethnic populations in the US with significant HBV infection reservoirs [49]. It's the first report on HBV prevalence among Indian immigrants in the US, with a prevalence of 3%, highlighting the lack of prior screening and LTC studies in this population at moderate risk. Urgent and extensive evaluation of HBV prevalence in the Indian American community is needed, along with community outreaches that have been successful in other Asian American communities [29] [36] [37]. Most HBV-infected subjects in this unique Indian American study were diagnosed for the first time, indicating a severe lack of screening and education, especially given the projected increase in the Indian immigrant population in the US. Similar challenges to LTC have been reported in other Asian American communities, emphasizing the need for improvements in patient education, counseling, and navigation efforts to improve linkages to HBV care. Future comprehensive, community-based HBV screening and evaluation programs may help facilitate LTC and reduce the HBV burden in the US.

## **4.2. Health Literacy and Sociocultural Factors**

### **4.2.1. Health Literacy**

Aside from screening and vaccination, education is critical to ensure HB is not overlooked in at-risk populations [52]. The Institute of Medicine and CDC emphasize working with stakeholders to develop effective education programs to raise HB awareness [52]. There is still a significant lack of education, however, particularly in middle and high schools in New York and New Jersey, where there are large immigrant populations from HBV-endemic countries. These schools require HB vaccination records but do not require screening or provide education on HB prevention or management [53] [54].

Studies have shown low HB knowledge in high-risk populations, particularly among Asian Americans, which is linked to demographic and acculturation factors. These findings highlight the importance of health literacy in enhancing care linkage [55] [56] [57]. Our studies evaluated HB knowledge among individuals from HBV-endemic communities, revealing a serious need for education. A survey of 521 Korean American adults, including 296 parents, conducted during community-based HB awareness campaigns in New York from January 2015 to November 2016 showed significant knowledge deficits [58]. While many knew

CHB is a liver disease and had been screened, they lacked understanding of vaccination, screening, modes of HBV transmission, their own HB status, and the consequences and treatment of CHB. Many were also unaware of their children's HB status. This lack of health literacy contributes to poor health access to HB care in both adults and children, indicating an urgent need for education on HB among Korean American parents and young children. Given the high rate of HBV in certain populations, more effort and resources must be devoted to educating the affected community and children about CHB and its serious complications to improve health disparities among racial and ethnic minorities

#### **4.2.2. Health as a Cultural Concept**

Screening and preventive behaviors in Asian Americans are infrequent and poor, leading to low healthcare utilization for consistent CHB monitoring and treatment [59]. Cultural and social determinants of health, such as resource availability, education quality, and social support, significantly influence health outcomes [13] [60] [61]. Health is also a cultural concept, as culture shapes how individuals perceive their experiences in health. Cultural determinants of health include people's beliefs, practices, and values, which impact their health behaviors and, thus, outcomes. These factors can also interact with biological factors to shape health experiences and outcomes [62] [63].

Sociocultural factors also impact health literacy, which is crucial for healthcare-seeking behaviors and outcomes. Low health literacy affects one-third of the U.S. adult population, reducing preventive measures, higher hospital admissions, and long-term health conditions [64]-[67]. It disproportionately affects racial and ethnic minorities, contributing to health disparities [68]. For CHB, prevalent among ethnic minorities, poor health literacy can worsen outcomes.

Social and cultural determinants of health correlate with HBV testing and access to care, specifically among foreign-born US residents. Studies have suggested that social determinants such as income, English fluency, religion, and education level all play a role in the burden of HBV infection among foreign-born US residents. Certain economic conditions, such as worrying about rent, were associated with lower HBV testing, indicating that fiscal concerns may influence individuals to prioritize needs other than health and health care [69]. Asian Americans were more likely to never have been screened if they did not speak English fluently [70]. Other studies in African and Chinese immigrant communities found that linguistic discordance in healthcare settings contributed to a feeling of misunderstanding and cultural disconnect [60] [71]. The cultural stigma around screening [69], the taboo and secrecy of discussing disease [71], and the use of traditional medicine and spiritual healing [60] [71] are some examples of cultural influences on HBV care.

The US healthcare system also surfaced as a strong social determinant of health. Its complexity, stemming from limited health literacy, perceived discrimination, cost, and difficulties navigating the reimbursement system, was found to influence access to healthcare. Mistrust also arose in communities with historically rooted

fears of experimentation [71] and in those with a lack of trust in physicians [60].

Few interventions have been designed to address sociocultural barriers to HBV care in diverse populations. Some novel initiatives have been employed to mitigate the effects of low health literacy and increase awareness of HBV, however. One intervention created engaging YouTube channels to facilitate the understanding of CHB history and pathophysiology [72]. Another intervention developed culturally tailored photonovels to spread awareness of CHB and liver cancer [73]. These featured culturally relevant components, such as faces of people in the same ethnic group playing central characters and storylines drawn from shared cultural experiences. This approach has been used effectively as a form of participatory education that actively draws upon cultural aspects of the target population.

HBV interventions could better reach high-risk populations by incorporating sensitivity to cultural factors, especially language and community contexts. Community-based initiatives are one channel through which health promotion has notably succeeded in high-risk populations [27] [28]. These programs have delivered culturally appropriate educational initiatives and care packages encompassing HBV screening, ongoing disease monitoring, and treatment [17] [74]. Among foreign-born US residents susceptible to HBV, continued health promotion that uses targeted cultural and linguistically appropriate messaging may be promising and improve HBV-related outcomes.

In one recent study, we evaluated various sociocultural factors and their interaction with health literacy in impacting CHB care in a Korean American population [3]. This study involved focus groups with Korean American adults with CHB to investigate sociocultural barriers to hepatitis B literacy and their influence on healthcare access. Results highlighted themes of risk perception, language and stigma, and financial and institutional barriers, revealing a poor understanding of CHB and its complications. Cultural differences and a lack of understanding of healthcare systems further limited health literacy and care-seeking behavior. Culture-specific barriers to health literacy also affected health behaviors in HB care. These findings may inform strategies for developing culturally tailored resources and programs, facilitating HB education and screening initiatives in immigrant communities.

### **4.3. Tools to Enhance Communication**

Effective communication between patients and HCPs is essential for achieving positive health outcomes. Several barriers can impede accurate and timely communication, however. First, there is a language barrier where well-meaning HCPs may provide medically accurate information but phrase it in a way that patients with limited English proficiency struggle to understand, hindering their engagement with care [75]-[77]. Second, the high cost of visiting a physician, which may include not only time lost from work but also the cost of child care, can deter some patients from seeking or maintaining appointments [78]-[81]. Third, outside of scheduled appointments, HCPs have limited ways to provide patients with

information and educational materials about their health conditions. Finally, patients may live too far from HCPs, making it difficult to access care when needed [82] [83]. There is a clear need for efficient communication systems that facilitate two-way communication between patients and HCPs so that patients can understand and engage with their care, manage costs, access information, and overcome geographic barriers.

Secure communication via texting between patients and HCPs may be used for consultation, patient engagement and education, and direct instant messaging [84]-[86]. Much evidence supports the use of texting between patients and HCPs and positive health outcomes. Text messaging can provide laboratory results, reminders of appointments, medication administration and flu vaccination, and other services [87]-[89]. Specifically, text messaging has been shown to improve adherence to medication and attendance at medical appointments among HIV and other chronic disease patients [90] [91]. Text4Health projects have also helped to engage the underserved population and improve their health [92]. SmokeFreeText, for instance, more than doubled the smoking cessation rate among teens by texting smoking cessation messages to them [93]. Furthermore, the Text4Baby Campaign has helped expectant mothers to receive crucial prenatal care resources, thereby fostering the safe delivery of their babies [94].

As texting has become a progressively effective tool in patient engagement, the number of health apps has dramatically increased during the past decade. As of 2013, there were more than 1700 diabetes mellitus apps in all the app stores combined (Apple app store, Google Play store, and Windows) [95]. These mobile health apps on smartphones can collect and deliver healthcare data and monitor patients' vital signs in real-time [96] [97].

We have previously investigated the use of mobile text messaging in facilitating the connection between HCPs and individuals with CHB or at risk for it [98]. The study's results demonstrated a significant positive impact on access to care after just a 3-month intervention period. This suggests that using mobile text messaging interventions could help patients better engage with healthcare providers, potentially improving their access to healthcare and their understanding of their own needs.

To further examine the efficacy of mobile texting in engaging patients in collaborating in their own HB care, we developed a text messaging app, *HepTalk* [99]. We evaluated the effects of its use in two groups of individuals similar to those in our previous study: people with CHB, who are not currently accessing care and thus need to see HCPs for further evaluation; and nonimmune individuals who need vaccination at a health care facility.

The results of this study demonstrated that *HepTalk* could be employed to boost patient engagement and improve outcomes in HB care. This study further supports the finding of our previous investigation, which suggested that a form of mobile texting combined with the patient navigator program facilitated communication between the patients and HCPs and enhanced LTC [98]. *HepTalk*

provided an effective communication mechanism through which patient navigators could guide participants to appropriate health care resources. The benefits of *HepTalk* include communication speed, accessibility, and reduced patient expense. *HepTalk* is not limited by geographic boundaries and can help people lacking transportation. Finally, as all the communication was in the patients' native language, *HepTalk* could also overcome linguistic and cultural barriers, at least where providers fluent in the patient's language are available.

In conclusion, *HepTalk* can empower patients to access healthcare effectively. Combining mobile texting with community-based patient navigation programs can enhance HB care and potentially care for other chronic illnesses in minority populations.

## **5. Discussion**

### **5.1. A Multifaceted Approach Confronting Barriers in CHB among Asian Americans**

Key strategies for tackling systemic barriers in CHB care include language access, culturally competent care, community engagement, health equity initiatives, and data collection and research. Examples include linguistically sensitive programs with seminars and materials in Chinese, Korean, Hindi, and Burmese. It is crucial to encourage healthcare providers proficient in these languages to participate in awareness campaigns. Collaborations with community organizations, hospitals, and leaders are essential for targeted outreach through workshops, health fairs, and support groups.

### **5.2. Implementing Long-Term Improvement in CHB-Related Disparities among Asian Americans**

To achieve lasting improvements in chronic hepatitis B (CHB)-related health disparities within Asian American communities, a comprehensive and multifaceted strategy is necessary. This involves understanding their specific needs and experiences, fostering collaborations, and promoting cultural competence among healthcare providers. Expanding outreach efforts to increase access to screening, vaccination, and treatment, while addressing barriers like cost, transportation, and stigma, is crucial. Additionally, establishing patient navigation and support services, conducting tailored health education campaigns, and enhancing data collection to track progress and assess strategy effectiveness are essential steps.

### **5.3. Establishing Shared Goals in Culturally Relevant Ways among the Community Partners**

Collaborations integrate cultural relevance into goals, respect diverse perspectives, and address inequalities sustainably. Providing cultural competence training to community leaders and partners enhances understanding of diverse cultural perspectives and communication styles, fostering empathy and mutual respect. Engaging affected communities through forums, focus groups, and storytelling

sessions, and using tools like the HepTalk mobile app for patient communication, improves engagement and healthcare access. Town hall sessions enable community members to share experiences and concerns respectfully. Acknowledging contributions and celebrating cultural achievements reinforces collective identity and solidarity.

## 6. Limitations

This review has several key limitations. First, the samples used in the studies may not fully represent the broader Asian American population with chronic HBV. Future studies with larger, more diverse samples that consider health literacy and social determinants are needed to confirm and clarify these findings. Additionally, reliance on data collection from individuals attending health campaigns may introduce biases that affect the final analysis. Second, larger sample sizes from other geographic regions would be necessary to more accurately assess the interaction among factors influencing linkage to care in these moderate to high-risk populations. Third, our studies do not generalize findings across all Asian American subpopulations. We recognize the diversity and varying cultural nuances within this group. Finally, due to the nature of these studies as population surveys and linkage-to-care studies, the use of control groups was not feasible.

## 7. Conclusion

CHB disproportionately affects minority groups in the US, particularly Asian Americans, with numerous barriers and systemic factors contributing to this disparity. As immigration-related minority populations are expected to rise in the US, this health gap may widen. Developing a strategy focused on increasing research, CHB screening, and access to primary prevention in high-risk populations is crucial. A grassroots campaign led by CVH during the past sixteen years involving the community, healthcare professionals, and policymakers has proved highly effective. Our Hepatitis B Screening and Awareness Campaign, tailored to the Asian American community, serves as a successful model for screening and connecting individuals to care, as well as addressing language and cultural barriers. Insights from hepatitis B community outreach programs have guided the development of culturally relevant resources and education initiatives. These findings could also inform health efforts in other immigrant communities, in the US and globally, in battling an array of disorders prevalent in such groups.

## Author Contributions

CSH conceived the study, participated in its design, and drafted the manuscript. SK, SH, and JM participated in manuscript preparation. All authors read and approved the final manuscript.

## Funding

This study was partially supported by a grant from the Gilead Foundation.

## Acknowledgements

The authors acknowledge the work of members and volunteers of the Center for Viral Hepatitis and the Korean Community Services.

## Data Availability Statement

The data used and/or analyzed in the current review are available from the references.

## Conflicts of Interest

The authors declare that there are no conflicts of interest.

## References

- [1] Cooke, G.S., Andrieux-Meyer, I., Applegate, T.L., *et al.* (2019) Accelerating the Elimination of Viral Hepatitis: A Lancet Gastroenterology & Hepatology Commission. *The Lancet Gastroenterology and Hepatology*, **4**, 135-184. [https://doi.org/10.1016/S2468-1253\(19\)30099-8](https://doi.org/10.1016/S2468-1253(19)30099-8)
- [2] Moonen, C.P.B., den Heijer, C.D.J., Dukers-Muijers, N.H.T.M., van Dreumel, R., Steins, S.C.J. and Hoebe, C.J.P.A. (2023) A Systematic Review of Barriers and Facilitators for Hepatitis B and C Screening among Migrants in the EU/EEA Region. *Frontiers in Public Health*, **11**, Article 1118227. <https://doi.org/10.3389/fpubh.2023.1118227>
- [3] Hyun, S., Ko, O., Kim, S. and Ventura, W.R. (2021) Sociocultural Barriers to Hepatitis B Health Literacy in an Immigrant Population: A Focus Group Study in Korean Americans. *BMC Public Health*, **21**, Article No. 404. <https://doi.org/10.1186/s12889-021-10441-4>
- [4] Chang, E.T. and So, S.K.S. (2007) Re: "Ten Largest Racial and Ethnic Health Disparities in the United States Based on Healthy People 2010 Objectives". *American Journal of Epidemiology*, **166**, 1105-1106. <https://doi.org/10.1093/aje/kwm261>
- [5] Hollinger, F.B., Liang, T.J. (2001) Hepatitis B Virus. In: Knipe, D.M., *et al.*, Eds., *Fields Virology (4th edition)*, Lippincott Williams & Wilkins, 2971-3036.
- [6] Block, T.M., Mehta, A.S., Fimmel, C.J. and Jordan, R. (2003) Molecular Viral Oncology of Hepatocellular Carcinoma. *Oncogene*, **22**, 5093-5107. <https://doi.org/10.1038/sj.onc.1206557>
- [7] McMahon, B.J. (2010) Natural History of Chronic Hepatitis B. *Clinics in Liver Disease*, **14**, 381-396. <https://doi.org/10.1016/j.cld.2010.05.007>
- [8] Lok, A. (2001) Chronic Hepatitis B: AASLD Practice Guidelines. *Hepatology*, **34**, 1225-1241. <https://doi.org/10.1053/jhep.2001.29401>
- [9] Office of Minority Health (2023) Hepatitis and Asian Americans. <https://minorityhealth.hhs.gov/hepatitis-and-asian-americans>
- [10] Wong, R.J., Brosgart, C.L., Welch, S., Block, T., Chen, M., Cohen, C., *et al.* (2021) An Updated Assessment of Chronic Hepatitis B Prevalence among Foreign-Born Persons Living in the United States. *Hepatology*, **74**, 607-626. <https://doi.org/10.1002/hep.31782>
- [11] Cohen, C., Evans, A.A., London, W.T., Block, J., Conti, M. and Block, T. (2007) Underestimation of Chronic Hepatitis B Virus Infection in the United States of America. *Journal of Viral Hepatitis*, **15**, 12-13.

- <https://doi.org/10.1111/j.1365-2893.2007.00888.x>
- [12] Cohen, C., Holmberg, S.D., McMahon, B.J., Block, J.M., Brosgart, C.L., Gish, R.G., *et al.* (2010) Is Chronic Hepatitis B Being Undertreated in the United States? *Journal of Viral Hepatitis*, **18**, 377-383. <https://doi.org/10.1111/j.1365-2893.2010.01401.x>
- [13] Hu, K., Pan, C.Q. and Goodwin, D. (2011) Barriers to Screening for Hepatitis B Virus Infection in Asian Americans. *Digestive Diseases and Sciences*, **56**, 3163-3171. <https://doi.org/10.1007/s10620-011-1840-6>
- [14] Philbin, M.M., Erby, L.A.H., Lee, S. and Juon, H. (2011) Hepatitis B and Liver Cancer among Three Asian American Sub-Groups: A Focus Group Inquiry. *Journal of Immigrant and Minority Health*, **14**, 858-868. <https://doi.org/10.1007/s10903-011-9523-0>
- [15] Cohen, C., Caballero, J., Martin, M., Weerasinghe, I., Ninde, M. and Block, J. (2013) Eradication of Hepatitis B: A Nationwide Community Coalition Approach to Improving Vaccination, Screening, and Linkage to Care. *Journal of Community Health*, **38**, 799-804. <https://doi.org/10.1007/s10900-013-9699-4>
- [16] Ward, J.W. and Byrd, K.K. (2012) Hepatitis B in the United States: A Major Health Disparity Affecting Many Foreign-Born Populations. *Hepatology*, **56**, 419-421. <https://doi.org/10.1002/hep.25799>
- [17] Pollack, H., Wan, K., Miyoshi, T., *et al.* (2007) Management of Chronic Hepatitis B Virus (HBV) Infection by Primary Care Physicians in Urban Hospitals and Clinics in New York City. *Hepatology*, **46**, 676A.
- [18] Upadhyaya, N., Chang, R., Davis, C., Conti, M.C., Salinas-Garcia, D. and Tang, H. (2010) Chronic Hepatitis B: Perceptions in Asian American Communities and Diagnosis and Management Practices among Primary Care Physicians. *Postgraduate Medicine*, **122**, 165-175. <https://doi.org/10.3810/pgm.2010.09.2213>
- [19] Ferrante, J.M., Winston, D.G., Chen, P.H., de la Torre, A.N. (2008) Family Physicians' Knowledge and Screening of Chronic Hepatitis and Liver Cancer. *Family Medicine*, **40**, 345-351.
- [20] Asian American Federation (2023) State of Change: Asian Populations Transform New York. <https://www.aafederation.org/research/state-of-change-asian-populations-transform-new-york/>
- [21] Brasuell, J. (2021) Where New Asian Residents Are Transforming New York City. <https://www.planetizen.com/news/2021/10/115031-where-new-asian-residents-are-transforming-new-york-city>
- [22] U.S. Census Bureau (2022) Growth in U.S. Population Shows Early Indication of Recovery Amid COVID-19 Pandemic. <https://www.census.gov/newsroom/press-releases/2022/2022-population-estimates.html>
- [23] Nonprofit Quarterly (2023) Advancing Culturally Competent Care for the AANHPI Community. <https://nonprofitquarterly.org/advancing-culturally-competent-care-for-the-aanhpi-community/>
- [24] Beech, B.M., Ford, C., Thorpe, R.J., Bruce, M.A. and Norris, K.C. (2021) Poverty, Racism, and the Public Health Crisis in America. *Frontiers in Public Health*, **9**, Article 699049. <https://doi.org/10.3389/fpubh.2021.699049>
- [25] Centers for Disease Control and Prevention. (2023) Racial and Ethnic Differences in Social Determinants of Health and Health-Related Social Needs among Adults—

- Behavioral Risk Factor Surveillance System, United States, 2022. *Morbidity and Mortality Weekly Report*, **73**, 273-279.  
<https://www.cdc.gov/mmwr/volumes/73/wr/mm7309a3.htm>
- [26] Jackson, C.S. and Gracia, J.N. (2014) Addressing Health and Health-Care Disparities: The Role of a Diverse Workforce and the Social Determinants of Health. *Public Health Reports*, **129**, 57-61. <https://doi.org/10.1177/00333549141291s211>
- [27] Rein, D.B., Lesesne, S.B., Smith, B.D. and Weinbaum, C.M. (2011) Models of Community-Based Hepatitis B Surface Antigen Screening Programs in the U.S. and Their Estimated Outcomes and Costs. *Public Health Reports*, **126**, 560-567.  
<https://doi.org/10.1177/003335491112600412>
- [28] Robotin, M.C. and George, J. (2014) Community-Based Hepatitis B Screening: What Works? *Hepatology International*, **8**, 478-492.  
<https://doi.org/10.1007/s12072-014-9562-4>
- [29] Hyun, C.S., Kim, S., Kang, S.Y., Jung, S. and Lee, S. (2016) Chronic Hepatitis B in Korean Americans: Decreased Prevalence and Poor Linkage to Care. *BMC Infectious Diseases*, **16**, Article No. 415. <https://doi.org/10.1186/s12879-016-1732-7>
- [30] Hann, H.L., Hann, R.S. and Maddrey, W.C. (2007) Hepatitis B Virus Infection in 6,130 Unvaccinated Korean-Americans Surveyed between 1988 and 1990. *The American Journal of Gastroenterology*, **102**, 767-772.  
<https://doi.org/10.1111/j.1572-0241.2007.01060.x>
- [31] Lee, H.O., Levin, M., Kim, F., *et al.* (2008) Hepatitis B Infection among Korean Americans in Colorado: Evidence of the Need for Serologic Testing and Vaccination. *Hepatitis Monthly*, **8**, 91-96.
- [32] Navarro, N., Lim, N., Kim, J., Joo, E., Che, K., Runyon, B.A., *et al.* (2014) Lower than Expected Hepatitis B Virus Infection Prevalence among First Generation Koreans in the U.S.: Results of HBV Screening in the Southern California Inland Empire. *BMC Infectious Diseases*, **14**, Article No.269. <https://doi.org/10.1186/1471-2334-14-269>
- [33] Kim, H., Shin, A.R., Chung, H.H., Kim, M.K., Lee, J.S., Shim, J., *et al.* (2013) Recent Trends in Hepatitis B Virus Infection in the General Korean Population. *The Korean Journal of Internal Medicine*, **28**, 413-419.  
<https://doi.org/10.3904/kjim.2013.28.4.413>
- [34] Park, N.H., Chung, Y. and Lee, H. (2010) Impacts of Vaccination on Hepatitis B Viral Infections in Korea over a 25-Year Period. *Intervirology*, **53**, 20-28.  
<https://doi.org/10.1159/000252780>
- [35] Mast, E.E., Margolis, H.S. and Fire, A.E. (2005) A Comprehensive Immunization Strategy to Eliminate Transmission of Hepatitis B Infection in the United States: Recommendations of the Advisory Committee on Immunization Practices Part 1: Immunization of Infants, Children, and Adolescents. *MMWR Recommendations and Reports*, **54**, 1-31.
- [36] Hyun, C.S., Ko, O., Lee, S. and McMenamin, J. (2019) Long Term Outcome of a Community-Based Hepatitis B Awareness Campaign: Eight-Year Follow-Up on Linkage to Care (LTC) in HBV Infected Individuals. *BMC Infectious Diseases*, **19**, Article No. 638. <https://doi.org/10.1186/s12879-019-4283-x>
- [37] Hyun, C., Wang, H., Ko, O., Lee, S. and McMenamin, J. (2021) Hepatitis B Awareness Campaign in Chinese Americans: A Community Outreach Model to Facilitate Screening and Linkage to Care. *International Journal of Health Promotion and Education*, **59**, 366-377. <https://doi.org/10.1080/14635240.2021.1964375>
- [38] Pew Research Center (2021) Key Facts about Asian Americans.

- <https://www.pewresearch.org/fact-tank/2021/04/29/key-facts-about-asian-americans/>
- [39] Lin, S.Y., Chang, E.T. and So, S.K. (2007) Why We Should Routinely Screen Asian American Adults for Hepatitis B: A Cross-Sectional Study of Asians in California. *Hepatology*, **46**, 1034-1040. <https://doi.org/10.1002/hep.21784>
- [40] Kowdley, K.V., Wang, C.C., Welch, S., Roberts, H. and Brosgart, C.L. (2012) Prevalence of Chronic Hepatitis B among Foreign-Born Persons Living in the United States by Country of Origin. *Hepatology*, **56**, 422-433. <https://doi.org/10.1002/hep.24804>
- [41] Bailey, M.B., Shiau, R., Zola, J., Fernyak, S.E., Fang, T., So, S.K.S., *et al.* (2010) San Francisco Hep B Free: A Grassroots Community Coalition to Prevent Hepatitis B and Liver Cancer. *Journal of Community Health*, **36**, 538-551. <https://doi.org/10.1007/s10900-010-9339-1>
- [42] Bai, S., Dang, W., Hong, W., Liao, W. and Smith, R.D. (2024) The Prevalence of Hepatitis B in Chinese General Population from 2018 to 2022: A Systematic Review and Meta-Analysis. *BMC Infectious Diseases*, **24**, Article No. 211. <https://doi.org/10.1186/s12879-024-09103-8>
- [43] Kumar, A., Arora, A., Sharma, P., Bansal, N., Anikhindi, S.A., Khare, S., *et al.* (2023) Public Knowledge, Awareness, and Vaccination Rates for Hepatitis B in India: A Cross-Sectional Survey. *Cureus*, **15**, e43997. <https://doi.org/10.7759/cureus.43997>
- [44] Bhattacharya, H., Parai, D., Sahoo, S.K., Swain, A., Pattnaik, M., Mohapatra, I., *et al.* (2023) Hepatitis B Virus Infection among the Tribal and Particularly Vulnerable Tribal Population from an Eastern State of India: Findings from the Serosurvey in Seven Tribal Dominated Districts, 2021-2022. *Frontiers in Microbiology*, **14**, Article 1039696. <https://doi.org/10.3389/fmicb.2023.1039696>
- [45] World Health Organization (2016) WHO Factsheet-b-World Hepatitis Day 2016. [https://www.who.int/docs/default-source/searo/india/health-topic-pdf/factsheet-b-hepatitisday2016.pdf?sfvrsn=da61ef0\\_2](https://www.who.int/docs/default-source/searo/india/health-topic-pdf/factsheet-b-hepatitisday2016.pdf?sfvrsn=da61ef0_2)
- [46] Kumar, D., Peter, R.M., Joseph, A., Kosalram, K. and Kaur, H. (2023) Prevalence of Viral Hepatitis Infection in India: A Systematic Review and Meta-Analysis. *Journal of Education and Health Promotion*, **12**, 103. [https://doi.org/10.4103/jehp.jehp\\_1005\\_22](https://doi.org/10.4103/jehp.jehp_1005_22)
- [47] Hoffman, A. and Batalova, A. (2022) Indian Immigrants in the United States. <https://www.migrationpolicy.org/article/indian-immigrants-united-states>
- [48] Rico, B., Hahn, J.K., Spence, C. (2023) United Census Bureau. Asian Indian Was the Largest Asian Alone Population Group in 2020. <https://www.census.gov/library/stories/2023/09/2020-census-dhc-a-asian-population.html>
- [49] Hyun, C., Kim, S., Li, E., Lee, M., Spinnell, M.K., McMenamin, J., *et al.* (2024) Chronic Hepatitis B in Indian Americans: Lack of Screening and Poor Linkage to Care. *International Journal of Clinical Medicine*, **15**, 197-209. <https://doi.org/10.4236/ijcm.2024.154014>
- [50] Wang, Z., Jamal, A., Wang, R., Dan, S., Kappagoda, S., Kim, G., *et al.* (2023) Disparities and Trends in Routine Adult Vaccination Rates among Disaggregated Asian American Subgroups, National Health Interview Survey 2006-2018. *AJPM Focus*, **2**, Article ID: 100044. <https://doi.org/10.1016/j.focus.2022.100044>
- [51] Murhekar, M.V., Santhosh Kumar, M., Kamaraj, P., Khan, S.A., Allam, R.R., Barde, P., *et al.* (2020) Hepatitis-B Virus Infection in India: Findings from a Nationally Representative Serosurvey, 2017-18. *International Journal of Infectious Diseases*, **100**,

- 455-460. <https://doi.org/10.1016/j.ijid.2020.08.084>
- [52] Hepatitis and Liver Cancer (2010) A National Strategy for Prevention and Control of Hepatitis B and C. Committee on the Prevention and Control of Viral Hepatitis Infections, Institute of Medicine.  
<http://www.nap.edu/catalog/12793.html>
- [53] (2005) A Guidance Document for Achieving the New York State Standards in Health Education.  
<https://www.nysed.gov/sites/default/files/programs/curriculum-instruction/guid-ancedocumentfinal1105.pdf>
- [54] (2014) Summary of Revisions to the 2014 NJSLs for Comprehensive Health and Physical Education.  
<https://www.ehcs.k12.nj.us/site/handlers/filedownload.ashx?moduleinstanceid=127&dataid=6622&FileName=2022%20EHC%20Revised%20Health%20and%20PE%20Curriculum%20.docx.pdf>
- [55] Lee, H., Lee, O., Kim, S., Hontz, I. and Warner, A. (2007) Differences in Knowledge of Hepatitis B among Korean Immigrants in Two Cities in the Rocky Mountain Region. *Asian Nursing Research*, **1**, 165-175.  
[https://doi.org/10.1016/s1976-1317\(08\)60019-5](https://doi.org/10.1016/s1976-1317(08)60019-5)
- [56] Do, T.N. and Nam, S. (2011) Knowledge, Awareness and Medical Practice of Asian Americans/Pacific Islanders on Chronic Hepatitis B Infection: Review of Current Psychosocial Evidence. *Health and Social Welfare Review*, **31**, 341-364.  
<https://doi.org/10.15709/hswr.2011.31.3.341>
- [57] Taylor, V.M., Choe, J.H., Yasui, Y., Li, L., Burke, N. and Jackson, J.C. (2005) Hepatitis B Awareness, Testing, and Knowledge among Vietnamese American Men and Women. *Journal of Community Health*, **30**, 477-490.  
<https://doi.org/10.1007/s10900-005-7282-3>
- [58] Hyun, S., Lee, S., Ventura, W.R. and McMenamin, J. (2017) Knowledge, Awareness, and Prevention of Hepatitis B Virus Infection among Korean American Parents. *Journal of Immigrant and Minority Health*, **20**, 943-950.  
<https://doi.org/10.1007/s10903-017-0609-1>
- [59] Wong, R. and Corley, D.A. (2008) Racial and Ethnic Variations in Hepatocellular Carcinoma Incidence within the United States. *The American Journal of Medicine*, **121**, 525-531. <https://doi.org/10.1016/j.amjmed.2008.03.005>
- [60] Fang, D.M. and Stewart, S.L. (2018) Social-Cultural, Traditional Beliefs, and Health System Barriers of Hepatitis B Screening among Hmong Americans: A Case Study. *Cancer*, **124**, 1576-1582. <https://doi.org/10.1002/cncr.31096>
- [61] Jorgensen, C., Chen, S., Carnes, C.A., Block, J., Chen, D., Caballero, J., *et al.* (2016) "Know Hepatitis B": A Multilingual Communications Campaign Promoting Testing for Hepatitis B among Asian Americans and Pacific Islanders. *Public Health Reports*, **131**, 35-40. <https://doi.org/10.1177/00333549161310s206>
- [62] Tram, T. (2009) Understanding Cultural barriers in Hepatitis B Virus Infection. *Cleveland Clinic Journal of Medicine*, **76**, S10-S13.  
<https://doi.org/10.3949/ccjm.76.s3.03>
- [63] Hernandez, L.M. and Blazer, D.G. (2006) Institute of Medicine (US) Committee on Assessing Interactions Among Social, Behavioral, and Genetic Factors in Health. In: Hernandez, L.M. and Blazer, D.G., Eds., *Genes, Behavior, and the Social Environment: Moving beyond the Nature/Nurture Debate*, National Academies Press (US), 2.

- [64] Cutilli, C.C. and Bennett, I.M. (2009) Understanding the Health Literacy of America: Results of the National Assessment of Adult Literacy. *Orthopaedic Nursing*, **28**, 27-32. <https://doi.org/10.1097/01.nor.0000345852.22122.d6>
- [65] White, S. (2008) Relationship of Preventive Health Practices and Health Literacy: A National Study. *American Journal of Health Behavior*, **32**, 227-242. <https://doi.org/10.5993/ajhb.32.3.1>
- [66] Bostock, S. and Steptoe, A. (2012) Association between Low Functional Health Literacy and Mortality in Older Adults: Longitudinal Cohort Study. *BMJ*, **344**, e1602-e1602. <https://doi.org/10.1136/bmj.e1602>
- [67] Berkman, N.D., Sheridan, S.L., Donahue, K.E., *et al.* (2011) Health Literacy Interventions and Outcomes: An Updated Systematic Review. Agency for Healthcare Research and Quality.
- [68] Rikard, R.V., Thompson, M.S., McKinney, J. and Beauchamp, A. (2016) Examining Health Literacy Disparities in the United States: A Third Look at the National Assessment of Adult Literacy (NAAL). *BMC Public Health*, **16**, Article No. 975. <https://doi.org/10.1186/s12889-016-3621-9>
- [69] Greene, K.M., Duffus, W.A., Xing, J. and King, H. (2017) Social Determinants of Health Associated with HBV Testing and Access to Care among Foreign-Born Persons Residing in the United States: 2009-2012. *Journal of Health Disparities Research and Practice*, **10**, 1-20.
- [70] Ma, G.X., Lee, S., Wang, M., Tan, Y., Gao, W., Ma, X., *et al.* (2011) Role of Sociocultural Factors in Hepatitis B Screening among Asian Americans. *Southern Medical Journal*, **104**, 466-472. <https://doi.org/10.1097/smj.0b013e31821f8ab0>
- [71] Freeland, C., Bodor, S., Perera, U. and Cohen, C. (2020) Barriers to Hepatitis B Screening and Prevention for African Immigrant Populations in the United States: A Qualitative Study. *Viruses*, **12**, Article 305. <https://doi.org/10.3390/v12030305>
- [72] Lord, H.L., Newland, J., Cama, E., *et al.* (2014) Understanding the Phases of Chronic Hepatitis B; the Problem and a Novel Solution Using Renamed Phases, the Hepatitis B Bear and a Video (See "Understanding Hepatitis B" on YouTube). *Hepatology*, **60**, 1001A-1002A.
- [73] Lee, S., Yoon, H., Chen, L. and Juon, H. (2013) Culturally Appropriate Photonoel Development and Process Evaluation for Hepatitis B Prevention in Chinese, Korean, and Vietnamese American Communities. *Health Education & Behavior*, **40**, 694-703. <https://doi.org/10.1177/1090198112474003>
- [74] Gish, R.G. and Cooper, S.L. (2010) Hepatitis B in the Greater San Francisco Bay Area: An Integrated Programme to Respond to a Diverse Local Epidemic. *Journal of Viral Hepatitis*, **18**, 28-33. <https://doi.org/10.1111/j.1365-2893.2010.01382.x>
- [75] Chu, C. (1998) Cross-Cultural Health Issues in Contemporary Australia. *Ethnicity & Health*, **3**, 125-134. <https://doi.org/10.1080/13557858.1998.9961854>
- [76] Jacobs, E., Chen, A.H., Karliner, L.S., Agger-Gupta, N. and Mutha, S. (2006) The Need for More Research on Language Barriers in Health Care: A Proposed Research Agenda. *The Milbank Quarterly*, **84**, 111-133. <https://doi.org/10.1111/j.1468-0009.2006.00440.x>
- [77] Meuter, R.F.I., Gallois, C., Segalowitz, N.S., Ryder, A.G. and Hocking, J. (2015) Overcoming Language Barriers in Healthcare: A Protocol for Investigating Safe and Effective Communication When Patients or Clinicians Use a Second Language. *BMC Health Services Research*, **15**, Article No. 371. <https://doi.org/10.1186/s12913-015-1024-8>

- [78] Parikh, P.B., Yang, J., Leigh, S., Dorjee, K., Parikh, R., Sakellarios, N., *et al.* (2013) The Impact of Financial Barriers on Access to Care, Quality of Care and Vascular Morbidity among Patients with Diabetes and Coronary Heart Disease. *Journal of General Internal Medicine*, **29**, 76-81. <https://doi.org/10.1007/s11606-013-2635-6>
- [79] DeVoe, J.E., Fryer, G.E., Phillips, R. and Green, L. (2003) Receipt of Preventive Care among Adults: Insurance Status and Usual Source of Care. *American Journal of Public Health*, **93**, 786-791. <https://doi.org/10.2105/ajph.93.5.786>
- [80] Wilper, A.P., Woolhandler, S., Lasser, K.E., McCormick, D., Bor, D.H. and Himmelstein, D.U. (2009) Hypertension, Diabetes, and Elevated Cholesterol among Insured and Uninsured U.S. Adults. *Health Affairs*, **28**, w1151-w1159. <https://doi.org/10.1377/hlthaff.28.6.w1151>
- [81] Garfield, R., Orgera, K., Damico, A. (2019) The Uninsured and the ACA: A Primer—Key Facts about Health Insurance and the Uninsured Amidst Changes to the Affordable Care Act. Kaiser Family Foundation. <https://www.kff.org/unin-sured/report/the-uninsured-and-the-aca-a-primer-key-facts-about-health-insurance-and-the-uninsured-amidst-changes-to-the-affordable-care-act/>
- [82] Syed, S.T., Gerber, B.S. and Sharp, L.K. (2013) Traveling Towards Disease: Transportation Barriers to Health Care Access. *Journal of Community Health*, **38**, 976-993. <https://doi.org/10.1007/s10900-013-9681-1>
- [83] Kullgren, J.T., McLaughlin, C.G., Mitra, N. and Armstrong, K. (2011) Nonfinancial Barriers and Access to Care for U.S. Adults. *Health Services Research*, **47**, 462-485. <https://doi.org/10.1111/j.1475-6773.2011.01308.x>
- [84] Ozdalga, E., Ozdalga, A. and Ahuja, N. (2012) The Smartphone in Medicine: A Review of Current and Potential Use among Physicians and Students. *Journal of Medical Internet Research*, **14**, e128. <https://doi.org/10.2196/jmir.1994>
- [85] Mosa, A.S.M., Yoo, I. and Sheets, L. (2012) A Systematic Review of Healthcare Applications for Smartphones. *BMC Medical Informatics and Decision Making*, **12**, Article No. 67. <https://doi.org/10.1186/1472-6947-12-67>
- [86] Krishna, S., Boren, S.A. and Balas, E.A. (2009) Healthcare via Cell Phones: A Systematic Review. *Telemedicine and e-Health*, **15**, 231-240. <https://doi.org/10.1089/tmj.2008.0099>
- [87] Hammonds, T., Rickert, K., Goldstein, C., Gathright, E., Gilmore, S., Derflinger, B., *et al.* (2015) Adherence to Antidepressant Medications: A Randomized Controlled Trial of Medication Reminding in College Students. *Journal of American College Health*, **63**, 204-208. <https://doi.org/10.1080/07448481.2014.975716>
- [88] McKenzie, R.B., Berquist, W.E., Foley, M.A., *et al.* (2015) Text Messaging Improves Participation in Laboratory Testing in Adolescent Liver Transplant Patients. *Journal of Participatory Medicine*, **7**, e7.
- [89] Badawy, S.M., Barrera, L., Sinno, M.G., Kaviani, S., O'Dwyer, L.C. and Kuhns, L.M. (2017) Text Messaging and Mobile Phone Apps as Interventions to Improve Adherence in Adolescents with Chronic Health Conditions: A Systematic Review. *JMIR mHealth and uHealth*, **5**, e66. <https://doi.org/10.2196/mhealth.7798>
- [90] Horvath, T., Azman, H., Kennedy, G.E. and Rutherford, G.W. (2012) Mobile Phone Text Messaging for Promoting Adherence to Antiretroviral Therapy in Patients with HIV Infection. *Cochrane Database of Systematic Reviews*, **14**, CD009756. <https://doi.org/10.1002/14651858.cd009756>
- [91] Arya, M., Kallen, M.A., Street, R.L., Viswanath, K. and Giordano, T.P. (2014) African-

- American Patients' Preferences for a Health Center Campaign Promoting HIV Testing. *Journal of the International Association of Providers of AIDS Care (JIAPAC)*, **13**, 488-491. <https://doi.org/10.1177/2325957414529823>
- [92] Kharbanda, E.O. (2012) Effect of a Text Messaging Intervention on Influenza Vaccination in an Urban, Low-Income Pediatric and Adolescent Population: A Randomized Controlled Trial. *JAMA*, **307**, 1702-1708. <https://doi.org/10.1001/jama.2012.502>
- [93] Free, C., Knight, R., Robertson, S., Whittaker, R., Edwards, P., Zhou, W., *et al.* (2011) Smoking Cessation Support Delivered via Mobile Phone Text Messaging (txt2stop): A Single-Blind, Randomised Trial. *The Lancet*, **378**, 49-55. [https://doi.org/10.1016/s0140-6736\(11\)60701-0](https://doi.org/10.1016/s0140-6736(11)60701-0)
- [94] Evans, W.D., Abrams, L.C., Poropatich, R., Nielsen, P.E. and Wallace, J.L. (2012) Mobile Health Evaluation Methods: The Text4baby Case Study. *Journal of Health Communication*, **17**, 22-29. <https://doi.org/10.1080/10810730.2011.649157>
- [95] Isaković, M., Sedlar, U., Volk, M. and Bešter, J. (2016) Usability Pitfalls of Diabetes mHealth Apps for the Elderly. *Journal of Diabetes Research*, **2016**, Article ID: 1604609. <https://doi.org/10.1155/2016/1604609>
- [96] Dias, D. and Paulo Silva Cunha, J. (2018) Wearable Health Devices—Vital Sign Monitoring, Systems and Technologies. *Sensors*, **18**, Article 2414. <https://doi.org/10.3390/s18082414>
- [97] Di Rienzo, M., Rizzo, F., Parati, G., Brambilla, G., Ferratini, M. and Castiglioni, P. (2005). Magic System: A New Textile-Based Wearable Device for Biological Signal Monitoring. Applicability in Daily Life and Clinical Setting. 2005 *IEEE Engineering in Medicine and Biology 27th Annual Conference*, Shanghai, 17-18 January 2006, 7167-7169. <https://doi.org/10.1109/iembs.2005.1616161>
- [98] Hyun, C.S., Yoon, S., Kim, S., Lee, S. and McMenamin, J. (2017) Patient Navigator Facilitated Text Messaging Intervention Improves Linkage to Care in Viral Hepatitis B: A Pilot Study. *Journal of Mobile Technology in Medicine*, **6**, 11-18. <https://doi.org/10.7309/jmtm.6.2.2>
- [99] Hyun, C., McMenamin, J., Ko, O. and Kim, S. (2020) Efficacy of a Mobile Texting App (HepTalk) in Encouraging Patient Participation in Viral Hepatitis B Care: Development and Cohort Study. *JMIR mHealth and uHealth*, **8**, e15098. <https://doi.org/10.2196/15098>