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ORIGINAL PAPER

Hepatitis B Virus Screening and Vaccination in First-generation African Immigrants: A Pilot Study

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Abstract

Foreign-born African immigrants bear a large burden of hepatitis B virus (HBV)-related liver disease in the U.S. However, HBV awareness and knowledge of HBV screening and vaccination among this population is limited. This study aimed to provide a better understanding of HBV burden in this vulnerable population and to identify risk factors for the implementation of more effective prevention and treatment programs. We conducted a cross-sectional survey among 71 first-generation African Americans in New York City. Participants' sociodemographic characteristics, HBV screening and vaccination history, knowledge of HBV transmission, and other related issues were asked. The study sample included 46 men and 23 women, with an average age of 32.75. Of the sample, 87.50% participants migrated from sub-Saharan Africa and 79.10% had lived in the U.S. for 10 or fewer years. Almost half of participants never underwent HBV screening (44.29%) or HBV vaccination (49.23%). About two-thirds (60.87%) of participants never received any HBV screening or vaccination recommendation from doctors. Multivariable analysis results showed that having a college degree and being currently married were significantly associated with HBV screening, while having health insurance was significantly associated with HBV vaccination. Survey data further indicated that first-generation African immigrants had very limited knowledge of HBV transmission, suggesting that this population would benefit from greater awareness of HBV risk factors and modes of transmission. The influence of education, marriage and spousal support, and access to health insurance on HBV screening and vaccination should be noted and further examined in future public health interventions and research.

Keywords HBV · First-generation African immigrants · Screening · Vaccination · Liver cancer

Introduction

Worldwide, nearly 257 million people live with chronic hepatitis B virus (HBV) infection [1], which significantly increases risk of chronic hepatitis, cirrhosis, and hepatocellular carcinoma (HCC). Globally, these diseases account for 500,000 to 1.2 million deaths each year [2]. Morbidity and mortality from HBV are notably high in tropical and subtropical countries [3]. This is the case especially in many sub-Saharan countries, including Cameroon, Gabon, Namibia, Burkina Faso, and Nigeria, where HBV infection is considered hyperendemic. In these countries, about 8% of the general population are chronic carriers of hepatitis B surface antigen (HBsAg) [4].

Despite the fact that a vaccine against HBV has been available since 1982, HBV vaccine coverage remains low in Africa, estimated at 70% in 2012 [5]. In addition, the prevalence of African adults with chronic HBV infection is estimated at 5–10%. Due to the relatively low prevalence of the serum hepatitis B e-antigen (HBeAg) among Africans, HBV infection in Africa is thought to be acquired primarily in early childhood through horizontal transmission rather than through vertical transmission

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(mother-to-offspring), which is more common in regions such as Asia [6–9]. In response to ongoing HBV transmission in Africa, efforts have been made to improve HBV vaccine access. Indeed, funding from the Global Alliance for Vaccine and Immunization and assistance from the World Health Organization have played an important role in the implementation of HBV vaccination programs in Africa.

Since the 1960s, the rate of African-born immigrants arriving and staying in the U.S. has been increasing, owing to the establishment of legislative grounds and the growth of immigration networks and pathways [10]. There currently are 1.58 million African immigrants in the U.S., accounting for approximately 4% of the entire U.S. foreign-born population [10]. According to data from the U.S. Census 2009 American Community Survey, New York had the largest number of foreign-born African immigrants, hosting 168,426 individuals, equivalent to 11.3% of the African-born population in the U.S. [11].

Despite recent increases in the foreign-born African population in the U.S., knowledge of HBV burden, screening, and vaccination among African immigrants is notably limited [12]. In a review of studies in the past three decades, researchers reported that the prevalence of hepatitis B infection ranged from 9.1 to 11.8% among sub-Saharan African immigrants in the U.S. [13]. A more recent study of more than 900 African immigrants in New York City found that about 73.9% had been previously exposed to HBV and 9.6% had current, chronic, or long-term infections [14]. The situation of hepatitis B infection in this population was exacerbated by a relatively high poverty level, poor health insurance coverage, and, for men in particular, a reduced likelihood to act upon health concerns [14, 15]. The impacts of HBV infection on morbidity and mortality in the African immigrant population are potentially great, owing in particular to HBV-associated elevations in HCC and liver cancer risk [16–18]. Without knowledge of HBV screening and vaccination prevalence in this vulnerable yet understudied population [14, 19], interventional efforts and public health policies to raise awareness and promote screening and vaccination are severely handicapped.

An accurate estimation of the prevalence of HBV infection and screening and vaccination rates would provide a much-needed factual basis for public health campaigns and social policies. To the best of our knowledge, however, no studies have examined the screening and vaccination rates of foreign-born African immigrants in major city community settings. The goal of the present study was to assess HBV screening and vaccination prevalence, to identify predictors of these behaviors, and to generate implications for public health interventions to promote HBV screening and vaccination in African immigrants.

Method

Data Source

We conducted a cross-sectional survey among 71 first-generation African Americans in New York City in 2016. Survey questions were asked regarding participants' HBV infection status, screening and vaccination history, practice of infection monitoring and treatment, knowledge of HBV transmission, and perceived barriers to screening and proper monitoring. Each survey, consisting of 25 questions, took 15–20 min to administer to participants. Descriptive analyses, Chi square test, and student's *t* test were conducted to describe the study sample and to identify predictors of HBV screening and vaccination. Temple University Institutional Review Board (IRB) reviewed and exempted the study protocol. Informed consent was obtained from participants.

Measures

Participants were asked if they had ever heard about a screening test for hepatitis B or had received HBV screening and if they had ever heard about or had received an HBV vaccine. Participants who had not had a screening test were asked about the specific reasons why they had not undergone screening. Participants were also asked whether they had received a doctor's recommendation for HBV vaccination. We also measured participants' knowledge about the HBV status of family members and about ways in which HBV is transmitted. Four sociodemographic factors (age, gender, marital status, and educational attainment), two immigration-related factors (whether from sub-Saharan Africa and years lived in the U.S.), and two health-related factors (having any health insurance and having a regular physician) were also measured in the survey.

Statistical Analysis

We conducted univariate analysis to describe sample characteristics, the results of which are presented in Tables 1, 2. We conducted a Chi square test and a t-test to examine the association between each risk factor and HBV screening and between each risk factor and HBV vaccination (Tables 3, 5). We then ran binary logistic regression analysis to identify the risk factors of HBV screening and vaccination (Tables 4, 6). All analyses were conducted in Stata 14 [24].

Results

Descriptive statistics of sociodemographic, immigration, and health-related characteristics are presented in Table 1. Of the 70 participants, the average age was 32.75, with

Table 1 Sociodemographic, immigration, and health-related characteristics of first-generation African immigrants in New York City, 2016 (N = 70)

	n (%) or mean (sd)
Age (range 20–70)	32.75 (9.84)
Gender	
Female	23 (33.33%)
Male	46 (67.67%)
Marital status	
Currently married	26 (37.68%)
Not currently married	43 (62.32%)
Education	
< College	22 (31.43%)
≥ College	48 (68.57%)
From sub-Saharan Africa	
Yes	57 (87.50%)
No	8 (12.50%)
Years lived in US (range 0.08–38)	6.91 (6.45)
≤ 10 years	53 (79.10%)
> 10 years	14 (20.90%)
Having insurance	
Yes	43 (63.27%)
No	25 (36.76%)
Having regular physician	
Yes	37 (54.41%)
No	31 (45.59%)

Table 2 HBV screening and vaccination-related knowledge, attitude, and behaviors among first-generation African immigrants in New York City, 2016 (N = 70)

	n (%)
Ever heard of HBV screening	
Yes	55 (78.57%)
No	15 (21.43%)
Ever had HBV screening	
Yes	39 (55.71%)
No	31 (44.29%)
Major reasons stop you from getting HBV screening	
Afraid if I will be getting bad test results	4 (5.80%)
Haven't had any problems or symptoms	19 (27.14%)
Don't have a health insurance to cover the expense	10 (14.29%)
Doctor did not recommend me to get a HBV test	11 (15.71%)
Never heard about HBV screening test	9 (12.86%)
Too busy to have time to see a doctor	6 (8.70%)
Ever heard of HBV vaccine	
Yes	47 (71.21%)
No	19 (28.79%)
Doctor ever recommended HBV vaccine	
Yes	27 (39.13%)
No	42 (60.87%)
Ever had HBV vaccine	
Yes	33 (50.77%)
No	32 (49.23%)
Family members infected with HBV	
Yes	0
No	43 (61.43%)
Don't know	27 (38.57%)
How is HBV transmitted? (Choose all that apply)	
Sharing food plates with a Hepatitis B carrier	9 (12.68%)
Eating food prepared by a Hepatitis B carrier	7 (9.86%)
Sharing needles (ear piercing, tattooing)	40 (56.34%)
From mother to child during birth	29 (40.85%)
Sharing toothbrush	25 (35.31%)
Shaking hands with a Hepatitis B carrier	6 (8.45%)
Through sexual intercourse	52 (73.24%)

one-third (33.33%) being female. Less than 40% (37.68%) of participants were currently married, and more than two-thirds (68.57%) had a college or higher degree. Regarding immigration-related factors, the great majority (87.50%) of participants came from sub-Saharan Africa, and many (79.10%) had lived in the U.S. for fewer than 10 years. More than half of participants had health insurance (63.27%) and a regular physician (54.41%).

We also examined participants' knowledge, attitude, and behaviors related to HBV screening and vaccination, the results of which are presented in Table 2. Although 78.57% of participants had previously heard of HBV screening, only slightly more than half (55.71%) had received HBV screening. Among the reasons why participants did not receive screening, "not having any problems or symptoms," "doctors not recommending HBV test," and "not having insurance to cover the expense" were the top three. While 71.21% of the study sample had heard of HBV vaccine, only 39.13% of participants reported that their doctors had previously recommended HBV vaccination. Only half (50.77%) of participants had received HBV vaccine. Although no participants reported having family members with HBV infection, more than one-third (38.57%) said that they "did not know," indicating a lack of knowledge of HBV family history. In addition, while 73.24% of participants correctly identified "having sexual intercourse" as a mode of HBV transmission, only about half (56.34%) correctly identified "sharing needle." Even fewer participants correctly identified "mother-to-child during birth" (40.85%) and "sharing toothbrush" (30.85%) as other modes of transmission.

We conducted bivariate analysis between HBV screening and sociodemographic, immigration, and health-related factors (Table 3). Three factors, having a college degree, having health insurance, and having a regular physician, were significantly associated with HBV screening ($p < 0.05$), while older age, having lived in the U.S. for 10

Table 3 Bivariate analysis of association between HBV screening and sociodemographic and health-related factors (N = 70)

	Had HBV screening	No HBV screening	t (df), p-value Chi square (df), p-value
Age: n, mean (s.e.)	37, 31 (6.88)	30, 34.9 (12.36)	1.64 (65), p = 0.05
Gender			
Female	15 (65.22%)	8 (34.78%)	1.44 (1), p = 0.23
Male	23 (50.00%)	23 (50.00%)	
From sub-Saharan Africa			0.23 (1), p = 0.64
Yes	30 (53.57%)	26 (46.43%)	
No	5 (62.50%)	3 (37.50%)	
Years lived in U.S.			2.72 (1), p = 0.09
≤ 10 years	32 (60.38%)	21 (39.62%)	
> 10 years	5 (35.71%)	9 (64.29%)	
Had college degree			7.43 (1), p = 0.01
Yes	32 (66.67%)	16 (33.33%)	
No	7 (31.82%)	15 (68.18%)	
Currently married			2.74 (1), p = 0.09
Yes	18 (69.23%)	8 (30.77%)	
No	21 (48.84%)	22 (51.16%)	
Had health insurance			8.01 (1), p = 0.005
Yes	29 (67.44%)	14 (32.56%)	
No	8 (32.00%)	17 (68.00%)	
Had regular physician			8.23 (1), p = 0.004
Yes	26 (70.27%)	11 (29.73%)	
No	11 (35.48%)	20 (64.52%)	

Table 4 Results from logistic regression on HBV screening

	β (s.e.)
Age	−0.07 (0.04)†
Lived in U.S. > 10 years (vs. <= 10 yrs)	−1.62 (0.93)†
Had college degree (vs. not)	2.07 (0.80)**
Currently married (vs. not)	−2.24 (0.92)*
Had health insurance (vs. not)	1.53 (0.91)†
Had regular physician (vs. not)	1.06 (0.88)
Constant	1.58 (1.85)

Log-likelihood = −27.71

McFadden's R-square = 0.34

Likelihood-ratio test = 28.73, p < 0.001

†p < 0.10; *p < 0.05; **p < 0.01; ***p < 0.001

or fewer years, and being currently married were marginally significant (p < 0.10). Next, we included all six factors in multivariate logistic regression (Table 4). Having a college degree ($\beta = 2.07$, p < 0.01) and being currently married ($\beta = -2.24$, p < 0.05) were significantly associated with a higher likelihood of HBV screening. The effects of older age ($\beta = -0.07$), having lived in the U.S. for 10 or fewer years ($\beta = 1.62$), and having health insurance ($\beta = 2.07$) on HBV screening were only marginally significant (p < 0.10). Having a regular physician was not significantly associated with HBV screening. Together the six factors explained 34% of the variability in HBV screening.

We also conducted bivariate analysis between HBV vaccination and sociodemographic, immigration, and health-related factors (Table 5). Two factors, having health insurance and having a regular physician, were significantly associated with HBV screening (p < 0.01), while having lived in the U.S. for 10 or fewer years and having a college degree were marginally significant (p < 0.10). Next, we included all three factors in multivariate logistic regression (Table 6). Having health insurance ($\beta = 2.37$, p < 0.01) was significantly associated with HBV vaccination. The other two factors were not significant predictors. Together the three factors explained 25% of the variability in HBV vaccination.

Discussion

This study has five major findings. First, the rates of HBV screening and vaccination are low among first-generation African immigrants, with only half of participants reporting having received screening and vaccination. Given the high prevalence and incidence rate of hepatitis B in African immigrants in the U.S. [20, 21], it is a critical matter to increase screening rates in this population to identify those

Table 5 Bivariate analysis of association between HBV vaccination and sociodemographic and health-related factors (N = 65)

	Had HBV screening	No HBV screening	t (df), p-value Chi square (df), p-value
Age: n, mean (s.e.)	30, 32.43 (10.03)	32, 32.8 (9.23)	1.66 (60), p = 0.44
Gender			0.94 (1), p = 0.33
Female	13 (56.52%)	10 (43.48%)	
Male	18 (43.90%)	23 (56.10%)	
From sub-Saharan Africa			74 (1), p = 0.39
Yes	24 (46.15%)	28 (53.85%)	
No	5 (62.50%)	3 (37.50%)	
Years lived in U.S.			2.72 (1), p = 0.09
≤ 10 years	32 (60.38%)	21 (39.62%)	
> 10 years	5 (35.71%)	9 (64.29%)	
Had college degree			3.14 (1), p = 0.08
Yes	25 (56.82%)	19 (43.18%)	
No	7 (33.33%)	14 (66.67%)	
Currently married			.59 (1), p = 0.44
Yes	14 (56.00%)	11 (44.00%)	
No	21 (53.85%)	21 (53.85%)	
Had health insurance			17.36 (1), p < 0.001
Yes	27 (67.50%)	13 (32.50%)	
No	4 (16.67%)	120 (83.33%)	
Had regular physician			8.65 (1), p = 0.003
Yes	23 (65.71%)	12 (34.29%)	
No	8 (27.59%)	21 (72.41%)	

Table 6 Results from logistic regression on HBV vaccination

	β (s.e.)
Had college degree (vs. not)	0.96 (0.65)
Had health insurance (vs. not)	2.37 (0.83)**
Had regular physician (vs. not)	0.45 (0.73)
Constant	−2.63 (0.82)

Log-likelihood = −32.90

McFadden's R-square = 0.25

Likelihood-ratio test = 21.39, p < 0.001

†p < 0.10; *p < 0.05; **p < 0.01; ***p < 0.001

infected with HBV and, furthermore, to vaccinate susceptible contacts to prevent transmission [22]. Approximately one-quarter of participants had never heard to HBV screening or vaccination, which indicates a need for immediate efforts from public health professionals and local stakeholders to raise HBV screening and vaccination awareness in African immigrant communities.

Second, about two-thirds of participants reported having never received any recommendation for HBV screening or vaccination from their doctors, which suggests that public health campaigns should directly involve doctors in raising awareness of HBV risk and promoting screening and vaccination. Doctor recommendation has been found to significantly increase HBV screening and vaccination rates among other immigrant populations [23–25], yet its effect remains untested in African immigrant populations.

Third, participants' knowledge of HBV transmission was low, especially with regard to sharing needles, childbirth, and sharing a toothbrush as modes of transmission. This indicates an urgent need for educational efforts in African immigrant communities to increase knowledge and raise awareness of hepatitis B. Such efforts would further promote HBV screening and vaccination [26–28], especially among newly arrived immigrants [29].

Fourth, we found that having a college or higher degree and being currently married were significant predictors of having undergone HBV screening among African immigrants. Previous studies of Asian immigrants, another group at with high HBV prevalence, have found a positive effect of educational attainment [25, 30], which not only is linked to financial ability to access health services but also is a close indicator of health literacy, factors that are associated with HBV screening and vaccination behaviors [28, 31–33], as well as other cancer prevention behaviors [34, 35] in Asian American populations. These findings highlight the need for stronger educational efforts from public health professionals, healthcare providers, and social work efforts to raise awareness in high-risk, underserved minority populations. What is unique in our finding is the

positive effect of being currently married on HBV screening, which was not reported in previous HBV studies. Marriage has been found to be positively related to screening for colorectal cancer [36, 37], prostate cancer [38, 39], breast cancer [38, 40], and cervical cancer [38, 40]. Our finding indicates a similar protective effect of marriage on HBV screening, suggesting that educational efforts and other interventions should target unmarried individuals.

With regard to HBV vaccination, we identified having health insurance as the sole predictor, which is consistent with the existing literature [28, 41, 42]. This finding confirms the importance of health insurance in providing access to HBV vaccination. The fact that more than one-third of participants in this study lacked any health insurance speaks to the difficulties that individuals in African immigrant communities often face in accessing health care, which needs to be addressed by social policies and social welfare programs.

This study is not without limitations. We used a convenient community sample, and the size was limited, which means that our findings may not be relevant for the entire population of African immigrants in the U.S. A study to fully examine the prevalence and predictors of HBV screening and vaccination in first-generation African immigrants is needed. In particular, the effects of age and years lived in the U.S., on HBV screening and vaccination require further investigation, given that the two factors were marginally significant in our analysis. In addition, this pilot study lacks a comprehensive evaluation on participants' knowledge of HBV. A full examination of individual's knowledge of the prevalence, risk factors, symptoms, and consequences of hepatitis B infection is necessary to help guide the design of educational materials in public health campaigns.

Limitations notwithstanding, we are able to identify two predictors of HBV screening and one for vaccination, with both regression models (Table 4 and Table 6) carrying moderately high exploratory power (R-square > 20%). Our findings have important practical implications for public health campaigns and social policies and help shed light on future research efforts.

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Compliance with Ethical Standards

Conflict of interest The authors declare no conflict of interest.

References

1. World Health Organization. (2018, January 2). Hepatitis B. *WHO*. 2015. Retrieved April 7, 2017, from http://www.who.int/mediacentre/factsheets/fs204/en/
2. Geleijnse, J. M. (2015). Global, regional, and national age–sex specific all-cause and cause-specific mortality for 240 causes of death, 1990–2013. *The Lancet, 385*(9963), 117–171. https://doi.org/10.1016/S0140-6736(14)61682-2.
3. Center for Disease Control and Prevention. (2015). Hepatitis B Information | Division of Viral Hepatitis | CDC. Retrieved January 2, 2018, from https://www.cdc.gov/hepatitis/hbv/index.htm
4. Kramvis, A., & Kew, M. C. (2007). Epidemiology of hepatitis B virus in Africa, its genotypes and clinical associations of genotypes. *Hepatology Research, 37,* S9–S19. https://doi.org/10.1111/j.1872-034X.2007.00098.x.
5. Ladep, N. G., Lesi, O. A., Mark, P., Lemoine, M., Onyekwere, C., Afihene, M., et al. (2014). Problem of hepatocellular carcinoma in West Africa. *World Journal of Hepatology, 6*(11), 783–792. https://doi.org/10.4254/wjh.v6.i11.783.
6. Kiire, C. F. (1996). The epidemiology and prophylaxis of hepatitis B in sub-Saharan Africa: a view from tropical and subtropical Africa. *Gut, 38*(Suppl 2), S5–12. https://doi.org/10.1136/gut.38.Suppl_2.S5.
7. Kew, M. C. (1996). Progress towards the comprehensive control of hepatitis B in Africa: a view from South Africa. *Gut, 38*(Suppl 2), S31–S36. https://doi.org/10.1136/gut.38.Suppl_2.S31.
8. Nur, Y. A., Groen, J., Elmi, A. M., Ott, A., & Osterhaus, A. D. (2000). Prevalence of serum antibodies against bloodborne and sexually transmitted agents in selected groups in Somalia. *Epidemiology and Infection, 124*(1), 137–141. https://doi.org/10.1017/S0950268899003441.
9. Ott, J. J., Stevens, G. A., & Wiersma, S. T. (2012). The risk of perinatal hepatitis B virus transmission: hepatitis B e antigen (HBeAg) prevalence estimates for all world regions. *BMC Infectious Diseases, 12,* 131. https://doi.org/10.1186/1471-2334-12-131.
10. Gambino, C. P., Trevelyan, E. N., & Fitzwater, J. T. (2014). *The foreign-born population from Africa: 2008–2012. American Community Survey Briefs.* Washington, DC. Retrieved from https://www.census.gov/content/dam/Census/library/publications/2014/acs/acsbr12-16.pdf
11. McCabe, K. (2011). African Immigrants in the United States. *Migration Information Source*. Retrieved January 3, 2018, from http://www.sacausa.org/images/AfricanImmigrantsUSAMigrationInformation.pdf
12. Sriphanlop, P., Jandorf, L., Kairouz, C., Thelemaque, L., Shankar, H., & Perumalswami, P. (2014). Factors Related to Hepatitis B Screening among Africans in New York City. *Text.*. https://doi.org/10.5993/AJHB.38.5.12.
13. Rossi, C., Shrier, I., Marshall, L., Cnossen, S., Schwartzman, K., Klein, M. B., et al. (2012). Seroprevalence of chronic hepatitis B virus infection and prior immunity in immigrants and refugees: A systematic review and meta-analysis. *PLoS ONE, 7*(9), e44611. https://doi.org/10.1371/journal.pone.0044611.

14. Shankar, H., Blanas, D., Bichoupan, K., Ndiaye, D., Carmody, E., Martel-Laferriere, V., et al. (2016). A novel collaborative community-based hepatitis B screening and linkage to care program for african immigrants. *Clinical Infectious Diseases, 62,* 289–297. https://doi.org/10.1093/cid/ciw090.
15. Lucas, J. W., Barr-Anderson, D. J., & Kington, R. S. (2003). Health status, health insurance, and health care utilization patterns of immigrant black men. *American Journal of Public Health, 93*(10), 1740–1747. https://doi.org/10.2105/AJPH.93.10.1740.
16. El-Serag, H. B. (2012). Epidemiology of viral hepatitis and hepatocellular carcinoma. *Gastroenterology, 142*(6), 1264–1273.e1. https://doi.org/10.1053/j.gastro.2011.12.061.
17. Forde, K. A., Tanapanpanit, O., & Reddy, K. R. (2014). Hepatitis B and C in African Americans: Current status and continued challenges. *Clinical Gastroenterology and Hepatology, 12*(5), 738–748. https://doi.org/10.1016/j.cgh.2013.06.006.
18. Massoumi, H., Buchheit, K., Gunturu, S., Thlick, J.-E., & Gaglio, P. (2016). Clinical characteristics of chronic hepatitis B virus infection in immigrants from Sub-Saharan Africa. *Hepatitis Monthly*. https://doi.org/10.5812/hepatmon.41781.
19. Kukka, C. (2016, August 31). Advocates Raise Awareness About African Immigrants' High Risk of Hepatitis B. *Hepatitis B Foundation*. Retrieved from http://www.hepb.org/blog/advocates-raise-awareness-african-immigrants-high-risk-hepatitis-b/
20. Mitchell, T., Armstrong, G. L., Hu, D. J., Wasley, A., & Painter, J. A. (2011). The increasing burden of imported chronic hepatitis B — United States, 1974–2008. *PLoS ONE, 6*(12), e27717. https://doi.org/10.1371/journal.pone.0027717.
21. Kim, W. R., Benson, J. T., Therneau, T. M., Torgerson, H. A., Yawn, B. P., & Melton, L. J. (2004). Changing epidemiology of hepatitis B in a U.S. community. *Hepatology, 39*(3), 811–816. https://doi.org/10.1002/hep.20098.
22. Venters, H., & Gany, F. (2011). African immigrant health. *Journal of Immigrant and Minority Health, 13*(2), 333–344. https://doi.org/10.1007/s10903-009-9243-x.
23. Ma, G. X., Shive, S. S., Toubbeh, J., Wu, D., & Wang, P. (2006). Risk perceptions, barriers, and self-efficacy of hepatitis B screening and vaccination among Chinese immigrants. *International Electronic Journal of Health Education, 9,* 141–153.
24. Li, S., Sim, S.-C., Lee, L., Pollack, H. J., Wyatt, L. C., Trinh-Shevrin, C., et al. (2017). Hepatitis B screening & vaccination behaviors in a community-based sample of Chinese & Korean Americans in New York City. *American Journal of Health Behavior, 41*(2), 204–214. https://doi.org/10.5993/AJHB.41.2.12.
25. Cheng, S., Li, E., & Lok, A. S. (2017). Predictors and barriers to Hepatitis B screening in a Midwest Suburban Asian population. *Journal of Community Health, 42*(3), 533–543. https://doi.org/10.1007/s10900-016-0285-4.
26. Hu, K.-Q., Pan, C. Q., & Goodwin, D. (2011). Barriers to screening for Hepatitis B virus infection in Asian Americans. *Digestive Diseases and Sciences, 56*(11), 3163. https://doi.org/10.1007/s10620-011-1840-6.
27. Shiau, R., Bove, F., Henne, J., Zola, J., Fang, T., & Fernyak, S. (2011). Using survey results regarding hepatitis B knowledge, community awareness and testing behavior among Asians to improve the San Francisco Hep B free campaign. *Journal of Community Health, 37*(2), 350–364. https://doi.org/10.1007/s10900-011-9452-9.
28. Ma, G. X., Shive, S. E., Toubbeh, J. I., Tan, Y., & Wu, D. (2008). Knowledge, attitudes, and behaviors of Chinese hepatitis B screening and vaccination. *American Journal of Health Behavior, 32*(2), 178–187. https://doi.org/10.5993/AJHB.32.2.7.
29. Rossi, C., Schwartzman, K., Oxlade, O., Klein, M. B., & Greenaway, C. (2013). Hepatitis B screening and vaccination strategies for newly arrived adult Canadian immigrants and refugees: A cost-effectiveness analysis. *PLoS ONE, 8*(10), e78548. https://doi.org/10.1371/journal.pone.0078548.
30. Yau, A. H. L., Ford, J.-A., Kwan, P. W. C., Chan, J., Choo, Q., Lee, T. K., et al. (2016). Hepatitis B awareness and knowledge in Asian communities in British Columbia. *Canadian Journal of Gastroenterology and Hepatology.*. https://doi.org/10.1155/2016/4278724.
31. Ma, G. X., Lee, S., Wang, M., Tan, Y., Gao, W., Ma, X., et al. (2011). The role of sociocultural factors in hepatitis B screening among Asian Americans. *Southern Medical Journal, 104*(7), 466–472. https://doi.org/10.1097/SMJ.0b013e31821f8ab0.
32. Ma, G. X., Tan, Y., Wang, M. Q., Yuan, Y., & Chae, W. G. (2010). Hepatitis B screening compliance and non-compliance among Chinese, Koreans, Vietnamese and Cambodians. *Clinical Medicine Insights: Gastroenterology, 3,* 1–11.
33. Ma, G. X., Lee, M. M., Tan, Y., Hanlon, A. L., Feng, Z., Shireman, T. I., et al. (2018). Efficacy of a community-based participatory and multilevel intervention to enhance hepatitis B virus screening and vaccination in underserved Korean Americans. *Cancer*. https://doi.org/10.1002/cncr.31134.
34. Ma, G. X., Lee, M., Mayaan, B., Das, R., Feng, Z., Wang, M. Q., et al. (2018). Community-clinical linkage intervention to improve colorectal cancer screening among underserved Korean Americans. *Cancer Health Disparities, 1,* e1–e16. https://doi.org/10.9777/rr.2017.10005.
35. Maxwell, A. E., Taylor, V. M., & Bastani, R. (2016). Cancer Screening Among Asian Americans. In A. H. Wu (Ed.), *Cancer Epidemiology Among Asian Americans* (pp. 81–105). Cham: Springer. https://doi.org/10.1007/978-3-319-41118-7_4.
36. Van Jaarsveld, Cornelia H. M., Miles, Anne, Edwards, Rob, & Wardle, Jane. (2006). Marriage and cancer prevention: Does marital status and inviting both spouses together influence colorectal cancer screening participation? *Journal of Medical Screening, 13*(4), 172–176. https://doi.org/10.1177/096914130601300403.
37. Beydoun, H. A., & Beydoun, M. A. (2008). Predictors of colorectal cancer screening behaviors among average-risk older adults in the United States. *Cancer Causes and Control, 19*(4), 339–359. https://doi.org/10.1007/s10552-007-9100-y.
38. Blewett, L. A., Johnson, P. J., Lee, B., & Scal, P. B. (2008). When a usual source of care and usual provider matter: Adult prevention and screening services. *Journal of General Internal Medicine, 23*(9), 1354. https://doi.org/10.1007/s11606-008-0659-0.
39. Lehto, Rebecca H., Song, Lixin, Stein, Karen F., & Coleman-Burns, Patricia. (2010). Factors influencing prostate cancer screening in African American men. *Western Journal of Nursing Research, 32*(6), 779–793. https://doi.org/10.1177/0193945910361332.
40. Lee, H. Y., Ju, E., Vang, P. D., & Lundquist, M. (2010). Breast and cervical cancer screening disparity among Asian American Women: Does race/ethnicity matter? *Journal of Women's Health, 19*(10), 1877–1884. https://doi.org/10.1089/jwh.2009.1783.
41. Middleman, A. B. (2004). Race/ethnicity and gender disparities in the utilization of a school-based hepatitis B immunization initiative. *Journal of Adolescent Health, 34*(5), 414–419. https://doi.org/10.1016/j.jadohealth.2003.08.009.
42. Lu, P., Byrd, K. K., Murphy, T. V., & Weinbaum, C. (2011). Hepatitis B vaccination coverage among high-risk adults 18–49 years U. *Vaccine, 29*(40), 7049–7057. https://doi.org/10.1016/j.vaccine.2011.07.030.