National Task Force on Hepatitis B

www.hepbtaskforce.org

Meeting Notes

Date: Wednesday, September 7, 2022 (every 1st Wednesday of the month)
Time: 3PM ET / 2PM CT / 1PM MT / 12PM PT / 10 AM Hawaii
Email: administrator@hepbtaskforce.org

Zoom Meeting registration link: https://us02web.zoom.us/meeting/register/tZwkcumtrTwqE9RKoJ1dyu9n7DUuTWD6mSvf

Attendance (at or after 3:05PM) are as follows:

Executive Board Members (Officers):

☒ **Co-Chair: Carol Brosgart, MD** (San Franscisco, CA)
☒ **Co-Chair: Richard So, MPH,** Executive Director, SF Hep B Free – Bay Area (San Francisco, CA)
☒ **Secretary: Catherine Freeland, MPH**, Public Health Program Director, Hepatitis B Foundation (Doylestown, PA)
☒ **Administrator** (and notetaker)**: Amy Trang, PhD, MEd,** Founder and CEO, Social Capital Solutions (Chantilly, VA)

Regional Directors:

☐ **Northeast Regional Director: Ruth Brogden, MPH,** Grants Manager, Center for Asian Health at Saint Barnabas Medical Center (Livingston, NJ)
☐ **Mid-Atlantic Regional Director: Kate Lu, MSW, LCSW-C,** Clinic Director, CCACC-Pan Asian Volunteer Health Clinic (Gaithersburg, MD)
☐ **Southeast Regional Director: Christina Meyers, MPH,** ORISE Fellow, CDC Division of Overdose Prevention (Atlanta, GA)
☐ **Midwest Regional Director: Oyu Tumurtuya, PharmD,** Founder & President, Mongolian Community Health Network (Chicago, IL)
☐ **South Midwest Regional Director: Stephen Fakoyejo, MD, MPH** Medical Resident, HCA Houston Healthcare West (Houston, TX)
☒ **Western Regional Director: Thaddeus Pham,** Viral Hepatitis Prevention Coordinator, Hawaii State Department of Health (Honolulu, HI)

Student Representation

☐ **Sandra Kong**, Medical Student at Johns Hopkins University (Baltimore, MD)

Board Advisors:

☒ Richard Andrews, MD, MPH, Board Advisor (Houston, TX)
☐ Moon Chen, PHD, MPH, Board Advisor; one of the original founders of the Task Force in 1997 (UC Davis; Sacramento, CA)
☐ Chari Cohen, DrPH, MPH, Board Advisor (Hep B Foundation; Doylestown, PA)
☒ Robert Gish, MD, Board Advisor (Robert G. Gish Consultants; San Diego, CA)
☒ Lu-yu Hwang, MD, Board Advisory (Department of Epidemiology, University of Texas HSC; Houston, TX)
☐ Karen Jiobu, Board Advisor (Asian American Community Services; Columbus, OH)
☐ Amy Tang, MD, Board Advisor (North East Medical Services; San Francisco, CA)

General Members (open to all on listserv; please excuse any typos)**: Total Number of attendees: 18**

- ✓ Renee St. Vrain, Perinatal Hepatitis B Nurse Manager, City of St. Louis Department of Health (St. Louis, MO)
- ✓ Kendra Pelz, PharmD, Syneos Health/VBI Vaccines (Kansas City, MO)
- ✓ Jacki Chen, PhD (NJ)
- ✓ Mutasem Shopon, Health Program Coordinator, CPACS (Atlanta, GA)
- ✓ Maggi Li, Hepatitis B Program Coordinator, MAHA (Chicago, IL)
- ✓ Stephanie Campbell, Dynavax
- ✓ Soo Yee, KAOG / HBI-DC (Washington, DC)
- ✓ Umaima Khatun, Program Manager, NYC Health Department (New York, NY)
- ✓ Binh Tran, PharmD, APHF and Hep B Free LA (Los Angeles, CA)
- ✓ Patricia Cerrato, Program Manager, Santa Clara County Health Department (Santa Clara, CA)

Note: There may be some members missing from this list of attendees; please excuse any omission.

Agenda:

1) Welcome Task Force members
2) Note any changes to previous meeting's notes
3) Project updates:
    a. HBV universal vaccination guidance promotion among providers
    b. HBV ECHO program expansion
    c. HBV workforce development projects
    d. HBV elimination plan best practices among state Viral Hepatitis Coordinators
    e. HBV work group on updating screening guidance
    f. Upcoming trainings or resources
4) Action Plan discussion: Next steps?
    a. Promoting and implementing AB7889 in California
5) Regional Updates (all Regional Directors)
    a. Term limits / renewals
6) Other items (all members)

Meeting format:

- strategic discussions and resource sharing to assist members with their local work

Notes:

1) Welcome: Introduction / Roll Call of Officers and Regional Directors (Amy Trang)

    a) Opening remarks made by Richard So and Catherine Freeland
    b) Members were asked to introduce themselves in the chat box
    c) Recognize any new members on the call: see list of attendees above

2) Note any changes to previous meeting's notes: none; no meetings were held in July or August.

3) Project Updates

    a) HBV universal vaccination guidance promotion among providers (Catherine Freeland)
        i) Hepatitis B Foundation has released a toolkit on vaccine uptake: Hepatitis B Foundation: Hepatitis B Vaccination (hepb.org)
            (1) Continuing to have meetings at the national level on ways to implement the universal vaccination guidelines
            (2) Discussion has been around continuing to implement vaccination guidelines and include / incorporate the new universal screening guidelines (updates anticipated for this October to early next year)
    b) HBV ECHO program expansion (Thaddeus Pham)
        i) Hawaii HBV ECHO launched on August 22, 2022.
            (a) 16-week pilot program
            (b) Every Monday from 12PM -1:15PM Hawaii Time, which is 6PM-7PM Eastern Time
            (c) Two sessions have already been held (skipped Labor Day)
            (d) About 30-35 attendees with great cases presented so far; includes primary care providers, pharmacists, nurse practitioners, and hepatologists; also includes individuals from continental US as well as Pacific Islander neighbors.

(e) Dr. Saltman has been assisting with this program.
(f) Looking into having patients pre-record their case and present it to the group ; want to share patient perspective; there are patients on the planning committee
(g) Positive feedback and review by Dr. Brosgart and Richard So.

ii) The San Francisco HBV ECHO hub will be taking a break after its last session for this year in November to regroup and plan for future activities.

iii) Dr. Andrews commented that participating in a combined HCV/HBV ECHO may help address the participation numbers as well as expand knowledge for providers.
(1) Amy will be collecting and sharing more viral hepatitis ECHO programs since some HCV ECHO groups are now including HBV in their sessions, including: the University of Washington (Seattle, WA) and Alaska.

c) HBV workforce development projects (Amy Trang)

i) Amy shared that HBI has been working with pre-med, med students, and public health students from George Washington University (GW), Georgetown University, George Mason University, Johns Hopkins University, and University of Maryland (all in the DC-Baltimore metropolitan region) to provide volunteer activities for free community health screenings/testing; this includes APAMSA and/or TeamHVB members.
(1) About 7 have been trained this past summer and 3 more will be trained this week.
(2) HBI's intention is to create "how to" prepare for community-based screenings/testing training video clips to share on its website.
(3) HBI has implemented a policy to have volunteers trained before assisting at screening / testing events.
(4) Catherine also shared that HBU also has a "how to screen" guide that could be accessed here: http://www.hepbunited.org/assets/pdfs/dc167e14e9/Community-based-screening-guide.pdf.

d) HBV elimination plan best practices among state Viral Hepatitis Coordinators: no new updates

i) Review the Hep ElimiNATION website for a National Evaluation of State's Capacity for Viral Hepatitis Elimination: Together We Can Eliminate Hepatitis by 2030 | Eliminate Hep. See how your state compares with others.

e) HBV work group on updating screening guidance (Amy Trang)

i) HBV universal screening guidelines from CDC are anticipated to be published soon.

ii) August 2, 2022: A few Task Force members who were also part of Hep B United's National Advisory Committee attended the White House Initiative on AA & NHPIs meeting "to address elimination of hepatitis B inequalities among AA and NH/PI communities. The purpose of the meeting was to share the hepatitis B community's federal policy priorities:

- Access to hepatitis B preventive services including screening and vaccination
- Address hepatitis B-related discrimination in the military and among healthcare students and workers
- Access to affordable hepatitis B treatments
- Investment in hepatitis B and liver cancer research and culturally competent community-based prevention programs

iii) September 1, 2022: The Task Force in collaboration with Hepatitis B Foundation had the first "treatment expansion" workgroup meeting last Thursday; it's the first of the 2-day (3 hour) meeting. The next meeting is next Thursday (9/15). There are about 40 individuals involved in this workgroup, including: Dr. Carol Brosgart, Dr. Robert Gish, Dr. Richard Andrews, Dr. Amy Tang, Dr. Jacki Chen, and Dr. Amy Trang.
(1) Dr. Gish shared that the "KOL how to simply guidelines" workgroup's purpose to simplify the complicated guidelines that are currently a barrier to providers.
(a) The guidelines should be super simple, i.e., test everyone, check DNA (if positive, address surveillance and follow-up lab tests to see who needs liver cancer surveillance; if negative, vaccinate), etc.

(b) The intention is to put together a 1-page document with an Appendix for further reference, which should take into consideration various methods of transmission, cultural barriers, and stigma.

(2) Kendra asked a follow-up question regarding individuals involved in the workgroup, "Are there PCPs involved?"
   (a) Not just PCPs, but also pharmacists, patients, and PAs.
   (b) Not just in the US, but also issue experts globally; therefore, there's a global perspective, the patient perspective, and the medical provider perspective as well.

(3) Dr. Brogart also added that another purpose was also to consider situations where you meet the patient, you test, and you give the first vaccine. If the patient tests negative, you proceed with the vaccination series.

(4) Dr. Gish emphasized focus on the "triple panel" (surface antigen, core antibody, and surface antibody); they should only get vaccine if they're triple negative bullet. He clarified that Dr. Brogart was describing the "incident to vaccination" strategy, which is what some people are doing so that they don't lose the opportunity to vaccinate adults who have time constraints; this is an option for clinic settings and other cost considerations.

(5) Catherine shared that in Philly, they are doing community-based screenings and offering the first dose of vaccination with the screening.

(6) Amy Trang mentioned the cultural consideration, especially at community screening events, is that community members may not want to get their first dose of vaccination unless they know for sure that they need it.
   (a) Referencing the COVID-19 vaccination outreach projects that GW and HBI has been involved in doing for the DC, MD, and VA area, there's definitely vaccine hesitancy among the target population serviced, i.e., limited English proficient, low/no income, uninsured/underinsured population.
   (b) There's more room for education i.e., provider and patient.

iv) Other support service explored:

(1) Warmline.
   (a) Over the summer, Dr. Richard Andrews initiated a meeting with the National Clinician Consultation Center (NCCC) to discuss adding hepatitis B to their program as a resource for clinicians who may need it, especially as we anticipate the universal screening guidelines to be published soon.
   (b) Dr. Andrews clarified that this a project that is moving forward, but may take a while because funding and support needs to be identified as well as developing a protocol at the "Warmline" that would be established to handle calls for HBV.
   (c) Dr. Chari Cohen, Dr. Gish, and Dr. Amy Trang attended the last meeting (last week) with Dr. Chris Bositis (UCSF / NCCC) to identify possible funding streams (not pharma).

(2) Action Group for HBV rapid testing.
   (a) Dr. Gish also shared that the "KOL" workgroup discussed working with the FDA to lower barriers for HBV rapid test approval.
      (i) Advocating for FDA to consider Class 2 instead of Class 3 because of the cost involved in testing the product.
      (ii) Also includes providing FDA with more information about HBV in general, i.e., current research studies, medication, treatment, etc.
      (iii) Dr. Gish also mentioned that there is a product on the market that has not gotten FDA approval that could test for HBV, HCV, and HIV; there's a lot development out there.
      (iv) More updates will be provided as we progress.
   (b) Amy added that having HBV rapid testing would definitely be a game changer for those who are doing in-community health screening / testing among vulnerable populations that don't have the resources to go to clinics or private providers. Reference HCV and HIV rapid tests as best practices and cost effective.
   (c) Dr. Brosgart recognized the challenges of the FDA process and the need to speak to the leadership at FDA to further the discussion. She commented that having a test that can do all three types of chronic infectious disease testing could reduce stigma around disease specific testing.

(d) Dr. Lu-yu Hwang commented that rapid tests has been very helpful, but are only allowed for research use; it's very convenient and should be used in the US. Dr. Hwang will share some of her research at end of the notes.

f) Upcoming trainings or resources (Amy Trang)
   i) None to share this month.

4) Action Plan discussion: Next steps?
   a) Richard So would like to continue to get help in promoting and implementing AB7889 in California.
      i) The goal is to help AB 7889 get implemented.
      ii) The challenge is that there's not state funding provided and penalties cannot be enforced if the recommendation is not adhered.
      iii) Per last meeting, we need help in connecting to primary care groups throughout the state of California. If you have connections to these groups, please help promote this; perhaps in a presentation to the group about AB7889 and what the recommendation is.
      iv) We need help making personal contacts with individual providers, medical societies in California, i.e.. Chinese Medical Association, Korean Medical Association, Vietnamese Medical Association, etc.
      v) Of note, Stanford University is involved in looking at the qualitative and quantitative study on the implementation of HBV screening; published research expected for the beginning of next year.
      vi) Per Dr. Andrews and Dr. Brosgart's suggestion at the last meeting, the Task Force should draft a templated letter signed by the co-Chairs that could be sent to the different medical societies / associations. Richard So will draft something that we could review (possibly at next meeting).
      vii) Amy suggested considering Dr. Brosgart's suggestion from the last meeting of putting together a framework / outline of slides that could be used as a resource for members to introduce our initiatives using a "Grand Rounds" model to build community trust. Amy can assist if needed.
      viii) Dr. Brosgart also suggested presenting the HBV guidelines in reference past recommendations and current recommendations so that providers are clear that there has been changes suggested by CDC.

5) The National Task Force on Hepatitis B is independent from the state and local Task Forces or coalitions. Everyone is welcome to join the National Task Force on Hepatitis B by registering through our website. Newsletter - The National Task Force on Hepatitis B (hepbtaskforce.org)
   a) Register for meetings in 2022: https://us02web.zoom.us/meeting/register/tZwkcumtrTwqE9RKoJ1dyu9n7DUuTWD6mSvf
   b) Promotion of the National Task Force on Hepatitis B is primarily through "word-of-mouth."

6) Term limits:
   a) Richard So will be renewing his term (January 1, 2023 – December 31, 2024) and continue to work alongside Dr. Carol Brogart who's term just started this year (January 1, 2022 – December 31, 2023).
   b) Regional Directors' terms that expire include:
      i) Student Representative
      ii) Midwest Region
      iii) South Midwest Region
      iv) Northeast Region
      v) Mid-Atlantic Region

vi) Southeast Region

c) Regional Directors' terms that are renewable (January 1, 2023 – December 31, 2024) include:
   i) Western Region

d) Based on our strategic plan (HepBTaskForce-StrategicPlan2021-2023-FINAL-04072021.pdf), we will also be renaming some regions to reflect the different time zones:
   i) Mid-Atlantic and Southeast will be combined and called Southeast (DE, MD, DC, VA, WV, KY, TN, NC, SC, GA, FL)
   ii) North Mid-west will be called North Central (IL, WI, MN, IA, NE, SD, ND)
   iii) South Mid-west will be called South Central (KS, MO, OK, AR, TX, LA, AL, MS)
   iv) Northwest and Southwest are now called Western, which includes Pacific and Mountain time zones (CA, NV, UT, AZ, CO, NM, HI, WA, OR, ID, MT, WY, AK).

e) Please begin to nominate and self-nominate to fill these positions.
   i) Submit a short bio and headshot photo to share
   ii) Email: administrator@hepbtaskforce.org

7) Regional Updates
   a) Student Representative (Sandra Kong): provided above in Workforce Development project discussion.
   b) Western Region (Thaddeus Pham):
      i) SF Hep B Free will be getting some funding from SFDPH for general HBV programming
         (1) 2 new events implement this past summer included a charity run for $2,500 (5 runners) and happy hour and mini press conference for World Hepatitis Day
         (2) Looking forward to upcoming community events, despite challenges amidst COVID
         (3) Focus on AB 7889
         (4) New employee hired from Pacific Islander community
      ii) APHF updates:
         (1) Liver Coalition of San Diego will be having an upcoming Liver Walk; offered APHF an opportunity to raise and keep funds for their health screening activities
         (2) Leadership group (comprised of rising young leaders) came up with a way to incentivize "Train the trainer" program, i.e., tracing the trainers and the number of individuals that they have trained
         (3) Abstract will be presented at the upcoming US HIV/AIDS conference in Puerto Rico October 8 – 10, 2022.
         (4) additional updates shared via email (at end of notes)
      iii) Hawaii is finalizing their hepatitis B mortality report to show the burden of hep B mortality on Hawaii using CDC wonder data (very available data); the intention is to justify increasing hep B activities
   c) Midwest Region (Oyu Tumurtuya):
      i) MAHA continuing to offer free outreach, education, screening to patients; recently received free liver cancer screening kits from pharmaceutical company and have been using them to screen patients
   d) South Midwest Region (Stephen Fakoyejo): no new updates
   e) Northeast Region (Ruth Brogden):
      i) NYC Health Department updates:
         (1) anticipates releasing the 2021 annual report, which includes NY's HBV and HCV data as well as programmatic, capacity building, and training activities.
         (2) The team has been activated to also address Monkeypox.
         (3) Joint symposium conference with NY State Department of Health is underway for early 2023.
         (4) Partnering with NASTAD to do a coalition building elimination toolkit to be released in October, but no firm date yet.
   f) Mid-Atlantic Region (Kate Lu): no new updates
   g) Southeast Region (Christina Meyers):
      i) CPACS is continuing community outreach and looking to extend those opportunities as they plan for future health fairs; unfortunately, they were not able to leverage the COVID-19 vaccination outreach project to screen / test for HBV.

8) Other items: (not discussed in the meeting)

a) All The National Task Force on Hepatitis B are currently on a voluntary basis by all members. There are currently no funds to support any particular projects. This has actually allowed the Task Force to explore ways to participate and support other ongoing projects among the hepatitis B networks.

Meeting adjourned at 4:00PM Eastern Time.

- Next Hep B Task Force Zoom meeting date: **Wednesday, October 5, 2022 at 3PM Eastern Time** /2PM Central/ 1PM Mountain/ 12PM Pacific / 10 AM Hawaii (1st Wednesday of each month).
  - Other dates in 2022: Nov 2, Dec 7
- Suggestions for the next agenda:

  i) Follow-up on Action Plan discussed and progress of provider outreach efforts.

  ii) Review nominations for Regional Directors and Student Representative for the next 2-years.

Upcoming HBV ECHO sessions: Free CME

West Coast (SF Hep B Free Bay Area): Hepatitis B ECHO Program (sfhepbfree.org)
- Every 3rd Tuesday of the month
  - 2022: Sep 20, Oct 18, Nov 15
- 12:30PM – 1:30PM PDT / 3:30PM – 4:30PM EDT / 9:30AM – 10:30AM HST
- To register, email: ECHO@sfhepbfree-bayarea.org

Gulf Coast (Texas Heart Institute with Baylor St. Luke Medical Center): Project ECHO Interest Form (bcm.edu)
- Every 3rd Wednesday of the month
  - 2022: Sep 21, Oct 19, Nov 16
- 12:00PM to 1:00PM Central Time
- To register: Project ECHO Interest Form (bcm.edu)

East Coast (Hep B United Philadelphia): Hepatitis B ECHO Meeting Registration - Zoom
- Every 4th Thursday of the month
  - 2022: Sep 22, Oct 27
- 12:00PM – 1:00PM Eastern Time
- To register: Meeting Registration - Zoom

Other ECHO programs with HBV:
- The University of Washington Project ECHO Viral Hepatitis meets every Tuesday, 12 – 1:30 PM Pacific Time.
- To discuss if this ECHO program would be a good fit or if other training or consult options would better suit your interests/schedules, please email Pam Landinez, landinez@uw.edu.
- The sessions are geared towards individuals in the state of Washington and focus on hepatitis B or C is driven by the program participants.

Items shared via email:

Please see details of updates from APHF:

1. The San Diego Liver Walk is a fundraising event for Asian Pacific Health Foundation and the Liver Coalition of San Diego on October 1, 2022. It is an in-person and virtual event starting with a health fair from 7 am and walk through 7 bridges around Balboa Park in San Diego. APHF goal is to raise $20,000 to purchase a new bone densitometer to be used for osteoporosis screening in the community.

Please join the SD Liver Walk by clicking on
SD Liver Walk - APHF Team Donation Page

2. APHF is piloting a new program through the development of the *Community Education Mapping web application*. This application will allow APHF to disseminate Hepatitis B health information and track the spread of this information throughout various communities. We are conducting a testing phase of this application, and the abstract of the work will be presented by Andrew Pham and Winnie Gong at the US Conference on HIV and AIDS- Hepatitis Pathway in Puerto Rico on October 8-10, 2022.

MAJOR ARTICLE

Accelerated Hepatitis B Vaccination Schedule among Drug Users: A Randomized Controlled Trial

Lu-Yu Hwang,[1] Carolyn Z. Grimes,[1] Thanh Quoc Tran,[1] April Clark,[1] Rui Xia,[2] Dejian Lai,[2] Catherine Troisi,[1] and Mark Williams[3]

[1]Center for Infectious Diseases, Division of Epidemiology and Disease Control, [2]Division of Biostatistics, and [3]Center for Health Promotion and Prevention Research, Division of Health Promotion and Behavioral Sciences, School of Public Health, University of Texas Health Science Center at Houston, Houston, Texas

Background. Hepatitis B vaccine provides a model for improving uptake and completion of multidose vaccinations in the drug-using community.

Methods. The Drugs, AIDS, STDs, and Hepatitis (DASH) project conducted a randomized controlled trial among not-in-treatment current drug users in 2 urban neighborhoods. Neighborhoods were cluster-randomized to receive a standard behavioral intervention (which provided information on human immunodeficiency virus [HIV]) or an enhanced behavioral intervention (designed to increase acceptance of or adherence to the hepatitis B vaccination protocol). Participants within clusters were randomized to a standard vaccination schedule (vaccines at 0, 1, and 6 months) or an accelerated vaccination schedule (vaccines at 0, 1, and 2 months). The outcomes were completion of the 3-dose vaccine and seroprotection against hepatitis B virus (HBV).

Results. Of participants with negative screening results for HIV and HBV, 77% accepted hepatitis B vaccination, and 75% of vaccinees received all 3 doses. Injection drug users (IDUs) on the accelerated schedule were significantly more likely to receive 3 doses (76%) than those on the standard schedule (66%; $P = .04$), although for drug users as a whole the corresponding adherence rates were 77% and 73%, respectively. No difference in adherence was observed between the behavioral intervention groups. Predictors of adherence were older age, African American race, stable housing, and alcohol use. Cumulative HBV seroprotection ($\geqslant$10 mIU/mL) was gained within 12 months by 65% of those completing the schedule. Seroprotection at 6 months was greater for those on the accelerated schedule.

Conclusion. The accelerated vaccination schedule improves hepatitis B vaccination adherence among IDUs.

Hepatitis B is one of the most frequently reported preventable diseases in the United States, with 43,000 new infections annually [1–3]. The most frequently reported risk factors for contracting hepatitis B virus (HBV) infection are multiple heterosexual sex partners, male-to-male sex, and injection drug use. Individuals with at least 1 of these risk factors make up 75% of new HBV infections [4]. At least 20% of HBV infections occur in injection drug users (IDUs) [5, 6]. HBV infection, which is preventable with vaccination, may result in persistent lifelong infection. The asymptomatic nature of chronic hepatitis B presents a public health threat because of its highly infectious nature. Long-term health consequences can develop in 15%–40% of chronically infected individuals, including cirrhosis, liver failure, and hepatocellular carcinoma [7]. Because the risk of developing clinical hepatitis after acute infection is greater in adults, vaccination will prevent more cases of clinical hepatitis and reduce future health care costs [8].

Immunization strategies in the United States that target health care workers, high-risk adults, and infants or children have been instrumental in reducing the overall transmission and incidence of hepatitis B. However, drug users have immunization rates that are among the lowest in the nation [9, 10] and a continued high prevalence of HBV infection and chronic carrier status [4, 11–14]. We began the Drugs, AIDS, STDs,

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Potential conflicts of interest: none reported.

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and Hepatitis (DASH) project to target drug users for AIDS, sexually transmitted diseases (STDs), and hepatitis prevention research [15].

Effective hepatitis B vaccination in drug users requires their adherence to a multidose vaccination schedule, which is needed for an adequate immune response to the vaccine. Few studies have focused on the behaviors that may affect vaccine acceptance and adherence among drug users. Instead, vaccination programs have sought to identify better ways to administer all 3 doses of the vaccine [16, 17], without addressing the behaviors and behavioral cognitions (eg, attitudes toward vaccines) that could contribute to nonacceptance of or nonadherence to the hepatitis B vaccination schedule [18–20].

An individual's immune response to a multidose vaccine may be compromised by characteristics or behaviors specific to drug-using populations; identification of these factors is necessary to design effective vaccination initiatives. Research reported elsewhere indicates that altering hepatitis B vaccination schedules may increase adherence and may also elicit an earlier adequate protective immune response [21, 22]. Little is known of the durability of immune protection in drug users with shorter vaccination protocols.

HBV and hepatitis C virus (HCV) infections were endemic among IDUs even before human immunodeficiency virus (HIV). Common risk factors for infection with these bloodborne viral agents, such as multiperson use of injecting equipment and risky sexual behaviors, have resulted in a high prevalence of infection with all 3 viruses among drug users. However, a significant proportion of this population remains at risk for these infections and should be targeted for vaccination [15, 23]. The objective of this study was to evaluate a hepatitis B vaccination program as a model for future HIV or hepatitis C vaccine efficacy trials in drug-using populations. Two components were analyzed to determine their effects on adherence to 3-dose vaccination schedules: a behavioral intervention and an accelerated vaccination schedule. The latter was also evaluated to see whether it had any significant effect on immune response.

METHODS

Study design and population. A randomized controlled trial was conducted among not-in-treatment current drug users in urban neighborhoods in Houston, Texas. This study was approved by the appropriate institutional review board and followed US Department of Health and Human Services human experimentation guidelines.

From February 2004 through October 2007, we screened 2827 not-in-treatment drug users for HIV, HBV, and HCV infections. Study participants were recruited by outreach workers and chain-referral methods from drug distribution areas, street corners, and crack houses in 2 neighborhoods. All screening took place at a designated community field site. Eligibility criteria were (1) age $\geqslant$18 years, (2) local residence with valid contact information for follow-up, (3) self-report of illicit drug use (eg, cocaine, heroin, methamphetamine, and/or marijuana) in the 48 h before screening, and (4) willingness and competency to give informed consent. Drug use was confirmed by urine screening by use of the OnTrak TesTstik (Varian).

After the participant underwent verbal screening and gave informed consent, a medical assistant or nurse obtained a 10-mL blood sample for the preliminary susceptibility screening test, the Core Combo HIV-HBsAg-HCV rapid test (Core Diagnostics), to detect antibodies to hepatitis B surface antigen (HBsAg), HIV types 1 and 2 (anti-HIV), and HCV (anti-HCV). If the blood sample was negative for both HIV and HBsAg, it underwent testing for antibody to HBsAg (anti-HBs) with microparticle enzyme immunoassay (AxSYM; Abbott Laboratories). Screened participants who tested negative for HBsAg, anti-HIV, and anti-HBs were qualified for enrollment into the randomized acceptance-adherence study. The hepatitis B core antibody (anti-HBc) was not tested at screening, because a positive anti-HBc test result alone does not indicate protective immunity, and it was deemed ethically necessary to revaccinate participants with such results. Those whose blood tested positive for anti-HBc were excluded from the immune response subgroup analysis.

Enhanced behavioral intervention and accelerated vaccination schedule. Randomization of the enhanced and standard behavioral interventions occurred at the neighborhood level. Study participants enrolled in odd-numbered months received the hepatitis B vaccine (Engerix B; 20 μg/mL; GlaxoSmithKline) on the standard schedule of 0, 1, and 6 months. Participants enrolled in even-numbered months were vaccinated on the accelerated schedule of 0, 1, and 2 months.

The hepatitis B vaccination behavioral intervention of 4 sessions, each 15–20 min, was based on brief self-efficacy interventions previously developed for community-based HIV prevention programs [24]. The purpose was to increase drug users' acceptance of and adherence to hepatitis B vaccine protocols by increasing self-efficacy, positive outcome expectations, perceived peer group support, and the value attached to hepatitis B vaccination. The intervention provided accurate and salient information about HBV and hepatitis B vaccination and the benefits that could be gained and the losses avoided by being tested and vaccinated for HBV, vicarious experience (discussion, stories, modeling, and graduated mastery learning processes), verbal persuasion by peer outreach workers, and positive emotional arousal. Sessions 1 and 2 were delivered at screening and enrollment, after written informed consent was obtained, and session 3 was delivered at the visit at 1 month (second vaccine dose). On the accelerated schedule, session 4 was delivered before the third dose of vaccine at 6 weeks, with the last dose given at a visit at 2 months. On the standard

schedule, session 4 was delivered before the third dose of vaccine at 2 months, with the last dose given at 6 months. The standard behavioral intervention, given at the same times, delivered information on HIV awareness and prevention that was provided by the National Institute on Drug Abuse [25].

Enrollment and follow-up. Study participants were enrolled into 1 of 4 arms: standard behavioral intervention with standard vaccination schedule (vaccines at 0, 1, and 6 months), enhanced behavioral intervention with standard vaccination schedule, standard behavioral intervention with accelerated vaccination schedule (vaccines at 0, 1, and 2 months), and enhanced behavioral intervention with accelerated vaccination schedule (Figure 1). Those who were eligible (on the basis of blood screening results and acceptance of hepatitis B vaccination) were further enrolled in a substudy, with separate consent, for follow-up to track vaccine adherence efficacy and durability. After enrollment, these substudy participants underwent follow-up at 1, 2, 6, 12, 18, and 24 months, with interviews and blood sampling for anti-HIV, anti-HCV, anti-HBs, anti-HBc, and HBsAg. A gratuity of $30 was paid at enrollment, to all participants, and $20 was paid for each subsequent follow-up visit.

Data collection and laboratory methods. The screening, enrollment, and follow-up questionnaires were adapted from instruments used in previous studies. The enrollment baseline questionnaire included additional questions on drug bingeing (drug, places, and sexual behaviors while bingeing) and HBV perception scales (strongly agree to strongly disagree) with regard to the transmission of HBV and to hepatitis B vaccination. All interviews were administered verbally and recorded electronically via computer-assisted personal interview (QDS software; version 2.4; NOVA Research System).

Blood specimens collected at enrollment and follow-up were tested for anti-HIV (PPC Commander system; Abbott Laboratories) and for anti-HCV, anti-HBs, HBsAg, and anti-HBc (AxSYM; Abbott Laboratories). Repeatedly reactive HIV samples were confirmed by Western blot analysis (Cambridge Biotech).

Definitions. Blood samples with indeterminate or positive Western blot results were considered to be positive for HIV. Past or current HBV infection was defined to have occurred when a sample tested positive for HBsAg, anti-HBc, or both, irrespective of the anti-HBs result. HCV infection was defined as the detection of anti-HCV. Participants who were willing to receive $\geqslant$1 dose of hepatitis B vaccine and completed $\geqslant$1 dose were defined as acceptors and were compared with nonacceptors. Adherence was defined as completing all 3 doses of the hepatitis B vaccine, irrespective of schedule. An anti-HBs titer of $\geqslant$10 IU/mL was the cutoff point for seroprotection.

Statistical analysis. Sample sizes were calculated by the

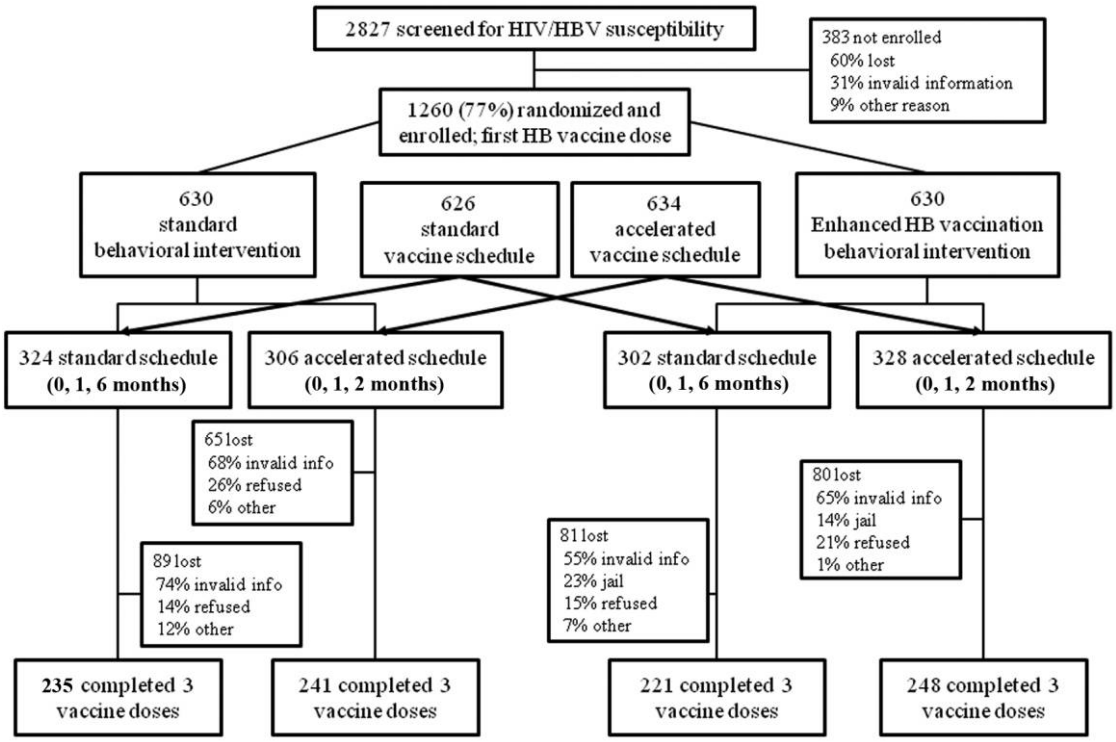

Figure 1. Participants' screening, enrollment, and follow-up in hepatitis B (HB) vaccine intervention. HBV, hepatitis B virus; HIV, human immunodeficiency virus.

methods of Dupont and Plummer [26] at the 2-sided significance level of $\alpha = 0.05$. With a sample size of >300 in each group, the study had 80% power to detect a 10% difference between groups at $\alpha = 0.05$.

Questionnaire data were exported into SAS software (version 9.1; SAS Institute). Data were analyzed using Stata software (version 9.1; StataCorp). For simple logistic regression analysis, odds ratios (ORs) and 95% confidence intervals (CIs) were calculated for each risk factor and demographic variable. In the case of small cell sizes, the χ^2 test and Fisher exact test were also used to determine the significance of associations. Because of their small numbers, Asian participants and those whose race was categorized as "other" were combined with Hispanic participants for analysis.

For multiple logistic regression analysis, risk factors for which $P < .2$ in the simple logistic regression were entered into the multiple logistic regression model, together with age, sex, and race. Independent variables in the multiple logistic regression models were eliminated on the basis of backward stepwise regression [27]. Adjusted ORs and 95% CIs were calculated for the variables for which $P \leq .05$ or that were biologically plausible in the final model. Seroprotection rates were calculated and compared at 2, 6, and 12 months.

RESULTS

Study population, enrollment, and acceptance of hepatitis B vaccination. Of the participants who were screened, 1643 (58%) of 2827 had negative results for anti-HIV, HBsAg, and anti-HBs, and 1266 (77%) of 1643 of those were enrolled in the randomized intervention study. Of the 377 who were eligible but not enrolled, >90% could not be recontacted. Six participants had missing data in the intervention longitudinal analyses, yielding a total of 1260 for analysis (Figure 1).

There were significant differences in age distribution between those receiving the enhanced and standard interventions (Table 1). There were significant differences between the 2 vaccine groups in the distribution of participants who had traded sex for money or drugs or used a combination of drugs within the past 30 d. The 2% who are listed in Table 1 as having no drug use in the past 30 d had positive drug screening results at the initial contact but denied current use at enrollment. The educational levels of all groups were higher than for the Houston population as a whole.

When we compared the characteristics of participants who accepted the hepatitis B vaccine with those of participants who did not, after adjustment in the multivariable analysis (data not shown), the following participants were significantly more likely to accept the vaccine: women (OR, 1.40; 95% CI, 1.02–1.84), participants ≥50 years old (reference, ≤29 years old; OR, 2.2; 95% CI, 1.43–3.30), African American participants (OR, 1.51; 95% CI, 1.04–2.20), and participants using drugs ≤10 times per week (OR, 2.01; 95% CI, 1.46–2.76).

Adherence to 3-dose hepatitis B vaccine. Three-fourths of the enrollees (941 of 1260) received all 3 vaccine doses (Figure 1). As seen in the 2-arm comparison (vaccination schedule) in Table 2, the standard schedule group had an adherence rate of 73%, compared with 77% for the accelerated schedule group ($P = .09$). After stratification by IDU status, adherence rates differed significantly between the standard (66%) and accelerated (75%) vaccination schedule groups ($P = .04$), whereas no significant difference was observed among non-IDUs.

In the 4-arm comparison, the accelerated vaccination schedule may have improved adherence among those receiving the standard behavioral intervention ($P = .08$) but not among those receiving the enhanced version ($P = .80$). In both the 2- and 4-arm comparisons, the enhanced behavioral intervention had no effect on improving adherence.

Among participants who did not complete the 3-dose schedule of hepatitis B vaccine, about half received only the first dose of vaccine (data not shown). The major reason for nonadherence observed in this study was the inability to follow up with the individual owing to invalid contact information; other reasons included incarceration in jail and refusal.

When we compared adherent and nonadherent participants in the univariate analysis, African American participants, participants who had traded sex for money or drugs in the past 30 d, participants currently using alcohol, and participants with stable housing were significantly more adherent to the hepatitis B vaccine. Participants who injected drugs or used crack cocaine, methamphetamine, or speedball (a mixture of heroin and cocaine that is injected) were less adherent. No significant differences in adherence were found as the number of drugs used increased.

A multiple logistic regression was used to identify predictors of hepatitis B vaccine adherence (Table 3). Participants on the accelerated vaccination schedule, older participants, African American participants, and alcohol users were all significantly more likely to receive all 3 doses; those who used speedball or who lived on the street were significantly less likely to do so. The enhanced behavioral intervention was not a significant predictor of receiving 3 hepatitis B vaccine doses.

Hepatitis B seroprotection rates among susceptible vaccinees. The substudy included 707 participants who were susceptible to HBV at enrollment, who completed 3 doses of the hepatitis B vaccine, and whose immune response to the vaccine could be assessed (Figure 2). Of the 308 participants who were not assessed, 33 had evidence of anti-HBs (≥10 mIU/mL) and 275 tested positive for anti-HBc. The characteristics of the 707 substudy participants resembled those for all enrolled study participants (data not shown).

For cumulative seroprotection, persons with measured anti-

Table 1. Characteristics of Enrolled Participants

Characteristic	No. (%) of participants				
		Behavioral intervention		Vaccination schedule	
	Total (n = 1260)	Standard (n = 630)	Enhanced (n = 630[a])	Standard (n = 626)	Accelerated (n = 634)
Sex					
Male	969 (77)	473 (75)	496 (79)	474 (76)	495 (78)
Female	291 (23)	157 (25)	133 (21)	152 (24)	139 (22)
Age, years					
18–29	119 (9)	46 (7)	73 (12)[b]	62 (10)	57 (9)
30–39	295 (23)	154 (24)	141 (22)	140 (22)	155 (24)
40–49	548 (44)	287 (46)	261 (41)	278 (44)	270 (43)
⩾50	298 (24)	143 (23)	154 (24)	146 (23)	152 (24)
Race					
African American	1071 (85)	537 (85)	534 (85)	534 (85)	537 (85)
White	129 (10)	56 (9)	73 (12)	65 (10)	64 (10)
Hispanic or other	60 (5)	37 (6)	22 (3)	27 (4)	33 (5)
Education level					
Less than high school	70 (6)	36 (6)	34 (5)	30 (5)	40 (6)
High school	898 (71)	444 (70)	453 (72)	460 (73)	438 (69)
Some college	292 (23)	150 (24)	142 (23)	136 (22)	156 (25)
Housing status					
Permanent	52 (4)	27 (4)	25 (4)	23 (4)	29 (5)
Temporary or street	1208 (96)	603 (96)	604 (96)	603 (96)	605 (95)
Positive history (ever)					
Drug treatment	763 (61)	369 (59)	393 (62)	373 (60)	390 (61)
Injection drug use	378 (30)	187 (30)	191 (30)	174 (28)	204 (32)
Positive for hepatitis C virus	423 (34)	199 (32)	223 (35)	200 (32)	223 (35)
Positive history in past 30 d					
Injection drug use	92 (7)	53 (8)	39 (6)	50 (8)	42 (7)
Traded sex for money or drugs	217 (17)	108 (17)	109 (17)	93 (15)	124 (20)[b]
Traded money or drugs for sex	200 (16)	97 (15)	103 (16)	87 (14)	113 (18)
Drug or alcohol use in past 30 d					
Crack	1151 (91)	575 (91)	576 (91)	560 (89)	591 (93)
Cocaine	204 (16)	101 (16)	103 (16)	108 (17)	96 (15)
Methamphetamine	50 (4)	26 (4)	24 (4)	25 (4)	25 (4)
"Fry"[c]	24 (2)	12 (2)	12 (2)	13 (2)	11 (2)
Marijuana	620 (49)	306 (49)	314 (50)	306 (49)	314 (50)
Alcohol	870 (69)	439 (70)	431 (68)	429 (69)	441 (70)
Heroin	48 (4)	32 (5)	16 (3)	25 (4)	22 (3)
Speedball[c]	23 (2)	12 (2)	11 (2)	13 (2)	10 (2)
No. of drugs used in past 30 d					
0	28 (2)	16 (3)	12 (2)	16 (3)	12 (2)[b]
1	215 (17)	99 (16)	116 (18)	92 (15)	123 (19)
2	478 (38)	243 (39)	235 (37)	264 (42)	214 (34)
⩾3	539 (43)	272 (43)	267 (42)	254 (41)	285 (45)

NOTE. The standard vaccination schedule included vaccines at 0, 1, and 6 months; the accelerated schedule included vaccines at 0, 1, and 2 months. The standard behavioral intervention delivered general information on human immunodeficiency virus (HIV) awareness and prevention, and the enhanced intervention was specifically designed to increase acceptance of and adherence to the hepatitis B vaccination protocol; see text for details.

[a] For sex, age, race, education level, and housing status, n = 629 because of missing data.

[b] $P < .05$ for comparison with the standard behavioral intervention or vaccination schedule.

[c] "Fry" is marijuana laced with phencyclidine and embalming fluid; speedball is heroin and cocaine.

Table 2. Adherence to 3-Dose Hepatitis B Vaccination Schedule in Drug Users by Intervention Group, Vaccination Schedule, and Status of Injection Drug Use

	All drug users (n = 1260)			IDUs (n = 378)			Non-IDUs (n = 882)		
Comparison groups	No. of adherent participants/no. of participants in group (%)	OR (95% CI)	*P*	No. of adherent participants/no. of participants in group (%)	OR (95% CI)	*P*	No. of adherent participants/no. of participants in group (%)	OR (95% CI)	*P*
2-arm comparison									
Behavioral intervention									
Standard	477/630 (76)	Reference	…	132/187 (71)	Reference	…	345/443 (78)	Reference	…
Enhanced	463/630 (73)	0.89 (0.69–1.15)	.37	137/191 (72)	1.06 (0.68–1.65)	.81	327/439 (74)	0.83 (0.61–1.13)	.24
Vaccination schedule									
Standard	454/626 (73)	Reference	…	115/174 (66)	Reference	…	339/452 (75)	Reference	…
Accelerated	486/634 (77)	1.24 (0.97–1.60)	.09	154/204 (75)	1.58 (1.01–2.47)	.04	333/430 (77)	1.14 (0.84–1.56)	.39
4-arm comparison									
Standard intervention and schedule	237/324 (73)	Reference	…	59/89 (66)	Reference	…	178/235 (76)	Reference	…
Enhanced intervention, standard schedule	217/302 (72)	0.94 (0.66–1.33)	.18	56/85 (66)	0.98 (0.52–1.84)	.95	161/217 (74)	0.92 (0.60–1.41)	.70
Standard intervention, accelerated schedule	240/306 (78)	1.34 (0.92–1.93)	.08	73/98 (75)	1.48 (0.79–2.79)	.22	167/208 (80)	1.30 (0.83–2.05)	.25
Enhanced intervention, accelerated schedule	247/328 (75)	1.12 (0.78–1.59)	.80	81/106 (76)	1.65 (0.88–3.09)	.12	166/222 (75)	0.95 (0.62–1.45)	.81

NOTE. The standard vaccination schedule included vaccines at 0, 1, and 6 months; the accelerated schedule included vaccines at 0, 1, and 2 months. The standard behavioral intervention delivered general information on human immunodeficiency virus (HIV) awareness and prevention, and the enhanced intervention was specifically designed to increase acceptance of and adherence to the hepatitis B vaccination protocol; see text for details. CI, confidence interval; IDU, injection drug user; OR, odds ratio.

Table 3. Factors Associated by Multiple Logistic Regression with Adherence of Drug Users to the 3-Dose Hepatitis B Vaccination Schedule

Factor	Adherence to 3-dose schedule, no. (%) of participants	Adjusted OR (95% CI)[a]	*P*
Vaccination schedule[b]			
Standard ($n = 626$)	454 (73)	Reference	…
Accelerated ($n = 634$)	486 (77)	1.26 (0.97–1.64)	.08
Behavioral intervention[c]			
Standard ($n = 630$)	477 (76)	Reference	…
Enhanced ($n = 630$)	463 (73)	0.89 (0.48–1.16)	.40
Age, years			
⩽29 ($n = 119$)	68 (57)	Reference	…
30–39 ($n = 295$)	210 (71)	1.73 (1.10–2.73)	.02
40–49 ($n = 548$)	408 (74)	1.98 (1.30–3.03)	<.01
⩾50 ($n = 297$)	254 (86)	3.96 (2.40–6.56)	<.01
Race			
White ($n = 129$)	78 (60)	Reference	…
African American ($n = 1071$)	824 (77)	1.56 (1.04–2.34)	.03
Hispanic or other ($n = 59$)	38 (64)	0.97 (0.50–1.88)	.92
Housing status			
Permanent or temporary ($n = 1207$)	911 (75)	Reference	…
Street ($n = 52$)	29 (66)	0.48 (0.26–0.87)	.02
Current speedball use			
No ($n = 1236$)	929 (75)	Reference	…
Yes ($n = 24$)	11 (46)	0.26 (0.11–0.63)	<.01
Current alcohol use			
No ($n = 451$)	190 (42)	Reference	…
Yes ($n = 808$)	618 (76)	1.38 (1.05–1.80)	.02

[a] Adjusted for interventions; age; race; housing status; use of speedball, alcohol, crack cocaine, or methamphetamine; injection drug use; and trading sex for money or drugs. CI, confidence interval; OR, odds ratio.

[b] The standard vaccination schedule included vaccines at 0, 1, and 6 months; the accelerated schedule included vaccines at 0, 1, and 2 months.

[c] The standard behavioral intervention delivered general information on human immunodeficiency virus (HIV) awareness and prevention, and the enhanced intervention was specifically designed to increase acceptance of and adherence to the hepatitis B vaccination protocol; see text for details.

HBs titers were classified into the seroprotection evident group at the visit at 2, 6, or 12 months, regardless of negative response at previous or subsequent visits. Overall, 459 (65%) of the 707 HBV-susceptible individuals developed the minimal adequate protective anti-HBs titer within 12 months after enrollment.

Because both vaccine groups received the first 2 doses at 0 and 1 months, the rates of protection at 2 months were similar (Figure 2). Participants on the accelerated schedule, who had received their third dose at 2 months, were significantly more likely (62% vs 49%) to have effective seroprotection at 6 months than those on the standard schedule, who had yet to receive their third dose.

DISCUSSION

This is the first study (to our knowledge) to examine the effectiveness of an enhanced behavioral intervention as well as of an accelerated vaccination schedule in increasing acceptance of and adherence to hepatitis B vaccination among not-in-treatment drug users. A slight difference was observed in the overall adherence rate between the standard (73%) and accelerated (77%) vaccination schedules, and participants on the accelerated schedule were 26% more likely to achieve completion when factors such as race and age were controlled for ($P = .08$). Although this difference did not achieve statistical significance, it is suggestive, and a study with a larger sample size might confirm it. However, the accelerated schedule made a significant difference ($P = .04$) for the IDU subgroup, raising completion rates by 10% (from 66% to 76%). The behavioral intervention did not confound the association between the accelerated schedule and completion of the series. The overall adherence rate of 75% is toward the higher end of rates reported for many published studies (41%–88%), using different types

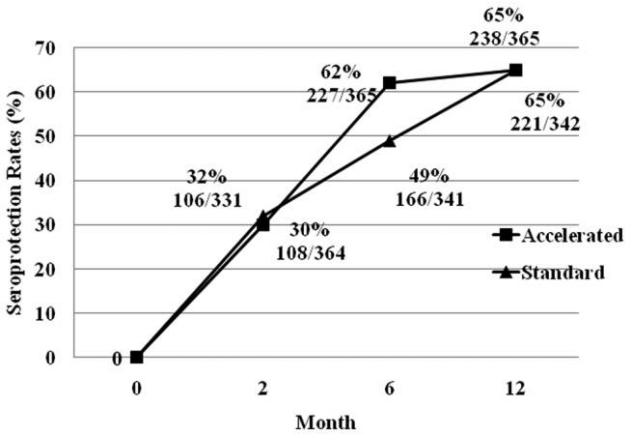

Figure 2. Cumulative seroprotection rates among participants in the standard and accelerated schedules at follow-up visits at 2, 6, and 12 months.

of incentives [4, 13, 28–31]. The accelerated schedule adherence of 77% is higher than in other reported studies (21%–70%) [28, 30].

The cluster-randomized design for the enhanced behavioral intervention, with randomization at the neighborhood level, was necessary to prevent contamination between the 2 groups. We adjusted the differences in independent variables at baseline among intervention groups in the analysis to minimize bias and confounding factors.

The results of this study indicate that providing monetary incentives at each visit, free vaccinations, and a shorter vaccination schedule may encourage adherence, particularly among the highly at-risk group of IDUs. It also showed that enrollment and follow-up of drug users can be effectively achieved without the need to establish an association with a health care or sexually transmitted disease clinic, needle exchange program, or other service in contact with this population [17].

Adherence to multidose vaccination schedules by drug users may be affected primarily by obstacles that prevent repeated contact with health care services, such as lack of a permanent residence, involvement in illicit activities, incarceration, and treatment center visits. This is particularly true for IDUs, who are also less likely to accept or complete the hepatitis B vaccine series than non-IDUs [13]. In the current study, drug users living on the street were twice as likely not to receive all 3 vaccine doses. Users of speedball were significantly less likely to be adherent.

Young drug users are a cause of concern because of poor compliance with preventive health behaviors and disparity in HBV infection rates. From 1982 to 1989, the majority of acute HBV infections occurred in individuals aged 20–29 years. Two studies in California showed that only 10% of drug users <30 years old completed the vaccination schedule [32, 33]. Addressing low vaccination rates is critical in young drug users, because most incident transmission occurs soon after the initiation of injection drug use [11, 34]. Other studies have shown that nontraditional means to provide vaccination, such as flexible vaccination schedules and the use of outreach workers, worked to remove barriers to enrollment and adherence for young drug users [17, 21, 35]. The current study was not successful in enrolling a proportionate number of younger participants (aged 18–29 years), perhaps because of the chain-referral recruiting methods, which will tend to skew recruitment to those who have been in an area longer (and are thus older). Results of this study showed that older drug users were more likely to complete the hepatitis B vaccine series.

The behavioral intervention used in this study aimed to increase adherence to hepatitis B vaccination by increasing drug users' beliefs in their self-efficacy. The results suggest that this behavioral intervention had no significant effect on adherence to a hepatitis B vaccination schedule, although other studies have shown that high self-efficacy does increase adherence [9, 36, 37]. In our study, the standard behavioral intervention provided health-related and prevention information about HIV; a no-intervention control group might have provided more information about the effect of a brief intervention on drug users' motivations to comply with a multidose schedule. Future qualitative studies of drug users may be needed to identify behavioral barriers that prevent adherence to the hepatitis B vaccination schedule and to develop and test behavioral interventions to increase such adherence.

Although the educational component seems to have made no significant difference in the completion rates for the 2 vaccination schedules, completion rates for both schedules were high. This suggests that the driving force for completion was financial rather than informational. The $20 paid per follow-up visit appears to have been a primary motivation for return, even up to a year later. This is consistent with findings that show that such moderate compensation for participation in public health research is part of an informal economy that is valued by persons on the margins of the formal economy [38]. Rather than limiting the efficacy of the behavioral intervention, the payments appear to have compensated, as it were, for its inefficacy.

The overall seroprotection rate of 65% among the HBV-susceptible subgroup is comparable to the findings from existing hepatitis B vaccine research on drug-using populations (66.4%–76%) [21, 29, 39–42]. The substantial difference in cumulative 6-month seroprotection rates between the standard and accelerated dosing schedules (49% vs 62%, respectively) underscores the need to administer subsequent vaccine doses as rapidly as possible. Compressed schedules are particularly germane to IDUs, who were 58% more likely to receive 3 doses if they were on the accelerated rather than the standard schedule. Furthermore, it is worth noting that receiving the third

dose at 2 months rather than 6 months may provide additional months of protection [43], during which an initiating drug user may migrate to injection drug use or partake in risky sexual behaviors (increasing the risk of transmission). This suggests that the focus of multidose vaccination programs for adult drug users should be on ensuring schedule completion by using accelerated schedules, thus eliminating potential reservoirs of hepatitis B and transmission threats to individuals in their drug-using networks. Further follow-up of long-term immune protection in such populations is needed.

There remains an urgent need for better hepatitis B vaccines for at-risk populations such as IDUs, individuals who are HIV positive, other immunocompromised individuals, patients receiving dialysis, and individuals with end-stage liver disease. It should be emphasized that the participants in our study population were HIV negative; therefore, our results are valid for immunocompetent individuals.

This study serves as a model for a future HIV or hepatitis C vaccine trial and provides information on the effectiveness of accelerated vaccination schedules for increasing immunization among drug users. Creating a model for acceptance of and adherence to an HIV or hepatitis C vaccination schedule among drug users is an important public health goal. Drug users, especially minority drug users, are the largest group of participants with newly diagnosed HIV or HCV infection. To effectively control epidemics of these infections, the drug-using population will need to be targeted once vaccines become available. Unless an effective model based on empirical experience with drug users is developed, any attempt to implement an HIV or hepatitis C vaccination program in this population is likely to be thwarted. Our study indicated that straightforward payment for the receipt of immunizations may be not only ethically sound but also an economically sensible way to use limited public health resources.

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References

1. Centers for Disease Control and Prevention Division of Viral Hepatitis. Disease burden from viral hepatitis A, B, and C in the United States. Centers for Disease Control and Prevention Web site. http://www.cdc.gov/hepatitis/pdfs/disease_burden.pdf. Published 2007. Accessed 4 October 2010.
2. Institute of Medicine Committee on the Prevention and Control of Viral Hepatitis Infections. Hepatitis and liver cancer: a national strategy for prevention and control of hepatitis B and C. Washington, DC: The National Academies Press, **2010**.
3. Rhodes SD, Hergenrather KC. Exploring hepatitis B vaccination acceptance among young men who have sex with men: facilitators and barriers. Prev Med **2002**; 35:128–134.
4. Altice FL, Bruce RD, Walton MR, Buitrago MI. Adherence to hepatitis B virus vaccination at syringe exchange sites. J Urban Health **2005**; 82:151–161.
5. Des Jarlais DC, Fisher DG, Newman JC, et al. Providing hepatitis B vaccination to injection drug users: referral to health clinics vs on-site vaccination at a syringe exchange program. Am J Public Health **2001**; 91:1791–1792.
6. Kuo I, Sherman SG, Thomas DL, Strathdee SA. Hepatitis B virus infection and vaccination among young injection and non-injection drug users: missed opportunities to prevent infection. Drug Alcohol Depend **2004**; 73:69–78.
7. Lok AS. Chronic hepatitis B. N Engl J Med **2002**; 346:1682–1683.
8. McMahon BJ, Alward WL, Hall DB, et al. Acute hepatitis B virus infection: relation of age to the clinical expression of disease and subsequent development of the carrier state. J Infect Dis **1985**; 151:599–603.
9. Seal KH, Ochoa KC, Hahn JA, Tulsky JP, Edlin BR, Moss AR. Risk of hepatitis B infection among young injection drug users in San Francisco: opportunities for intervention. West J Med **2000**; 172:16–20.
10. Centers for Disease Control and Prevention. Hepatitis B vaccination among high-risk adolescents and adults: San Diego, California, 1998–2001. MMWR Morb Mortal Wkly Rep **2002**; 51:618–621.
11. Goldstein ST, Alter MJ, Williams IT, et al. Incidence and risk factors for acute hepatitis B in the United States, 1982–1998: implications for vaccination programs. J Infect Dis **2002**; 185:713–719.
12. Hagan H, Thiede H, McGough JP, Alexander ER. Hepatitis B vaccination among research participants, Seattle, Washington. Am J Public Health **2002**; 92:1756.
13. Ompad DC, Galea S, Wu Y, et al. Acceptance and completion of hepatitis B vaccination among drug users in New York City. Commun Dis Public Health **2004**; 7:294–300.
14. Hutchinson SJ, Wadd S, Taylor A, et al. Sudden rise in uptake of hepatitis B vaccination among injecting drug users associated with a universal vaccine programme in prisons. Vaccine **2004**; 23:210–214.
15. Hwang LY, Ross MW, Zack C, Bull L, Rickman K, Holleman M. Prevalence of sexually transmitted infections and associated risk factors among populations of drug abusers. Clin Infect Dis **2000**; 31:920–926.
16. Budd J, Robertson R, Elton R. Hepatitis B vaccination and injecting drug users. Br J Gen Pract **2004**; 54:444–447.
17. Jain N, Yusuf H, Wortley PM, Euler GL, Walton S, Stokley S. Factors associated with receiving hepatitis B vaccination among high-risk adults in the United States: an analysis of the National Health Interview Survey, 2000. Fam Med **2004**; 36:480–486.
18. de Wit JB, Vet R, Schutten M, van Steenbergen J. Social-cognitive determinants of vaccination behavior against hepatitis B: an assessment among men who have sex with men. Prev Med **2005**; 40:795–802.
19. Quaglio G, Lugoboni F, Mezzelani P, Des Jarlais DC, Lechi A. Hepatitis vaccination among drug users. Vaccine **2006**; 24:2702–2709.
20. van Houdt R, Sonder GJ, Dukers NH, et al. Impact of a targeted hepatitis B vaccination program in Amsterdam, The Netherlands. Vaccine **2007**; 25:2698–2705.
21. Lum PJ, Ochoa KC, Hahn JA, Page Shafer K, Evans JL, Moss AR. Hepatitis B virus immunization among young injection drug users in San Francisco, Calif: the UFO Study. Am J Public Health **2003**; 93:919–923.
22. Marchou B, Excler JL, Bourderioux C, et al. A 3-week hepatitis B vaccination schedule provides rapid and persistent protective immunity: a multicenter, randomized trial comparing accelerated and classic vaccination schedules. J Infect Dis **1995**; 172:258–260.
23. Ross MW, Hwang LY, Leonard L, Teng M, Duncan L. Sexual behaviour, STDs and drug use in a crack house population. Int J STD AIDS **1999**; 10:224–230.
24. Bandura A. Self-efficacy mechanism in human agency. Am Psychol **1982**; 37:122–147.

25. National Institute on Drug Abuse. The NIDA community-based outreach model: a manual to reduce the risk of HIV and other bloodborne infections in drug users. Bethesda, MD: National Institute on Drug Abuse, **2000**.
26. Dupont WD, Plummer WD. Power and sample size calculations: a review and computer program. Control Clin Trials **1990**; 11:116–128.
27. Hosmer DW, Lemeshow S. Applied logistic regression. 2nd ed. New York, NY: Wiley, **2000**.
28. Dal-Re R, Gonzalez A, Ramirez V, Ballesteros J, del Romero J, Bru F. Compliance with immunization against hepatitis B: a pragmatic study in sexually transmitted disease clinics. Vaccine **1995**; 13:163–167.
29. Quaglio G, Talamini G, Lugoboni F, et al. Compliance with hepatitis B vaccination in 1175 heroin users and risk factors associated with lack of vaccine response. Addiction **2002**; 97:985–992.
30. Rodrigo JM, Serra MA, Aparisi L, et al. Immune response to hepatitis B vaccine in parenteral drug abusers. Vaccine **1992**; 10:798–801.
31. Samoff E, Dunn A, VanDevanter N, Blank S, Weisfuse IB. Predictors of acceptance of hepatitis B vaccination in an urban sexually transmitted diseases clinic. Sex Transm Dis **2004**; 31:415–420.
32. Seal KH, Kral AH, Lorvick J, McNees A, Gee L, Edlin BR. A randomized controlled trial of monetary incentives vs. outreach to enhance adherence to the hepatitis B vaccine series among injection drug users. Drug Alcohol Depend **2003**; 71:127–131.
33. Cox J, De P, Morissette C, et al. Low perceived benefits and self-efficacy are associated with hepatitis C virus (HCV) infection-related risk among injection drug users. Soc Sci Med **2008**; 66:211–220.
34. Rhodes SD, Hergenrather KC. Using an integrated approach to understand vaccination behavior among young men who have sex with men: stages of change, the health belief model, and self-efficacy. J Community Health **2003**; 28:347–362.
35. van Steenbergen JE. Results of an enhanced-outreach programme of hepatitis B vaccination in the Netherlands (1998–2000) among men who have sex with men, hard drug users, sex workers and heterosexual persons with multiple partners. J Hepatol **2002**; 37:507–513.
36. Zeldis JB, Jain S, Kuramoto IK, et al. Seroepidemiology of viral infections among intravenous drug users in northern California. West J Med **1992**; 156:30–35.
37. Garfein RS, Vlahov D, Galai N, Doherty MC, Nelson KE. Viral infections in short-term injection drug users: the prevalence of the hepatitis C, hepatitis B, human immunodeficiency, and human T-lymphotropic viruses. Am J Public Health **1996**; 86:655–661.
38. Slomka J, McCurdy S, Ratliff EA, Timpson S, Williams ML. Perceptions of financial payment for research participation among African-American drug users in HIV studies. J Gen Intern Med **2007**; 22:1403–1409.
39. Lugoboni F, Migliozzi S, Schiesari F, et al. Immunoresponse to hepatitis B vaccination and adherence campaign among injecting drug users. Vaccine **1997**; 15:1014–1016.
40. Minniti F, Baldo V, Trivello R, et al. Response to HBV vaccine in relation to anti-HCV and anti-HBc positivity: a study in intravenous drug addicts. Vaccine **1999**; 17:3083–3085.
41. Rumi M, Colombo M, Romeo R, et al. Suboptimal response to hepatitis B vaccine in drug users. Arch Intern Med **1991**; 151:574–578.
42. West DJ. Clinical experience with hepatitis B vaccines. Am J Infect Control **1989**; 17:172–180.
43. Jilg W, Schmidt M, Deinhardt F. Vaccination against hepatitis B: comparison of three different vaccination schedules. J Infect Dis **1989**; 160: 766–769.