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Effects of a Nurse-Managed Program on Hepatitis A and B Vaccine Completion Among Homeless Adults

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Abstract

Background—Hepatitis B virus (HBV) infection constitutes a major health problem for homeless persons. Ability to complete an HBV vaccination series is complicated by the need to prioritize competing needs, such as addiction issues, safe places to sleep, and food, over health concerns.

Objectives—The objectives of this study were to evaluate the effectiveness of a nurse-case-managed intervention compared with that of two standard programs on completion of the combined hepatitis A virus (HAV) and HBV vaccine series among homeless adults and to assess socio-demographic factors and risk behaviors related to the vaccine completion.

Methods—A randomized, three-group, prospective, quasi-experimental design was conducted with 865 homeless adults residing in homeless shelters, drug rehabilitation sites, and outdoor areas in the Skid Row area of Los Angeles. The programs included (a) nurse-case-managed sessions plus targeted hepatitis education, incentives, and tracking (NCMIT); (b) standard targeted hepatitis

education plus incentives and tracking (SIT); and (c) standard targeted hepatitis education and incentives only (SI).

Results—Sixty-eight percent of the NCMIT participants completed the three-series vaccine at 6 months, compared with 61% of SIT participants and 54% of SI participants. NCMIT participants had almost 2 times greater odds of completing vaccination than those of participants in the SI program. Completers were more likely to be older, to be female, to report fair or poor health, and not to have participated in a self-help drug treatment program. Newly homeless White adults were significantly less likely than were African Americans to complete the vaccine series.

Discussion—The use of vaccination programs incorporating nurse case management and tracking is critical in supporting adherence to completion of a 6-month HAV/HBV vaccine. The finding that White homeless persons were the least likely to complete the vaccine series suggests that programs tailored to address their unique cultural issues are needed.

Keywords

HAV/HBV vaccine completion; homeless adults; nurse case managed program; substance abuse

Hepatitis B virus (HBV) infection poses a serious threat to public health in the United States. Recent estimates place the true prevalence of chronic HBV in the United States at approximately 1.6 cases per 100,000 persons (Centers for Disease Control & Prevention [CDC], 2008). It is estimated that there were 51,000 new cases of HBV infection in 2005 (Wasley, Miller, & Finelli, 2007), a financial burden reaching \$1 billion annually (Cohen et al., 2007). Most of these cases occurred among high-risk groups, such as injection drug users (IDUs), men who had sex with men, and individuals with multiple sexual partners; these risk behaviors account for 75% of incident HBV cases in the United States (Goldstein et al., 2002).

Homeless populations are at particularly high risk of HBV infection due to high rates of unprotected sexual behavior and sharing of needles and other IDU paraphernalia. Previous studies have reported that HBV infection rates among homeless populations range from 17% to 31% (i.e., from 17,000 to 31,000 per 100,000 persons; Gelberg et al., 2001; Lum et al., 2003) compared with 2.1 per 100,000 in the general United States population (CDC, 2006). In addition, homeless adults have a high prevalence of hepatitis C virus (HCV) infection, with rates varying from 17% to 44% (Desai, Rosenheck, & Agnello, 2003; Nyamathi et al., 2002). Coinfection with HBV and HCV complicates treatment of each condition and leads to a more rapid onset of cirrhosis (Liu & Hou, 2006).

Vaccination for HBV is the most effective way to prevent HBV infection (CDC, 2006). Vaccination for HBV has been recommended to high-risk groups in the United States since 1982 and is now required for children (CDC, 2001). However, HBV vaccination coverage is low among homeless adults because of missed opportunities, lack of public and private insurance coverage for HBV vaccination of adults, and poor adherence to the vaccine regimen (Sorensen, Masson, & Perlman, 2002). During the years of the study vaccination protocol, HBV vaccination required that three doses be administered within a 6-month time period, making HBV vaccination of homeless persons particularly challenging (Rich et al., 2003). Furthermore, lack of awareness about the existence and risk of HBV, lack of concern about being infected, lack of information about the availability of an HBV vaccine, and access problems are major deterrents to achieving high HBV vaccination coverage among homeless adults (Sorensen et al., 2002).

Improving vaccination adherence rates among homeless persons is an important step toward reducing the high prevalence of HBV infection in this population. Previous studies have

shown that directly observed therapy (Moss et al., 2004), cash incentives (Tulsky et al., 2004), and targeted education programs (Morisky et al., 2001) can improve latent tuberculosis treatment adherence in the homeless population. However, few studies have examined HBV vaccination among homeless populations, and the strategies have been limited to targeting homeless IDUs with directly observed therapy, financial incentives, or both (Lum et al., 2003; Ompad et al., 2004). Thus, little is known about adherence to HBV vaccination among community samples of urban homeless persons or about the effect of stronger interventions to incorporate additional strategies, such as nurse case management and targeted HBV education along with client tracking. Information about correlates of HBV vaccination completion in this population is similarly limited.

This study was initiated to (a) assess the relative effect on completion of the three-series Twinrix hepatitis A virus (HAV)/HBV vaccine of a comprehensive intervention program employing nurse case management for a vulnerable population, targeted hepatitis education, client tracking, and financial incentives (NCMIT) compared with the effectiveness of one program with standard targeted hepatitis education, tracking, and incentives (SIT) and with that of another program with standard targeted hepatitis education and incentives only (SI) and (b) investigate socio-demographic factors and risk behaviors related to the completion of HBV vaccination by homeless adults. As HBV and HIV have similar modes of transmission, understanding factors associated with adherence to HBV vaccination also can inform future HIV vaccination programs in homeless populations once an HIV vaccine becomes available.

Theoretical Basis for Nurse-Case-Managed Intervention

The comprehensive health seeking and coping paradigm (CHSCP; Nyamathi, 1989) has been used to guide many investigations of drug-using, homeless, and impoverished adults (Nyamathi et al., 2007, 2008; Nyamathi, Stein, Dixon, Longshore, & Galaif, 2003). Originally adapted from the stress and coping paradigm of Lazarus and Folkman (1984) and the health-seeking paradigm of Schlotfeldt (1981), the CHSCP proposes that a number of factors impact health outcomes of vulnerable populations with health disparities. These include sociodemographic and personal factors, psychosocial resources and behavioral factors, cognitive appraisal, coping responses, nursing strategies, and health outcomes. In this study, variables of interest include sociodemographic factors (age, ethnicity, gender, education, recruitment site, and history of homelessness), resources (physical health status), psychosocial factors (depressive symptoms, poor emotional well-being, and social support), cognitive appraisal, nursing strategies (NCMIT, SIT, and SI programs), and behavior (drug and sexual risk behaviors), all of which may impact health-seeking outcomes, such as completion of the three-series Twinrix HAV/HBV vaccine.

Methods

Design

A randomized, three-group, prospective, quasi-experimental design was used to evaluate the effectiveness of a theoretically based intervention incorporating a nurse-case-managed approach compared with that of two standard programs on completion of an HAV and HBV vaccination series among sheltered homeless adults in the Skid Row area of Los Angeles. Data were collected from 865 homeless participants at baseline and 6-month follow-up between September 2003 and August 2007. The University of California, Los Angeles, Human Subjects Protection Committee provided oversight of all study activities.

Setting and Sample

Using simple random selection of sites stratified by type (homeless shelter, residential drug treatment recovery sites, or outdoor locations), homeless adults were recruited from 12 homeless shelters, four residential drug treatment recovery sites, and outdoor locations. Eligibility requirements included the following: (a) adult age 18–65 years and designated as homeless; (b) willing to undergo HAV, HBV, HCV, and HIV antibody testing at baseline and at 6-month follow-up; (c) willing to participate in the intervention; and (d) no history of HBV vaccination. As completing the HAV/HBV vaccine series was the key study outcome, persons testing positive for HBV antibodies were excluded from the study. A homeless person was one who had slept in one of the study sites or in the outdoors during the previous night.

A total of 2,086 persons were screened, of which 46 were ineligible to undergo HBV, HCV, and HIV testing and 4 refused such testing. Of the remaining 2,036 homeless persons tested for HBV, 820 (40%) persons were serum positive for HBV exposure or prior HBV vaccination (positive for HBV surface antigen, surface antibody, or core antibody) and were excluded. Of the remaining 1,216 homeless adults who tested HBV negative, 351 (29%) failed to return 2 weeks later for the test results or were excluded for medical reasons, such as inability to draw blood. The final sample consisted of 865 HBV-negative homeless participants, of which 20% were HCV positive.

Procedure

After stratification, sites were assigned randomly to the three programs; the homeless participants were then recruited into the program associated with their site. Participants recruited from outdoor locations were entered systematically into each of the three programs as they were enrolled. All sites were within 5 miles of the Weingart Center, where the study was conducted. Recruitment procedures consisted of posting flyers in the approved sites to inform residents of the study and to provide information for interested homeless persons who wanted to contact study staff. Detailed information was provided to homeless residents at the shelter and rehabilitation sites and to homeless street persons who came into the Weingart Center during scheduled clinic visits. After obtaining written informed consent to screening, outreach workers administered a brief questionnaire covering basic sociodemographic characteristics and a hepatitis-related health history designed to assess eligibility for the study. Eligible and interested participants then completed a second written informed consent followed by pretest counseling and a blood draw for HAV, HBV, HCV, and HIV assays.

Exposure to HBV, HAV, HCV, and HIV was determined by the following blood tests: HBV surface antigen, surface antibody, and core antibody; HAV antibody; HCV antibody; and HIV antibody based on the enzyme-linked immunosorbent assay with confirmation of positive tests by the Western blot.

Potential participants were then given referrals to see a research nurse stationed at the Weingart Center 2 weeks later for posttest counseling and test results. Those with a positive HBV antigen, HCV antibody, or HIV antibody were referred to the JWCH Medical Clinic at the Weingart Center for assessment and medical follow-up.

At the 2-week visit, HBV-negative homeless adults who provided final written informed consent for the study were administered the baseline survey, which lasted 60 minutes. All participants were tracked for completion of the 6-month assessment using a locator guide (Anglin, Danila, Tyan, & Mantius, 1996).

Intervention

Homeless participants in each group were offered the three-series Twinrix HAV (inactivated) and HBV (recombinant) vaccine by a study nurse blinded to the group assignment. The Twinrix was used because it would vaccinate homeless persons for HAV while vaccinating against HBV and still maintain the same 6-month timeframe as for the HBV vaccination series (0, 1, and 6 months). As homeless persons are generally also at risk of HCV and HIV, for which no vaccinations yet exist, in addition to education and counseling for HBV and HAV, education and counseling for HCV and HIV were also provided to all participants. Subsequently, participants had a 10-minute period to discuss questions with the nurse before they presented for each dose of the Twinrix vaccine series. Two nurse and outreach teams worked exclusively with participants in either the intervention or control programs. A team of outreach workers not involved in the programs provided tracking and follow-up on all participants for their 6-month questionnaire.

Nurse Case Management With Incentives and Tracking

Participants in the theoretically-guided nurse case management with incentives and tracking (NCMIT) program received the following: (a) targeted hepatitis education session, conducted by a trained research nurse during the first session, incorporating information about HAV, HBV, HCV, and HIV infection; diagnosis; prevention; and transmission and about HAV/HBV vaccination, its administration schedule, possible side effects, and the importance of adherence to the vaccine series; (b) nurse case management, also conducted by a trained nurse, and incorporated seven sessions which included enhancement of personal (self-esteem), social, and behavioral coping skills; training in self-management and communications skill competencies necessary for overcoming barriers to completion of the HBV vaccination series; and skill competencies to reducing risky substance use and sexual practices, all sessions were preceded by a needs assessment and included referrals and appointments as needed; (c) client tracking by outreach workers; (d) incentives for receiving each dose of the vaccine (\$5); and (e) a local community resource guide.

Standard With Incentives and Tracking and Standard With Incentives Programs

Participants in the standard with incentives and tracking (SIT) and standard with incentives (SI) groups received a 20-minute targeted hepatitis education session similar to that of the NCMIT group, as well as tracking, incentives, and a local community resource guide. The SIT and SI groups did not receive the nurse case management and associated support that the NCMIT group received. The SI group received the targeted hepatitis education session and incentives but no tracking. For all groups, the incentive for receiving each dose of the vaccine was \$5. All participants were reimbursed for the vaccine because it was already known that, for homeless populations, there were low rates of completion of the HBV vaccination without incentives. Additional financial incentives were provided equally to all participants for blood draw and for their return for test results and completion of the baseline and 6-month follow-up questionnaire.

Measures

Instruments utilized in the study had been tested previously and validated in impoverished or homeless African American, Latino, and White adults (Nyamathi, Berg, Jones, & Leake, 2005; Nyamathi, Christiani, Nahid, Gregerson, & Leake, 2006; Sherbourne & Stewart, 1991; Simpson & Chatham, 1995; Stewart, Hays, & Ware, 1988). All instruments were adapted to the sixth-grade level and were administered as face-to-face interviews by the research staff to all participants in a private location.

Control Variables

Sociodemographic variables collected at baseline included age, ethnicity, gender, education (dichotomized into ≥ 12 vs. < 12 years), employment status, recruitment site (homeless shelter, drug treatment recovery shelter, or outdoor location), total length of time homeless in lifetime (dichotomized into ≥ 1 year vs. newly homeless defined as < 1 year), veteran status, having an intimate partner (yes or no), and having exchanged sex for money or drugs in the past 6 months. Intention to adhere was assessed by asking how committed respondents were to taking the vaccine doses over the 6-month period.

Drug and alcohol use behaviors were measured primarily using the Texas Christian University (TCU) drug history form (Simpson & Chatham, 1995). This questionnaire has been tested in men and women with histories of drug addiction, prostitution, and homelessness. It is used to record lifetime and the past 6-month use of 16 drugs, including cocaine, heroin, and methamphetamine, and elicit information about the current frequency of noninjection and injection drug use. Additional items were used to assess the quantity of alcohol consumed in the past 6 months and attendance at a self-help program in the last 6 months.

Depressive symptoms were assessed with the Center for Epidemiological Studies Depression (CES-D) scale (Radloff, 1977). This 20-item self-report instrument is designed to measure depressive symptoms in the general population and has been validated for use in homeless populations (Nyamathi et al., 2005). Each item measures the frequency of a symptom on a 4-point response scale from 0 = *rarely or none of the time* (less than 1 day per week) to 3 = *most of the time* (5–7 days per week). After reverse scoring appropriate items, scores were summed, giving an overall scale that could range from 0 to 60. The scale was dichotomized at the customary value of 16 (Radloff, 1977), indicating a need for further evaluation of depressive symptoms. Consequently, all participants who scored 16 or higher on the CES-D depression screener were referred to neighborhood mental health services. The internal reliability of the scale in this sample was .90.

The 5-item mental health index, which has well-established reliability and validity, was used to measure emotional well-being (Stewart et al., 1988) on a scale of 0–100. An established cut point of 66 (Rubenstein et al., 1989) was used to identify participants' emotional well-being. Social support was assessed by an 18-item scale used in the RAND Medical Outcomes Study (Sherbourne & Stewart, 1991). Individuals who reported any social support were asked whether their support came primarily from drug users, nonusers of drugs, or both. Results for the latter variable are reported because it has been more important in previous studies and had a greater association with vaccine completion than any social support. Perceived health status was measured on a 5-point scale from *excellent* to *poor*, and a dichotomous item inquired about the past 6-month hospitalization. Health status was dichotomized at fair or poor versus better health.

Dependent Variable

Vaccine completion was measured by receipt of the three doses of the Twinrix HAV/HBV vaccine series, recorded at baseline, 1 month, and 6 months (with a 2-month grace period) by the research nurse. At 6 months postbaseline, all participants completed a posttreatment survey identical to the pretreatment survey, with the exception of immutable sociodemographic items.

Statistical Analyses

All HBV vaccine completion analyses were intent to treat. Preliminary analyses, including chi-square and *t* tests and analysis of variance, were used to assess comparability of the three

programs at baseline and to examine unadjusted correlates of vaccine completion. Multiple logistic regression modeling was used to assess program effects on treatment completion, controlling for potential confounders. Stepwise backward multiple logistic regression analysis was used to create a model of treatment completion; predictors included variables that were associated with vaccine completion at the .15 level in the preliminary analyses. Indicators for SIT and SI assignment were included in all models; other covariates were retained if they were significant at the .01 level. Variables that were not included in the stepwise modeling then were tested one at a time for inclusion in the model; these additional covariates were retained if they were significant at the .10 level or if they had a strong impact on the coefficients of other variables in the model. Because of the potential importance of targeting interventions to specific groups, interactions between race or ethnicity and other covariates, as well as those between age and other covariates, were tested. A significant ($p < .05$) interaction was found between being White and length of time homeless; consequently, White persons were divided into newly (less than 1 year in their lifetime) and chronically homeless subgroups (1 year or greater). Multicollinearity was assessed, and model fit was examined using the Hosmer–Lemeshow test. Finally, recruitment site was used as a random effect in a mixed-model logistic regression analysis for vaccine completion. Statistical analyses were performed with SAS/STAT (SAS Institute, Cary, NC) and Stata (Stata Corporation, College Station, TX).

Results

A total of 865 HBV-negative homeless adults were randomized by recruitment site into the NCMIT ($n = 332$), SIT ($n = 281$), or SI ($n = 252$) group. As shown in Table 1, the study participants were predominantly men (77%) and African American (69%), with a mean age of 42 years ($SD = 9$ years, range = 19–65 years). Approximately 95% of all participants verbalized intent to adhere to the vaccine series. In terms of substance use, approximately 17% reported lifetime use of injection drugs, with nearly 7% reporting recent or current IDU. Almost half reported attending recent self-help programs. The Consolidated Standards of Reporting Trials (CONSORT) diagram showing the flow of participants through each stage of a randomized trial is presented in Figure 1.

Program Comparisons

There were no group differences at baseline with respect to chronic homelessness, intention to adhere, injection drug use, methamphetamine use, or education; however, gender and ethnic differences were found. Men were overrepresented in the NCMIT program, and Latinos were overrepresented in the SIT program. The NCMIT participants were most likely to report daily alcohol and drug use and to have used noninjection drugs in the last 6 months. Veteran status, social support, and emotional well-being also differed somewhat between the programs, as did type of recruitment site.

Vaccine Completion

As shown in Table 1, 68% of the NCMIT participants completed the three-series vaccine at 6 months, plus 2-month grace period, compared with 61% of SIT participants and 54% of SI participants. Compared with noncompleters, completers were more likely to report chronic homelessness and having a significant other (Table 2). They were older and less likely to have participated in a self-help substance abuse program. Noncompleters were more likely to report male homosexual behaviors.

Multivariate Results

Adjusting for potentially confounding characteristics, NCMIT participants had almost 2 times greater odds of completing vaccination than those of participants in the SI group; SIT

participants had 1.5 greater odds of completion than those of the SI group, but the difference was not significant (Table 3). Older individuals, and those who reported fair or poor health, were also more likely to complete vaccination. Newly homeless White adults were significantly less likely than were African Americans to complete vaccination; male gender and participation in nonresidential substance abuse programs also were associated negatively with vaccine completion. Latinos and chronically homeless Whites were as likely as African Americans to adhere to the vaccine regimen.

Subsequent descriptive analyses were conducted on the newly homeless White participants. They resembled the overall sample in terms of age and gender but reported much higher rates of recent IDU and methamphetamine use (22% and 30%, respectively). Half reported lifetime injection activity, and 59% reported lifetime methamphetamine use.

Discussion

This prospective randomized study demonstrated that the NCMIT program significantly improved completion of a 6-month HAV/HBV vaccine regimen when compared with the SI approach. Controlling for potential confounders, the NCMIT participants had almost 2 times greater odds of completing the HBV vaccination than that of the standard control. Although the SIT participants had 1.5 times greater odds of completing HAV/HBV vaccination than those of the standard control, these findings were not significant. The vaccination completion rates in both programs that incorporated tracking (NCMIT and SIT) were also higher than those in previous studies using financial incentives alone (Ompad et al., 2004). A modest monetary incentive has been approved as an effective strategy to increase HBV vaccination coverage in hard-to-reach populations (Trubatch, Fisher, Cagel, & Fenaughty, 2000). The findings suggest that targeted education and client tracking are also critical elements in supporting adherence.

Although the findings revealed statistically significant differences between the NCMIT and SI program (68% vs. 54%) and no significant difference in HBV vaccine completion between the SIT and SI programs, a question of clinical significance arises as the completion rate of the SIT participants (61%) is fairly close to the completion rate of the NCMIT at 68%. However, it is believed that clinical significance is present as the NCMIT is the only program found to be statistically different than the control program, and a cost-benefit analysis found the NCMIT program to be the most cost-effective program, as compared with the SIT and SI programs, for increasing HBV vaccine coverage among homeless adults (Greengold et al., under review). Thus, it is believed that these findings are clinically different as well.

As guided by the CHSCP theoretical framework, a number of factors were associated with the completion of the HAV/HBV vaccine series. Nursing strategies (NCMIT) were found to be critical in enhancing completion among these homeless and marginalized persons at risk of hepatitis. In addition, as presented among the findings, a number of sociodemographic (age, gender, recruitment site, and years homeless), psychosocial (being partnered), and behavior (same-sex behaviors and attending self-help programs for drugs or alcohol) factors also were associated with the completion of the vaccine series.

In the current study, homeless persons who reported negative personal resources, such as fair or poor health, had higher odds of completing HBV vaccination. This finding is consistent with results from the study of adherence to tuberculosis chemoprophylaxis among homeless adults (Nyamathi et al., 2006). In this population, poor perceived health status has been found to be associated with alcohol and drug use and with chronic health problems (Nyamathi et al., 2003). Chronic illness, in turn, frequently leads to increased care seeking

(Nyamathi et al., 2005), which may produce higher vaccination adherence rates. Individuals with relatively poor perceived health status also may have been more motivated to get all their vaccine doses than were those with better health perceptions.

Also consistent with previous studies (Frangakis et al., 2004; Lamagni, Hope, Davison, Parry, & Gill, 2001), select sociodemographic factors predicted vaccine completion. In particular, the findings revealed that older homeless persons were more likely to complete the vaccine series than were younger homeless persons. One explanation may be that older people had been missed by many HBV vaccination campaigns and thus were more willing to participate in a free vaccination program. Alternatively, young drug users have shown poor adherence to preventive health behaviors (Seal et al., 2000). In addition, with the implementation of routine HBV vaccination at entry to school and at birth, young people might perceive themselves to be at less risk of getting HBV, resulting in a lower likelihood of getting vaccinated. However, IDUs aged 15–29 years have the highest risk of HBV infection in the United States (Garfein, Vlahov, Galai, Doherty, & Nelson, 1996). This study reveals a need to find additional strategies to improve HBV vaccine coverage in young male homeless populations; these might include, for example, incentives that appeal to men or social contacts.

It is not surprising that homeless adults who were younger and reported participating in self-help drug treatment programs were less likely to adhere to the vaccine regimen. Among homeless persons, youth are most at risk of HBV, HCV, and HIV because of methamphetamine and cocaine use, which are increasing rapidly in younger populations, including homeless persons (Santibanez et al., 2005). These findings are also consistent with literature demonstrating that alcohol and drug users have poor completion rates for preventive therapy (Nyamathi et al., 2006; Ompad et al., 2004). Substance use, particularly methamphetamine and injection drug use, also might be one of the reasons newly homeless Whites were less likely than were African Americans to complete the vaccinations. Another explanation might be lack of social support networks, which may be helpful in adhering to the vaccination series. In addition, newly homeless Whites may not have built up sufficient trust with the minority program staff in the short study period, and lack of trust has been reported to be an important barrier to treatment completion (Altice, Mostashari, & Friedland, 2001). The findings also suggest that newly homeless Whites may have different healthcare needs than those of chronically homeless persons. Designing culturally tailored programs for newly homeless White homeless persons might assist their rates of completion of the hepatitis vaccine series.

Homeless men were also less likely to complete the HAV/HBV vaccination series than were homeless women. As women are more likely to have used health services for reproductive healthcare, stronger healthcare interventions or greater incentives may be needed to achieve high rates of HBV vaccination completion among homeless men. Use of mobile vans to provide health services also might result in higher completion rates in this vulnerable population.

Although the long-term goal is for homeless populations to achieve a 90% or higher HAV/HBV completion rates, strategies for successful outcomes emanate from the findings. These include targeting the groups least likely to complete the vaccine series with culturally competent and gender- and age-sensitive programs. These specific subgroups include the young and newly homeless persons and those who were least likely to seek substance use programs. Finally, considering accelerated time sequence HAV/HBV vaccine series may also be helpful (Keystone & Hershey, 2008).

Surprising findings were that vulnerabilities common among the homeless, such as chronic homelessness, sleeping outdoors, alcohol and drug use, and mental health status, did not affect completion of the hepatitis vaccination series. In fact, nearly all homeless persons in the study reported that they intended to adhere to the vaccination protocol. Thus, service providers should not judge who among the homeless will be the most adherent to treatment programs.

Limitations

The study sample was both a strength and a weakness. Participants were recruited from the Skid Row area of Los Angeles and represent a highly mobile and difficult-to-treat group. External generalizability of the findings to other difficult-to-treat groups and to homeless populations in other cities may be limited. Another limitation was that randomization by individual was not feasible because of concern about contamination across the programs. Although multilevel analyses could not be done because many participants were not sheltered and were highly mobile, sites were stratified into homeless shelter, drug recovery shelter, and outdoor locations before the randomization and the effect of recruitment site or area were further examined in the preliminary analysis. To help account for other contextual characteristics, a mixed-model logistic regression analysis was utilized using site or area as a random effect. An additional limitation was that sites were randomized to programs, whereas analyses were performed by individuals. Finally, control variables were based on self-report, which is subject to well-known biases.

Conclusions

The findings reveal that a culturally sensitive comprehensive program, which included nurse case management plus targeted hepatitis education, incentives, and client tracking, performed significantly better than did a usual care program with an added incentive. As the CHSCP demonstrates, factors which represented select sociodemographic factors (age, gender, and time homeless), resources (physical health), and behaviors (attendance at substance self-help programs) predicted vaccine completion. A program that included client tracking and incentives also promoted vaccine completion; nevertheless, the nurse-case-managed program had the highest odds of HBV vaccine completion compared with those of a standard control program in this study with homeless adults. This study provides additional good news for public health program planners and funders; when funding is limited, it is possible for more than half of homeless clients to complete the 6-month HBV vaccine series if hepatitis education, hepatitis vaccinations, and minimal client incentives are provided.

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FIGURE 1.

The CONSORT diagram showing the flow of participants through each stage of a randomized trial. HBV = hepatitis B virus; NCMIT = nurse-case-managed sessions plus targeted hepatitis education, incentives, and tracking; SIT = standard targeted hepatitis education plus incentives and tracking; SI = standard targeted hepatitis education plus incentives and tracking only.

TABLE 1

Baseline Sample Characteristics of Homeless Adult Participants by Hepatitis Vaccination Program

Characteristics	NCMIT (<i>n</i> = 332)	SIT (<i>n</i> = 281)	SI (<i>n</i> = 252)	Total (<i>n</i> = 865)
Background				
Age, <i>M</i> (<i>SD</i>)	42.8 (8.5)	41.6 (9.4)	42.5 (9.2)	42.3 (9.1)
Male ***	89.5	74.0	62.7	76.7
Ethnicity **				
African American	72.3	60.9	73.8	69.0
White	15.7	15.7	12.3	14.7
Latino	9.9	20.6	11.5	13.9
Other	2.1	2.1	2.4	2.0
High school graduate	74.4	70.1	77.4	73.9
Partnered	26.2	32.0	31.8	29.7
Employed *	7.2	7.8	13.9	9.4
Recruitment site *				
Homeless shelter	34.4	32.0	33.7	33.5
Drug recovery shelter	32.9	38.1	25.0	32.3
Street	32.6	29.5	41.3	34.1
Homeless ≥1 year	64.7	58.2	61.9	61.7
HBV vaccine series				
Definitely intended to adhere	96.1	93.6	95.0	94.9
Completed vaccination **	67.7	60.9	54.0	61.5
Substance use				
Lifetime IDU	17.8	17.1	14.7	16.7
Recent IDU ^a	6.6	5.3	8.3	6.7
Recent non-IDU ^{a, **}	64.5	53.4	51.2	57.0
Recent daily alcohol use ^{a, **}	21.4	11.8	15.1	16.6
Recent daily drug use ^{a, *}	34.3	24.8	28.2	29.6
Fair or poor health	25.3	18.2	23.4	22.4
Recent self-help program	43.7	49.1	40.5	44.5
Psychological resources				
Depressive symptoms ^b	51.2	45.9	51.2	49.5
Poor emotional well-being ^{c, *}	51.2	40.6	47.2	46.6
Social support **				
Primarily drug users	5.4	3.9	5.6	5.0
Primarily nondrug users	63.3	74.4	61.5	66.4
Both	22.9	20.3	26.6	23.4
No one	8.4	1.4	6.4	5.6
Recent trade sex ^{a, **}	21.1	15.3	26.1	20.7
MSM	7.5	4.6	5.6	6.0

Characteristics	NCMIT (<i>n</i> = 332)	SIT (<i>n</i> = 281)	SI (<i>n</i> = 252)	Total (<i>n</i> = 865)
Veteran **	16.9	8.6	12.4	12.9

Note. Values are in %, unless otherwise indicated. NCMIT = nurse-case-managed sessions plus targeted hepatitis education, incentives, and tracking; SIT = standard targeted hepatitis education plus incentives and tracking; SI = standard targeted hepatitis education plus incentives and tracking only; IDU = injection drug users; MSM = men who had sex with men.

^aRefers to the past 6-month period.

^bBased on a CES-D score of 16 or more.

^cBased on a score of 65 or less on a 0–100 scale.

* $p < .05$, chi-square or *t* test for program differences.

** $p < .01$, chi-square or *t* test for program differences.

*** $p < .001$, chi-square or *t* test for program differences.

TABLE 2

Associations Between Baseline Characteristics and Completion of Hepatitis A and B Vaccine

Characteristic	Completed vaccine series (<i>n</i> = 530)	Did not complete vaccine series (<i>n</i> = 335)
Background, <i>M</i> (SD)		
Age ^{***} , <i>M</i> (SD)	43.8 (8.7)	39.9 (8.9)
Male	74.7	80.1
Ethnicity		
African American	71.9	64.8
White	12.3	18.4
Latino	13.2	14.8
Other	2.1	1.8
High school graduate	75.1	72.3
Partnered [*]	32.1	25.9
Employed	9.3	9.6
Recruitment site [*]		
Homeless shelter	33.3	33.7
Drug recovery shelter	28.9	37.4
Street	37.6	28.9
Veteran status	13.8	11.5
Homeless ≥ 1 year [*]	64.8	56.8
Intended to adhere	95.9	93.7
Substance use		
Lifetime IDU	15.9	18.1
Recent IDU ^a	5.5	8.7
Recent daily alcohol use ^a	17.1	21.1
Recent daily drug use ^a	28.5	30.8
Recent non-IDU ^a	57.6	55.7
Recent self-help program ^{a, **}	40.4	50.9
MSM [*]	4.7	8.1
Recent trade sex ^a	21.2	19.7
Psychosocial resources		
Depressive symptoms	48.7	50.6
Poor emotional well-being	47.7	45.2
Social support		
Primary drug user	4.2	6.3
Primary nondrug user	68.3	63.3
Both	22.1	24.7
No one	5.5	5.7

Note. Values are in %, unless otherwise indicated. IDU = injection drug users, MSM = men who had sex with men.

^a Refers to the past 6-month period.

*
 $p < .05$, chi-square or t test for differences between treatment completers and noncompleters.

**
 $p < .01$, chi-square or t test for differences between treatment completers and noncompleters.

TABLE 3Logistic Regression Results for Completion of Hepatitis A and B Vaccination Series ($n = 835$)

	Adjusted odds ratio	95% confidence interval	<i>p</i>
Intervention programs (vs. SI)			
NCMIT	1.85	1.13–3.04	.014
SIT	1.51	0.93–2.44	.095
Age ^a	1.03	1.03, 1.07	.001
Male	0.58	0.37, 0.90	.016
Ethnic background (vs. African American)			
White, newly homeless	0.41	0.21–0.79	.008
White, chronically homeless	1.11	0.65–1.88	.705
Latina	1.21	0.77–1.90	.417
Partnered ^b	1.33	0.94–1.87	.102
Fair or poor health ^c	1.58	1.08–2.31	.019
Recent self-help program ^{d,e}	0.66	0.48–0.90	.010

Note. NCMIT = nurse-case-managed sessions plus targeted hepatitis education, incentives, and tracking; SIT = targeted hepatitis education plus incentives and tracking; SI = targeted hepatitis education plus incentives and tracking only.

^aOne-unit increment.

^bCompared with not having a current partner.

^cCompared with good, very good, or excellent health.

^dRefers to the past 6-month period.

^eCompared with no recent attendance at informal substance abuse treatment meetings.