Hepatitis B Virus Immunization Among Young Injection Drug Users in San Francisco, Calif: The UFO Study

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Hepatitis B virus (HBV) infection is common (44%–80%) in injection drug users (IDUs),[1–8] and younger IDUs are at high risk.[9–11] Although a safe and effective vaccine is available, high vaccine completion rates in IDUs (70%–86%) have been achieved primarily in drug treatment settings.[12–15] Among street-recruited young injectors in San Francisco, Calif, only 13% had serological evidence of prior immunization, and 28% had been infected with HBV.[16]

We combined cash incentives and street outreach with flexible immunization schedules to improve HBV vaccine completion in young injectors in San Francisco. We examined factors associated with vaccine completion and observed postvaccination antibody responses in completers.

METHODS

Subjects were recruited in a San Francisco study of HIV and viral hepatitis (the UFO Study) described elsewhere.[17] Four hundred four IDUs younger than 30 years were interviewed and underwent counseling and serological testing for HIV, HBV, and hepatitis C virus (HCV). Persons without evidence of acute infection, a chronic carrier state, or immunity conferred by antibody to hepatitis B surface antigen (anti-HBs) were recruited. Those declining participation in the study were offered free immunizations.

A 20-μg intramuscular dose of recombinant DNA hepatitis B vaccine was administered at enrollment. Participants were instructed to return in 1 to 2 months for the second dose and then at 4 to 6 months for the third dose; they received $10 cash each time. Street-based outreach workers began delivering follow-up reminders 3 weeks after the first vaccine dose and again 11 weeks after the second dose.

We measured postvaccination anti-HBs seroconversion at 4 weeks after the third dose. We measured vaccine series completion and conducted bivariate analyses of variables associated with vaccine completion. We conducted a multiple logistic regression analysis of significant variables ($P < .10$) and other variables of interest or potential confounders.

RESULTS

Of the 404 persons screened, 265 (66%) were eligible for immunization. Of the

TABLE 1—Bivariate Associations of Selected Demographic Factors and Baseline Serology With Hepatitis B Vaccine Completion Among Young Injectors in San Francisco, Calif (N = 170)

	No. of Completers/n (%)	OR (95% CI)	*P*
All participants	80/170 (47.1)		
Age, y (median = 21; interquartile range = 19–24)			
15–19	26/54 (48.1)	1.00	.40
20–24	31/74 (41.9)	0.78 (0.36, 1.67)	
25–29	23/42 (54.8)	1.30 (0.54, 3.17)	
Sex			
Male	57/120 (47.5)	1.00	.86
Female	23/50 (46.0)	0.94 (0.46, 1.92)	
Race (n = 169)			
White	64/142 (45.1)	1.00	.32
Non-White	15/27 (55.6)	1.52 (0.62, 3.77)	
Education (n = 169)			
< High school	40/85 (47.1)	1.00	.94
High school graduate	26/53 (49.1)	1.08 (0.51, 2.28)	
Some college	14/31 (45.2)	0.93 (0.37, 2.29)	
Months lived in San Francisco			
< 3	31/86 (36.0)	1.00	< .01
≥ 3	49/84 (58.3)	2.48 (1.28, 4.84)	
Prior HIV test			
No	7/30 (23.3)	1.00	< .01
Yes	73/140 (52.1)	3.58 (1.35, 9.87)	
HIV antibody (n = 169)			
Negative	79/168 (47.0)	. . .	.29
Positive	1/1 (100.0)		
Hepatitis B antibody			
Negative	75/163 (46.0)	1.00	.19
Positive	5/7 (71.4)	2.93 (0.46, 31.45)	
Hepatitis C antibody (n = 169)			
Negative	46/112 (41.1)	1.00	.04
Positive	33/57 (57.9)	1.97 (1.03, 3.77)	

Note. OR = odds ratio; CI = confidence interval.

vaccine-eligible persons, 211 (80%) returned for their test results, and 170 of the 211 (81%) participants consented to enrollment. Participants did not differ from nonparticipants by demographics, serology, or injecting and sexual behavior (data not shown). Median age was 21 years, 84% were White, and 71% were male (Table 1). Most were new to San Francisco and unstably housed. During the prior year, 57% had been incarcerated. HIV-positive test results were found in 0.6%; 34% were anti-HCV positive. Most were frequent heroin injectors, and 76% attended syringe exchange programs in the last 30 days (Table 2). Thirty percent were gay or bisexual, and 8% had traded sex for money or drugs in the last 30 days.

Vaccine Completion

Of the 170 participants, 128 (75%) received the second vaccine dose, and 80 (47%) completed the series. The median time to the second dose was 5 weeks (interquartile range [IQR]=4–8 weeks) and the median time to the third dose was 21 weeks (IQR=17–26 weeks).

Vaccine completers were more likely to have lived in San Francisco for 3 or more months, to have received prior HIV testing, and to have anti-HCV-positive test results (Table 1). Completers were more likely to inject drugs daily, to attend syringe exchange programs, and to have had sex with another IDU (Table 2). They were less likely to receive new needles from friends ("kickdowns") or to purchase needles from a pharmacy. Completers also were more likely to report that they could rely on outreach workers for social support and marginally more likely to report that they could rely on syringe exchange program staff (Table 3).

On multivariate analysis, vaccine completion was associated with living in San Francisco for 3 months or longer (adjusted odds ratio [OR]=2.41; 95% confidence interval [CI]=1.20, 4.82), with prior HIV testing (adjusted OR=2.79; 95% CI=1.05, 7.41), and with outreach worker social support (adjusted OR=2.49; 95% CI=1.23, 5.05). Vaccine completion was less likely in persons receiving "kickdowns" (adjusted OR=0.43; 95% CI=0.21, 0.87).

Vaccine Response

Protective vaccine responses (anti-HBs ≥ 10 mIU/mL) were observed in 38 of 49 (78%) completers, including 12 of 17 (71%) completers who were anti-HCV positive and 26 of 32 (81%) who were anti-HCV negative (OR=0.55; 95% CI=0.12, 2.82).

DISCUSSION

With street-based outreach and $10 incentives, 75% of the young injectors received their second vaccine dose, and 47% completed a flexible HBV immunization schedule. These figures compare favorably with completion rates among street-recruited IDUs elsewhere: 27% in Washington[18] and 31% in Alaska.[19] Completion rates in non-IDUs are comparably low: 11% at a teenage clinic,[20] 17% to 38% at sexually transmitted disease clinics,[21–26] and 30% at correctional facilities.[25]

Geographic stability, HIV testing, reliance on outreach workers, and syringe sources were independently associated with vaccine completion. Young IDUs residing longer in San Francisco may have more stable

TABLE 2—Bivariate Associations of Injecting and Sexual Behavior With Hepatitis B Vaccine Completion Among Young Injectors in San Francisco, Calif (N = 170)

	No. of Completers/n (%)	OR (95% CI)	P
Injecting behavior			
Years injecting (median = 4; interquartile range = 1–7)			
0–1	18/49 (36.7)	1.00	.07
2–3	15/29 (51.7)	1.85 (0.66, 5.21)	
4–5	13/32 (40.6)	1.18 (0.43, 3.24)	
6–7	16/26 (61.5)	2.76 (0.93, 8.29)	
8–9	6/16 (37.5)	1.03 (0.28, 3.82)	
≥ 10	12/18 (66.7)	3.44 (0.97, 12.63)	
Frequency of injection			
< Daily	48/116 (41.4)	1.00	.03
Daily	32/54 (59.3)	2.06 (1.02, 4.19)	
Ever borrowed a used syringe			
No	25/57 (43.9)	1.00	.55
Yes	55/113 (48.7)	1.21 (0.61, 2.42)	
Exchanged syringes, last 30 days			
No	21/63 (33.3)	1.00	<.01
Yes	59/107 (55.1)	2.46 (1.23, 4.96)	
Exchanged at established SEP, last 30 days			
No	40/102 (39.2)	1.00	
Yes	40/68 (58.8)	2.21 (1.13, 4.35)	.01
Exchanged at underground SEP, last 30 days			
No	41/100 (41.0)	1.00	
Yes	39/70 (55.7)	1.81 (0.93, 3.52)	.06
Exchanged with outreach worker or friend, last 30 days			
No	50/101 (49.5)	1.00	.44
Yes	30/69 (43.5)	0.78 (0.40, 1.52)	
Received new syringes from friends, last 30 days (n = 169)			
No	58/107 (54.2)	1.00	
Yes	22/62 (35.5)	0.46 (0.23, 0.93)	.02
Purchased new syringes on street, last 30 days			
No	53/117 (45.3)	1.00	.50
Yes	27/53 (50.9)	1.25 (0.62, 2.53)	
Sexual behavior			
Sexual orientation (n = 168)			
Heterosexual	51/117 (43.6)	1.00	.26
Gay or bisexual	27/51 (52.9)	1.46 (0.71, 2.97)	
Years sexually active (n = 161)			
≤ 5	24/59 (40.7)	1.00	.17
> 5	53/102 (52.0)	1.58 (0.78, 3.18)	
Ever diagnosed with a sexually transmitted disease (n = 165)			
No	58/126 (46.0)	1.00	.77
Yes	19/39 (48.7)	1.11 (0.51, 2.43)	
Traded sex for money or drugs, last 6 mo			
No	70/156 (44.9)	1.00	.06
Yes	10/14 (71.4)	3.07 (0.84, 13.91)	

Continued

lifestyles, making a 6-month intervention more feasible. Had this intervention been limited to those living in San Francisco for 3 months or more, completion would have been 58%. Young IDUs who can rely on outreach workers may have greater engagement with social service agencies. Their vaccine adherence underscores the important work of these organizations. Immunizations also may be more acceptable to injectors, who identify with a drug culture and engage in other prevention activities, such as HIV testing and syringe exchange programs. Indeed, 30 of 36 (83%) syringe exchange program–recruited participants in New York completed the vaccine series.[19] Less established injectors may not recognize their high risk of infection and may think that immunizations are unwarranted.

Only 78% of the vaccine completers underwent anti-HBs seroconversion, compared with 99% reported by vaccine manufacturers.[27] These figures raise concerns about blunting of young injectors' immune responses. Suboptimal responses (58%–76%) have been noted among IDUs elsewhere.[28,29] Although higher immunogenicity is associated with younger age, young IDUs are more likely than other young people to have poorer health and altered immunity. We observed a lower vaccine response among participants who were anti-HCV positive, but numbers were too small for significance. Other studies, however, have suggested that HCV infection may diminish the HBV vaccine response.[30–32]

Strategies to improve HBV vaccine completion and response in young IDUs are urgently needed, given the high incidence of co-infection with HBV and HCV[10,17,33–35] and of accelerated liver damage in co-infected subjects.[36–40] Higher vaccine doses (40 μg) and accelerated schedules have been used successfully among hemodialysis patients[41] and alcoholic patients[42] and may be effective for young IDUs. Young injectors are a challenging population in which to implement interventions aimed at preventing blood-borne infections. We suggest that a combination of street outreach and financial incentives may be important components of immunization programs for young injectors in other cities. ■

TABLE 2—*Continued*

	No. of Completers/n (%)	OR (95% CI)	*P*
Sex with another injector, last 6 mo			
No	15/44 (34.1)	1.00	.05
Yes	65/126 (51.6)	2.06 (1.01, 4.21)	
No. of sexual partners, last 6 mo			
0	11/21 (52.4)	1.00	.81
1	33/71 (46.5)	0.79 (0.27, 2.32)	
>1	36/78 (46.2)	0.78 (0.27, 2.26)	
<100% condom use for vaginal or anal sex, last 6 mo			
No	14/31 (45.2)	1.00	.85
Yes	56/119 (47.1)	1.08 (0.46, 2.57)	

Note. OR = odds ratio; CI = confidence interval; SEP = syringe exchange program.

TABLE 3—Bivariate Associations of Social Supports With Hepatitis B Vaccine Completion Among Young Injectors in San Francisco, Calif (n = 160)

	No. of Completers/n (%)	OR (95% CI)	*P*
Can rely on family			
No	37/65 (56.9)	1.00	.04
Yes	38/95 (40.0)	0.51 (0.26, 1.02)	
Can rely on main sexual partner or spouse (n = 159)			
No	33/70 (47.1)	1.00	1.00
Yes	42/89 (47.2)	1.00 (0.51, 1.97)	
Can rely on friends (n = 159)			
No	10/24 (41.7)	1.00	.56
Yes	65/135 (48.1)	1.30 (0.50, 3.42)	
Can rely on outreach worker (n = 159)			
No	22/63 (34.9)	1.00	.01
Yes	53/96 (55.2)	2.30 (1.13, 4.67)	
Can rely on SEP staff (n = 159)			
No	27/69 (39.1)	1.00	.07
Yes	48/90 (53.3)	1.78 (0.90, 3.54)	

Note. OR = odds ratio; CI = confidence interval; SEP = syringe exchange program; no response = not much, none, or not applicable; yes response = some, very much, totally.

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Contributors

P.J. Lum designed and conducted the study, analyzed and interpreted the data, and wrote the brief. K.C. Ochoa participated in the design and execution of the study and the interpretation of the data. J.A. Hahn and J.L. Evans participated in the statistical analysis and interpretation of the data. K. Page Shafer and A.R. Moss participated in the design of the study, the interpretation of the data, and the revision of the brief.

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Human Participant Protection

The study was approved by the Committee on Human Research at the University of California, San Francisco.

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