MAJOR ARTICLE

Lack of Behavior Change after Disclosure of Hepatitis C Virus Infection among Young Injection Drug Users in Baltimore, Maryland

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We evaluated behavior change after disclosure of a positive hepatitis C virus (HCV) antibody test result among a cohort of young injection drug users (IDUs). Participants underwent semiannual interviews, human immunodeficiency virus (HIV) and HCV antibody testing, and pretest and posttest counseling. We used χ^2 statistics to study changes in the frequencies of high-risk behaviors from baseline to a 6-month follow-up visit among 46 IDUs who had a positive HCV test result and among 60 IDUs who did not have a positive HCV test result or who were unaware of their test result. No significant differences were detected between the 2 groups. Both groups continued to share syringes, needles, and other injection paraphernalia. These findings suggest that young IDUs may not be aware of the risk of HCV infection and highlight the urgent need for post–HCV test guidelines and behavioral interventions to reduce ongoing high-risk behavior that perpetuates the risk of HCV transmission.

Approximately 3.9 million residents of the United States are infected with the hepatitis C virus (HCV), which corresponds to a prevalence rate of 1.8%, according to estimates from the Third National Health and Nutrition Examination Study [1]. The prevalence of HCV is ~65%–90% among injection drug users (IDUs) [2–5]. Injection drug use accounts for >60% of all HCV infections nationwide [6].

IDUs engage in a variety of behaviors that place them at risk for HCV infection through parenteral exposure. Previous studies have shown strong associations between acquisition of HCV infection and sharing of drug paraphernalia—both "direct" sharing of needles and syringes and "indirect" sharing of paraphernalia such as drug cookers and cotton filters [1, 2, 7–9]. HCV transmission is also closely associated with duration of injection drug use: among persons newly initiated into illicit-drug injection in Baltimore, MD, 65% had acquired HCV infection within 1 year after beginning to inject drugs [10]. Since many studies have shown that new IDUs are also at higher risk of acquiring infections with HCV and other bloodborne pathogens, such as HIV and hepatitis B virus, there is an urgent need to tailor interventions to this vulnerable subgroup.

We aimed to investigate changes in the frequencies of high-risk behaviors associated with HCV transmission (i.e., direct and indirect sharing of injection paraphernalia) after disclosure of a positive HCV antibody test result among young, recently initiated IDUs. We also assessed changes in alcohol consumption among persons with a positive HCV antibody test result, because heavy alcohol use is a documented risk factor for HCV-related cirrhosis and end-stage liver disease [11, 12].

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PARTICIPANTS AND METHODS

Participants. This report is based on a post hoc analysis of data from the Risk Evaluation and Community Health (REACH) II Study, which is a study of HIV risk among young, recently initiated IDUs in Baltimore that has been described elsewhere [13, 14]. In brief, 226 IDUs enrolled in the REACH II Study between July 1997 and May 1999. To be eligible for the study, participants were required to be 15–30 years old, to have initiated injection drug use ⩽5 years prior to study entry, to have injected illicit drugs at least once in the previous 6 months, and to provide informed consent. This study was approved by the Johns Hopkins School of Public Health (Baltimore, MD) institutional review board prior to initiation of any research.

Data collection. At baseline, participants underwent face-to-face interviews with trained interviewers to ascertain data on demographic characteristics and high-risk behavior and underwent venipuncture. Blood samples were tested for HCV antibodies using an EIA (Ortho Diagnostics HCV EIA, version 3) and for HIV antibodies using EIA (Vironostika) and confirmatory Western blot (Novapath; Biorad). Pretest counseling was conducted by certified HIV counselors at the time that phlebotomy was performed.

The questionnaire collected data on demographic characteristics, drug use, and high-risk sexual behaviors during the previous 6 months. Alcohol dependence was also measured at baseline using 10 questions from the National Household Survey of Drug Abuse [15]. These questions were used to collect data on the 6 months prior to the interview from those individuals who reported using alcohol during that period. Participants who met ⩾3 of the alcohol-dependence criteria in the *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition* were considered to be alcohol dependent.

Follow-up evaluations were conducted 6 months after the baseline visit. At follow-up visits, participants underwent face-to-face interviews with trained interviewers to ascertain data on demographic characteristics and high-risk behavior. Those who initially tested negative for HIV and/or HCV antibody were retested to determine incidence rates.

Counseling and testing. Two weeks after the baseline visit, participants returned for their HIV and HCV antibody test results and were given posttest counseling. Standard HIV counseling and testing procedures were followed, including risk-reduction counseling, in accordance with guidelines from the Centers for Disease Control and Prevention (CDC) [16]. Information on the hours of operation and the location of the Baltimore City Needle Exchange Program was provided. Substance abuse treatment was discussed during harm-reduction counseling, and referrals were provided on request.

All participants received additional information on HCV infection, including details on the natural history of HCV infection and the high infectivity rate of HCV, as compared with HIV. Participants were counseled to avoid sharing needles, syringes, and other injection equipment to reduce the risk of HCV transmission and were counseled to use needle exchange programs.

If a participant was found to test positive for HCV antibody, they were referred to a counselor with expertise in HCV infection. This HCV specialist discussed what was known about the natural history of HCV disease and counseled participants to reduce or cease alcohol use, in order to lessen the risk of progressive liver disease. Safe injection practices were encouraged. HCV-positive participants could see a physician for treatment if they wanted to do so, but, unfortunately, at that time treatment options were limited and not very promising. Furthermore, at that time treatment for active drug users was not recommended.

Statistical analysis. To evaluate behavior change after disclosure of a positive HCV test result, we compared participants who tested positive for HCV antibody at baseline and received their HCV test result at least 3 months prior to their 6-month follow-up visit (designated the "HCV group"; $n = 46$). Participants who tested negative for HCV antibody at baseline ($n = 50$) and participants who tested positive for HCV antibody at baseline but did not receive their HCV test result at least 3 months prior to their 6-month follow-up visit ($n = 10$) were designated the "non-HCV group" ($n = 60$). Participants who did not receive their HCV test results prior to their 6-month follow-up visit (e.g., participants who did not return for the scheduled results visit but returned for the 6-month follow-up visit) were excluded from the study, in an effort to ensure that the majority of the behaviors engaged in during the intervening time period were reported by participants with knowledge of their HCV serostatus.

Student's t test and contingency table analysis were used to evaluate behavior change between baseline and follow-up study visits in the HCV and non-HCV groups. Specifically, we investigated whether significant behavior changes had occurred during the follow-up period with respect to direct sharing of needles and/or syringes and indirect sharing of needles (i.e., when "backloading," which is the injection of prepared drugs from one syringe into the barrel of another syringe for the purpose of measuring and splitting drugs), cookers, cotton filters, and rinse water. We also investigated changes in alcohol consumption. The frequency of behaviors associated with direct and indirect sharing of paraphernalia was categorically measured with use of a 5-point scale ("never," "less than half the time," "about half the time," "more than half the time," and "always"). Alcohol intake was measured as ounces of alcohol ingested per week. Behavior change variables were determined by comparing the frequencies of high-risk behaviors at baseline and at follow-up. These variables were categorical and were as follows: "no

change," "increase," "decrease," and "not applicable" (i.e., the subject did not report engaging in the behavior at either time point). *P* values for contingency tables were calculated using Pearson's χ^2 statistic, unless cell sizes were small ($\leq$5 people per cell), in which case Fisher's exact test was used. Associations were considered significant if the *P* value was $\leq$.05.

RESULTS

Among the participants of the REACH II Study ($n = 226$), the majority of subjects were African American (61%) and female (64%). The mean age at enrollment was 26 years. The median age at first use of injection drugs was 23 years (range, 10–30 years), and the median length of time that participants had been injecting drugs at the time of study enrollment was 2.1 years (range, 7 days–5.6 years). The baseline prevalences of HCV and HIV infection were 60.5% and 10.6%, respectively; 7.7% of participants were coinfected with both HCV and HIV. The incidence of HCV infection was 19.7 cases per 100 person-years (95% CI, 7.3–30.5). The incidence of HIV infection was 6.6 cases per 100 person-years (95% CI, 2.2–13.3).

The baseline demographic characteristics of the HCV and non-HCV groups ($n = 106$) were similar with respect to sex, age, homelessness, and alcohol dependence (table 1). At baseline, ~43% of participants were alcohol dependent, according to the criteria of the *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition*. Compared with participants in the non-HCV group, participants in the HCV group were significantly less likely to be African American (67.4% vs. 85.0% of participants; $P = .032$) and more likely to have at least a 12th-grade education (47.8% vs. 28.3% of participants; $P = .039$).

We next investigated self-reported behavior changes between the baseline visit (i.e., prior to notification of HCV serostatus) and the 6-month follow-up visit (i.e., after notification of HCV serostatus) (table 2). Overall, participants reported only slight decreases in direct sharing of needles and/or syringes: 17.0% of participants reported decreasing their frequency of sharing needles. In addition, we observed some decrease in indirect sharing: 15.1% of participants reported decreasing their frequency of backloading. Compared with participants in the non-HCV group, participants in the HCV group were less likely to reduce their frequency of backloading, although this observation was not statistically significant. However, large proportions of HCV-infected individuals reported increasing or not changing the frequency of backloading (76.1%) and needle sharing (34.8%).

Moderate decreases in indirect sharing of injection equipment were observed: 29.3% of participants reported decreasing the sharing of drug cookers, 23.6% reported decreasing the sharing of cotton filters, and 26.4% reported decreasing the sharing of rinse water. Again, more participants in the HCV group had decreased their sharing of cookers and rinse water, compared with the non-HCV group. More than 50% of the HCV group increased or did not change their frequency of sharing cookers and rinse water. More than 45% of the HCV group increased or did not change their frequency of sharing cotton filters.

Although 38.7% of the study subjects reported a decrease in their alcohol intake (and a higher proportion of participants in the non-HCV group than in the HCV group), 24.5% actually increased or reported no change in their alcohol intake. Of those individuals in the HCV group who were classified as alcohol dependent at baseline ($n = 22$), one-half did not change or increased their alcohol intake.

Fifteen percent (7 of 46) of the HCV group were HIV infected. In recognition of this small number, we conducted a subanalysis to investigate the possibility that persons coinfected

Table 1. Baseline demographic characteristics of young persons recently initiated into injection drug use in Baltimore, Maryland.

Characteristic	Total ($n = 106$)	HCV group ($n = 46$)	Non-HCV group ($n = 60$)	*P*
Age at study entry, mean years ± SD	25.96 ± 3.21	25.46 ± 3.40	26.35 ± 3.03	.157
Sex				.735
Male	33.0	34.8	31.7	
Female	67.0	65.2	64.3	
Race				.032
African American	77.4	67.4	85.0	
White or other	22.6	32.6	15.0	
Education				.039
<12th grade	63.2	52.2	71.7	
⩾12th grade	36.8	47.8	28.3	
Homeless in the past 6 months	16.0	11.4	15.0	.739
Alcohol dependent	43.4	47.8	43.3	.645

NOTE. Data are percentage of study subjects, unless indicated otherwise.

Table 2. Behavior changes among young persons recently initiated into injection drug use in Baltimore, Maryland.

High-risk behavior, change variable	Percentage of subjects			P
	Total (n = 106)	HCV group (n = 46)	Non-HCV group (n = 60)	
Needle sharing				.083[a]
None	50.0	54.4	46.7	
No change	10.4	17.4	5.0	
Increase	22.6	17.4	26.7	
Decrease	16.9	10.9	21.7	
"Backloading"				.823[a]
None	5.7	6.5	5.0	
No change	59.4	54.4	63.3	
Increase	19.8	21.7	18.3	
Decrease	15.1	17.4	13.3	
Sharing drug cookers				.418
None	22.6	17.4	26.7	
No change	21.7	28.3	16.7	
Increase	26.4	23.9	28.3	
Decrease	29.3	30.4	28.3	
Sharing cotton filters				.961
None	29.3	28.3	30.0	
No change	19.8	19.6	20.0	
Increase	27.4	26.1	28.3	
Decrease	23.6	26.1	21.7	
Sharing rinse water				.565
None	26.4	23.9	28.3	
No change	17.9	23.9	13.3	
Increase	29.3	28.3	30.0	
Decrease	26.4	23.9	28.3	
Alcohol consumption				.112[a]
None	36.8	47.8	28.3	
No change	2.8	4.4	1.7	
Increase	21.7	15.2	26.7	
Decrease	38.7	32.6	43.3	

NOTE. Data for some behaviors in a group sometimes do not equal 100% because of rounding. "Backloading," injecting prepared drugs from one syringe into the barrel of another syringe for the purpose of measuring and splitting drugs.

[a] Calculated using Fisher's exact test.

with HIV and HCV were more likely to demonstrate a behavior change. Although the difference was not significant, those infected with HIV and HCV were more likely to decrease their frequency of direct sharing of needles and indirect sharing of other injection paraphernalia (i.e., cookers, cotton filters, and rinse water).

DISCUSSION

In our study of young IDUs who were seropositive for HCV antibody and were informed of their serostatus, reductions in direct sharing of needles were observed for fewer than one-fifth of the study subjects, suggesting that risk reduction counseling is of limited benefit. We observed that many HCV-infected persons failed to reduce the frequencies of high-risk behaviors, such as direct sharing of needles and/or syringes and indirect sharing of injection equipment. Specifically, at the 6-month follow-up visit, almost three-quarters of participants reported that they continued to practice backloading at the same or an increased rate as at baseline. This pattern was especially apparent among HCV-infected subjects aware of their serostatus, of whom >75% continued to practice backloading

at the same or an increased rate and more than one-third continued to share needles. Our findings are similar to those of a cross-sectional study conducted in France, which reported that HCV-positive IDUs aware of their serostatus were more likely to lend and borrow injection paraphernalia [17].

In the summer of 2001, the CDC published its National Hepatitis C Prevention Strategy [18]. Among the many points in the CDC's comprehensive plan, education, counseling, and testing feature prominently. Our findings suggest that a more comprehensive approach to HCV prevention is clearly warranted.

Although the risk of HCV transmission through sharing of needles and syringes has been known for some time, a recent study reported that indirect sharing of injection equipment (i.e., cookers and cotton filters) accounted for more than one-half of the new HCV infections observed among IDUs in Seattle [19]. Our finding that more than one-half of the HCV-infected individuals in our sample continued to share cotton filters and >40% continued to share cookers underscores the need for targeted behavioral interventions to reduce these high-risk behaviors. In particular, young IDUs may be unaware of the transmission risks associated with indirect sharing of injection equipment.

Previous studies have indicated that alcohol consumption may play an important role in HCV disease progression. Khan and Yatsuhashi [11] reported a 1.5–2.5-fold increased risk for liver cirrhosis among subjects with HCV infection who drank moderate or large amounts of alcohol, compared with subjects with HCV infection who did not drink alcohol. A recent study by our group found a >3-fold increased risk of end-stage liver disease among HCV-positive IDUs who drank >260 g of alcohol per week [12]. In the present study, we found that 48% of the young IDUs who were aware of their positive HCV-antibody status were alcohol dependent at baseline. Furthermore, one-half of these subjects increased or did not change their alcohol consumption after being informed that they were HCV positive. Coupled with the previous findings, this suggests that many HCV-infected IDUs may be at high risk for liver cirrhosis, if they continue such rates of alcohol consumption. However, participants in our study initiated injection drug use during the 5 years before study enrollment and, therefore, probably acquired HCV within those 5 years [7, 20]. Because HCV-associated liver cirrhosis is not an immediate consequence of HCV infection, early identification of infection presents a valuable opportunity to reduce alcohol consumption and to ameliorate disease progression among young IDUs.

It is important to note that this study is a post hoc analysis of data from a study designed to investigate the natural history of HIV infection among young IDUs and to describe factors predicting transition into injection drug use. This was not a study to assess the impact of HCV counseling and testing on behavior change. However, in the absence of such a study, our findings provide valuable insight into the effectiveness of current HCV counseling and testing practices.

Despite the fact that our study is limited by small sample size, our data provide an indication of the impact of current HCV counseling practices. Since our study sample comprised young individuals who were active drug users at enrollment, our findings may not be generalizable to older drug users or to other settings. In particular, women and African Americans were overrepresented in our sample. Nevertheless, this is the first prospective study, to our knowledge, that reports trends in behavior change after disclosure of HCV serostatus. Although Vidal-Trécan and colleagues [17] found similar associations, their study was limited to self-reported HCV status and could not describe risk-reduction and counseling messages that may have been provided.

Our findings suggest that routine HIV counseling and testing, with the addition of information on HCV, may not be enough to change the frequency of high-risk behaviors among young IDUs. Young HCV-positive IDUs continue to engage in behaviors that can result in transmission of HCV to others, while HCV-negative IDUs continue to engage in behaviors that place them at risk for HCV acquisition. National guidelines for HCV testing and pretest and posttest counseling have not yet been implemented, and, thus, their potential impact on behavior change is unknown.

Experience from the HIV epidemic suggests that targeted behavioral interventions will be needed to generate and sustain significant reductions in high-risk behaviors, lest these behaviors contribute to further transmission of HCV and other bloodborne infections. Examples of such interventions among IDUs are those that intervene in peer networks or dyads by use of appropriate theoretical models of behavior change [21–23]. Latkin et al. [21] used social influence processes to influence individual risk behaviors through the social network of IDUs. Substance abuse treatment, education, counseling, and testing should be bolstered with skills training for IDUs. Specifically, behavioral interventions are needed to provide practical training in the negotiation and implementation of harm-reduction strategies. Finally, expanded access to HCV therapy for IDUs is needed [24] and could conceivably reduce the probability of HCV transmission by reducing virus loads in IDUs.

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