Risky Sexual Behavior, Bleeding Caused by Intimate Partner Violence, and Hepatitis C Virus Infection in Patients of a Sexually Transmitted Disease Clinic

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Objectives. We sought to investigate independent contributions of risky sexual behaviors and bleeding caused by intimate partner violence to prediction of HCV infection.

Methods. We conducted a case–control study of risk factors among patients of a sexually transmitted disease clinic with and without HCV antibodies, group-matched by age.

Results. Multivariate analyses indicated that Black race (odds ratio [OR] = 2.4; 95% confidence interval [CI] = 1.3, 4.4), injection drug use (OR = 20.3; 95% CI = 10.8, 37.8), sharing straws to snort drugs (OR = 1.8; 95% CI = 1.01, 3.0), sharing razors (OR = 7.8; 95% CI = 2.0, 31.0), and exposure to bleeding caused by intimate partner violence (OR = 5.5; 95% CI = 1.4, 22.8) contributed significantly to the prediction of HCV infection; risky sexual behavior and exposure to blood or sores during sexual intercourse did not.

Conclusions. HCV risk among patients of a sexually transmitted disease clinic can be explained by direct blood exposure, primarily through injection drug use. Exposure to bleeding caused by intimate partner violence may be a previously unrecognized mechanism for HCV transmission associated with risky sexual behavior. (*Am J Public Health.* 2009;99:S173–S179. doi:10.2105/AJPH.2007.126383)

Investigations of acute cases of HCV infection from 1991 to 1995 by the Centers for Disease Control and Prevention have indicated that risk factors for HCV transmission can be identified approximately 90% of the time.[1] The majority are associated with high-risk drug use: 54% through injection drug use and 5% through snorting drugs. Other risk factors include sexual contact with a partner who is positive for HCV antibodies (anti-HCV positive; 15%), a history of sexually transmitted diseases (4%), occupational exposure (4%), household contacts (3%), and having received blood products prior to 1987 or blood transfusions prior to 1992 (4%). The nature of HCV transmission among injection drug users (IDUs; i.e., exposure to contaminated blood through shared drug paraphernalia) is well documented, whereas HCV transmission through sexual contact with sexual partners is less understood.[2]

RNA for HCV has been detected in both semen[3] and saliva,[4] but epidemiological studies have indicated that sexual transmission of HCV is rare and may depend upon the presence of other risk factors. For example, HCV transmission from an infected to an uninfected partner is seldom observed among heterosexual couples who are in long-term, monogamous relationships.[5,6] By contrast, a US national study showed that risk of HCV infection was about 5 times higher (odds ratio [OR] = 5.2; 95% confidence interval [CI] = 1.5, 18.2) for persons who had 20 or more lifetime sexual partners compared with persons who had fewer lifetime sexual partners, after control for intravenous and nonintravenous drug use, blood transfusions before 1992, poverty, race/ethnicity, age, gender, and place of birth.[7]

Recent studies of high-risk sexually transmitted disease (STD) clinic populations have yielded inconsistent findings. On the one hand, D'Souza et al. reported that sexual risk factors significantly associated with anti-HCV positivity at the univariate level were no longer significant after adjustment for drug use and a history for transfusion, indicating that much of the association between risky sexual behavior and HCV infection could be attributed to the association of risky sexual behavior with drug use.[8] On the other hand, Gunn et al. observed a significant relation between having sexual intercourse with a partner who injected drugs and HCV antibodies in STD clinic patients who did not have a history of injection drug use.[9] and Weisbord et al. reported that having with an HCV-positive partner was still significantly related to HCV infection after adjustment for injection drug use.[10]

Studies in another high-risk population, men who have sex with men (MSM), suggest that coinfection with HIV increases the risk of sexual HCV transmission. Cohort studies of MSM with a low prevalence of HIV positivity found a low incidence of HCV among non-IDUs, suggesting that HCV is not readily transmitted by sexual activity between men.[11–13] However, data from the large Swiss HIV Cohort Study revealed that unsafe sexual activity was significantly related to acquisition of HCV among non-IDUs who contracted HIV by having sex with a man who was an MSM, and risk of HCV conversion was higher among younger MSM.[14] Recent case reports found that acute HCV infections among MSM who were positive for HIV were associated with nonintravenous drug use during sexual intercourse, unprotected active and passive fisting potentially leading to mucosal damage, and concomitant STDs (e.g., rectal lymphogranuloma venereum or syphilis).[15–17] These findings suggest that sexual transmission of HCV may be enhanced by behaviors associated with bleeding during sexual activity and by immune deficiencies that promote high titers of HCV in men who are positive for both HIV and HCV or may increase the susceptibility of their partners who are HIV positive but HCV negative.

We sought to determine whether detailed questions about risky sexual behavior among STD clinic patients (e.g., asking about exposure to bleeding or sores during sexual activity) would shed light on practices that might be involved in sexual transmission of HCV. We

also sought to investigate the possibility that HCV transmission between sexual partners might take place via exposure to bleeding caused by intimate partner violence, rather than or in addition to unsafe sexual practices. This mechanism was suggested by a case report of HCV transmitted via a bloody fist fight[18] and research indicating that risky sexual behavior (e.g., having multiple sexual partners) is positively associated with intimate partner violence.[19–21] To address these questions we conducted a case–control study with data from a study of alcohol and drug use, risky sexual practices, intimate partner violence, and other risk factors for HCV transmission in STD clinic patients.

METHODS

Procedures

Data on patients of a publicly funded, inner-city STD clinic in western New York State were collected from January 2001 through January 2004 (Table 1). All patients were screened for HCV antibodies with Abbott anti-HCV EIA 2.0 (Abbott Laboratories, Abbott Park, IL). A history of HCV infection was confirmed by one of the following tests: COBAS AMPLICORE HCV Quantitative RNA PCR analysis (F. Hoffman-LaRoche Ltd, Basel, Switzerland), COBAS AMPLICOR HCV Qualitative PCR analysis (F. Hoffman-LaRoche Ltd, Basel, Switzerland), or CHIRON RIBA* HCV 3.0 (Novartis Vaccines & Diagnostics Inc, Emeryville, CA). Of 7860 unique patients seen during the study period, 266 were anti-HCV positive for a prevalence rate of 3.4%. Clinic nurses used a brief computerized questionnaire to screen 6731 patients (86%) for alcohol use and illicit drug use as part of their routine care. They also checked for tattoos and evidence of injection drug use during the patient's physical examination. All anti-HCV–positive patients and a systematic sample of anti-HCV–negative patients (N=1769) were selected for a computer-assisted self-interview to obtain data on frequent casual sexual activity, sexual activity with high-risk partners, exposure to blood or sores during sexual activity, intimate partner violence, blood transfusions prior to 1992, and sharing razors or toothbrushes. The computer-assisted self-interview was administered in a private room; a research nurse was available to answer questions and to read the interview questions to any participants who wanted help. Participants were guaranteed confidentiality and compensated for their time.

TABLE 1—Sample Sociodemographic Characteristics and HCV Risk Factors According to HCV Antibody (Anti-HCV) Status Among Patients of an STD Clinic: Western New York State, 2001–2004

	Anti-HCV Positive (n = 170)	Anti-HCV Negative (n = 345)
Men, %	68.1	60.0
Age, mean (SD)	43.9* (7.4)	42.0 (9.5)
Black, %	74.7**	62.3
Education, %		
Less than high school	31.2	24.3
High school diploma or GED	31.2	31.3
More than high school	37.6	44.3
Marital status, %		
Single	74.7	76.5
Married	13.5	13.3
Divorced or widowed	11.8	10.1
Sexual orientation, %		
Heterosexual	87.6	90.7
Homosexual	4.1	5.2
Bisexual	8.2	4.1
Frequent casual sexual intercourse, mean (SD)	4.0*** (1.3)	3.5 (1.3)
Lifetime prevalence (ever vs never experienced), %		
Injection drug use	65.3***	6.4
Received blood transfusion before 1992	8.8	8.4
Shared razors	35.3***	12.5
Shared toothbrushes	31.8*	21.4
Tattooed under nonsterile conditions	10.0**	2.6
Shared straws to snort drugs	56.5***	23.5
Sexual intercourse with high-risk persons	77.6***	46.1
Exposed to blood during sexual activity	74.7	67.0
Exposed to sores during sexual activity	21.2	18.3
Minor intimate partner violence[a]	90.0**	80.0
Severe intimate partner violence[b]	73.0***	57.4
Intimate partner violence with injuries[c]	69.4***	52.2
Bleeding caused by intimate partner violence	67.1***	43.5

Note. GED = general equivalency diploma; STD = sexually transmitted disease. Data on HIV status we are not tabled; only 3 participants were positive for HIV. Two of the 3 were also positive for anti-HCV, and both had injected drugs; the other was negative for anti-HCV and had not injected drugs. *P* values were obtained by using the χ^2 test for percentages and analysis of variance for means.
[a]For example, slapping or shoving.
[b]For example, beating up or using a knife or gun.
[c]For example, needing to see a doctor or breaking a bone.
*$P < .05$; **$P < .01$; ***$P < .001$.

Sample

Interviews were completed with 172 anti-HCV–positive case participants (65%), and 1095 anti-HCV–negative control participants (62%). All but 2 patients completed the interview on their own. An analysis for response bias comparing anti-HCV–positive and anti-HCV–negative patients who were and were not interviewed indicated minor differences in demographic characteristics, STD history, and number of lifetime sexual partners that were unlikely to influence findings. Consistent with

the age distribution of anti-HCV positivity in the household population,[7] STD clinic patients with HCV antibodies were substantially older on average than were those without. To adjust for this confounding factor, we group matched on age. All participants older than 35 years were retained for the study (155 as cases and 315 as controls, a ratio of approximately 2 control participants for every case participant). Only 17 case participants were younger than 35 years. To group match participants on age, 34 patients were randomly selected from among the 780 control participants younger than 35 years, for a total of 172 case participants and 349 control participants.

Twenty-two patients (4%) had missing data in 3 or fewer variables on risky sexual activity or intimate partner violence. Because a very small amount of data was missing, we replaced these missing data by using the expectation–maximization imputation missing data procedure implemented in SPSS 14.0 (SPSS Inc, Chicago, IL). However, 6 clients were excluded from data analyses because information regarding nonsterile tattoos and sharing razors was not available. The final sample consisted of 515 participants—170 as cases and 345 as controls.

Measures

We used 4 items to assess frequent casual sex: (1) lifetime number of sexual partners (scored 1–6: 1=1; 2=2–4; 3=5–9; 4=10–20; 5=21–50; and 6=more than 50), (2) average time to first sexual intercourse after meeting a new partner (scored 1–6: 1=more than a year; 2=6 months to a year; 3=1–5 months; 4=1–3 weeks; 5=2 days to 1 week; and 6=on the first day), (3) frequency of having sexual intercourse on the first meeting, and (4) frequency of engaging in 1-night stands. We used the same scale to measure the latter 2 items (scored 0–7: 0=never, 1=once, 2=2–3 times, 3=4–6 times, 4=7–10 times, 5=11–20 times, 6=21–50 times, and 7=more than 50 times). The Cronbach α for these items was .83, indicating good internal consistency. A mean score was calculated over these items to represent an overall level of having frequent casual sexual intercourse.

We assessed sex with high-risk partners by asking respondents how often in their lifetimes they had had sexual intercourse with (1) injection drug users, (2) former prisoners, (3) persons with HIV, and (4) persons with hepatitis. We used a 6-point scale to measure these behaviors (scored 0–5: 0=never; 1=once; 2=2–4 times; 3=5–10 times; 4=11–50 times; and 5=more than 50 times). The highest score reported in response to these 4 questions was taken to indicate level of sexual involvement with high-risk partners. This method was used to avoid overestimating the frequency of sexual intercourse with high-risk partners because the same partners with 2 or more risk factors might have been reported more than once. Although this method may have underestimated frequencies for these categories of behaviors, alternative scoring methods (i.e., summing the frequency scores or taking their mean) yielded comparable results. A similar method was employed to score our measures of exposure to blood and sores during sexual activity.

We assessed exposure to blood during sex by asking respondents a series of questions about the lifetime frequency of engaging in the following sexual behaviors: (1) having vaginal sexual intercourse when they or their partners had an injury involving bleeding (e.g., scratches or cuts); (2) scratching or biting their partners or being scratched or bitten by their partners so hard that it drew blood; (3) they or their partners bleeding as a result of engaging in rough sexual activity or sado-masochistic sexual activity in which 1 or both partners used whips, bondage, or other means of intentionally causing pain, injury, or bleeding; (4) engaging in anal sexual intercourse that caused pain or bleeding either to them or to their sexual partners; and (5) exposure to menstrual blood during sexual intercourse. We used a 6-point scale to measure respondents' bleeding and bleeding by their partners (scored 0–5: 0=never; 1=once; 2=2–4 times; 3=5–10 times; 4=11–50 times; and 5=more than 50 times). The highest score of the responses to these questions was taken to indicate frequency of exposure to blood during sexual activity.

We assessed exposure to sores while having oral sex by asking respondents how often in their lifetimes they had engaged in oral sex while either they or their sexual partners had a sore or raw area near the genitals or the mouth (e.g., split lip, gum disease, or cold sores). Again, we measured these behaviors separately for respondents and their partners with a 6-point scale (scored 0–5: 0=never; 1=once; 2=2–4 times; 3=5–10 times; 4=11–50 times; and 5=more than 50 times). The highest score of responses to these questions was taken to indicate level of exposure to sores during oral sex.

To assess bleeding caused by intimate partner violence we used the revised conflict tactic scale[22] to ask respondents about the frequency, since they were aged 14 years, of violence involving an intimate partner. The revised conflict tactic scale subscales included minor physical assaults (5 items), such as slapping or shoving; severe physical assaults (7 items), such as beating up or using a knife or gun; and injuries (6 items), such as needing to see a doctor or breaking a bone. Scales were assessed twice, for violence perpetrated by respondents and violence perpetrated by respondents' partners. Items were scored 0 to 7: 0=never; 1=once; 2=2–5 times; 3=6–10 times; 4=11–20 times; 5=21–50 times; 6=51–100 times; and 7=more than 100 times. Interviewers then listed aloud the types of intimate partner violence the respondents had just reported perpetrating and asked how frequently they had caused their partners to bleed. This question was repeated to assess the lifetime frequency of partners' violence causing respondents to bleed. The higher score of the latter 2 questions was taken to indicate frequency of bleeding by respondents or their partners caused by intimate partner violence.

Other HCV risk factors assessed were whether participants had ever injected drugs, shared straws to snort drugs, obtained tattoos under nonsterile conditions, or received blood transfusions prior to 1992, and frequencies of sharing razors and toothbrushes scored on a 6-point scale (scored 0–5: 0=never; 1=once; 2=2–4 times; 3=5–10 times; 4=11–50 times; and 5=more than 50 times). Data on HIV status was abstracted from clinic records.

We also determined respondents' sociodemographic characteristics, including age, gender, race/ethnicity, marital status, and educational achievement.

Data Analysis Plan

Distributions of scores for sexual activity with high-risk partners, exposure to blood or sores during sexual activity, intimate partner violence scales, and bleeding caused by

intimate partner violence were highly skewed. In descriptive analyses, these scores were dichotomized in terms of whether case participants and control participants had ever (1) or never (0) had these experiences. The significance of differences between case participants and control participants was tested by using the χ^2 test for percentages and analysis of variance for means. Risk factors with scores having skewed distributions were log transformed for inclusion in regression analyses. Univariate logistic regression analyses were conducted to examine bivariate associations of HCV risk factors and sociodemographic characteristics with anti-HCV status. Multivariate logistic regression analyses predicting anti-HCV status were conducted on variables significantly associated with anti-HCV status at the univariate level.

RESULTS

Sample sociodemographic characteristics and HCV risk factors are summarized in Table 1 according to anti-HCV status. Average scores for frequent casual sexual intercourse are presented, but exposure to other risk factors is expressed in terms of ever versus never having been exposed. Anti-HCV–positive patients were more likely to be Black and were slightly older, but they did not differ significantly from anti-HCV–negative patients on gender, educational level, marital status, or sexual orientation. As expected, case participants were more likely than were control participants to have been exposed to HCV risk factors. In addition to injection drug use, case participants were more likely to have shared razors and toothbrushes, shared straws to snort drugs, and obtained tattoos under nonsterile conditions. Case participants scored significantly higher than did control participants on frequent casual sexual intercourse and were more likely to have had sexual intercourse with a high-risk person, but case and control participants did not differ in ever having been exposed to blood or sores during sexual activity. Case participants were also more likely than were control participants to have experienced intimate partner violence and bleeding caused by intimate partner violence. Significant differences in age remained, indicating that group matching was not entirely successful in eliminating this confounding factor.

Univariate Logistic Regression Analyses

A series of univariate logistic regression analyses were conducted to examine the unadjusted relative risks for anti-HCV positivity represented by these HCV risk factors (Table 2). In most cases, the level of statistical significance for associations between risk factors and anti-HCV status was comparable for both lifetime prevalence of ever having been exposed and continuous scores that took frequency of exposure into consideration. However, case participants and control participants differed significantly on lifetime frequency of exposure to blood during sexual activity, whereas they did not differ significantly on ever having been exposed to blood during sexual activity.

Multivariate Logistic Regression Analyses

All variables that were significantly associated with anti-HCV positivity at the .05 level or less in univariate analyses were entered in a multivariate logistic regression model to simultaneously predict anti-HCV status. To better understand the effect of bleeding caused by intimate partner violence on associations between other risk factors and HCV status, the regression model was estimated with and without bleeding caused by intimate partner violence. In Table 3, the first model without bleeding caused by intimate partner violence indicated that only injection drug use, sharing straws to snort drugs, sharing razors, and race were significantly related to anti-HCV status. Factors that were no longer statistically significant were sharing toothbrushes, frequent casual sexual intercourse, frequency of sexual intercourse with high-risk persons, frequency of exposure to blood or sores during sexual activity, and frequency of experiencing or perpetrating minor physical assault, severe physical assault, or injuries related to intimate partner violence. The second model showed that exposure to bleeding caused by intimate partner violence significantly predicted anti-HCV status. Adding this variable to the model did not greatly affect relative risks associated with the other significant predictors.

We used data from 382 patients who did not have a history of injection drug use (59 case and 323 control participants) to conduct an additional multivariate analysis. Findings confirmed the significance of the previously mentioned variables in predicting anti-HCV status: sharing straws to snort drugs (OR=2.2; 95% confidence interval [CI]=1.1, 4.1), sharing razors (OR=6.0; 95% CI=1.2, 31.3), bleeding caused by intimate partner violence (OR=6.8; 95% CI=1.2, 37.5), and being Black (OR=2.11; 95% CI=1.03, 4.34). There were no significant interactions between either gender or race and bleeding caused by intimate partner violence.

DISCUSSION

Our failure to find a significant relation between risky sexual behavior and anti-HCV status after we adjusted for injection drug use illustrates the extent to which the relationship between risky sexual behavior and anti-HCV positivity is confounded by drug use in STD populations. This raises the possibility that previous reports of an independent relation between risky sexual behavior and HCV infection may be attributable in part to incomplete ascertainment of injection drug use. In studies of both STD clinic clients[9] and blood donors,[23] a number of respondents who denied injection drug use prior to HCV diagnosis later admitted it. The fact that multiple methods of assessment were used to increase ascertainment of injection drug use in our sample may have contributed to our finding that injection drug use accounted for much of the relation between risky sexual behavior and HCV infection. Measures of exposure to blood or sores during sexual activity were weakly related to anti-HCV status, even at the univariate level, failing to support our hypothesis that such exposure might serve as a possible mechanism for sexual HCV transmission.

More important, we did find evidence to support our hypothesis that HCV transmission may take place between sexual partners via exposure to bleeding caused by intimate partner violence. The significance of this association is enhanced by the fact that it was robust, surviving adjustment for a wide array of competing parenteral and sexual risk factors in analyses both including and excluding injection drug users. In addition, the association between HCV infection and bleeding caused by intimate partner violence remained significant even after we controlled for measures of intimate

TABLE 2—Univariate Associations of Sociodemographic Characteristics and Risk Factors With HCV Infection Among Patients of an STD Clinic (N = 515): Western New York State, 2001–2004

	OR (95% CI)
Age	1.03* (1.01, 1.05)
Gender	
Women (Ref)	1.00
Men	0.72 (0.50, 1.06)
Race/ethnicity	
Non-Black (Ref)	1.00
Black	1.74** (1.16, 2.60)
Education	
High school diploma or GED (Ref)	1.00
Less than high school	1.29 (0.80, 2.06)
More than high school	0.82 (0.53, 1.26)
Marital status	
Single (Ref)	1.00
Married, divorced, or widowed	1.07 (0.70, 1.63)
Sexual orientation	
Heterosexual (Ref)	1.00
Homosexual or bisexual	1.29 (0.72, 2.30)
Received blood transfusion before 1992	
No (Ref)	1.00
Yes	1.05 (0.55, 2.02)
Ever injected drugs	
No (Ref)	1.00
Yes	27.15*** (16.02, 45.99)
Shared razors	8.91*** (3.70, 21.41)
Shared toothbrushes	2.10* (1.05, 4.20)
Tattooed under nonsterile conditions	
No (Ref)	1.00
Yes	3.77** (1.69, 8.42)
Shared straws to snort drugs	
No (Ref)	1.00
Yes	4.18*** (2.83, 6.18)
Frequent casual sexual intercourse	1.33*** (1.16, 1.54)
Sexual intercourse with high-risk persons	11.33*** (5.84, 21.96)
Exposure to blood during sexual activity	2.21* (1.12, 4.37)
Exposure to sores during oral sexual intercourse	1.49 (0.60, 3.69)
Intimate partner violence	
Minor assault[a]	5.24*** (2.50, 10.96)
Severe assault[b]	4.43*** (2.30, 8.52)
Injuries[c]	4.56*** (2.38, 8.73)
Bleeding	6.39*** (3.23, 12.64)

Note. OR = odds ratio; CI = confidence interval; GED = general equivalency diploma; STD = sexually transmitted disease.
[a]For example, slapping or shoving.
[b]For example, beating up or using a knife or gun.
[c]For example, needing to see a doctor or breaking a bone.
*$P < .05$; **$P < .01$; ***$P < .001$.

partner violence itself, indicating that the association is specific to intimate partner violence that causes bleeding.

The specificity of the association with bleeding is consistent with a plausible explanation for how transmission of a blood-borne virus could take place in the context of intimate partner violence. Intimate partner violence is often reciprocal, and reciprocal violence is more likely to result in injury.[24] If reciprocal injuries cause bleeding by both partners, an exchange of blood that could transmit virus may take place. The feasibility of such transmission is supported by a documented instance in which phylogenetic analysis was used to link an acute HCV infection after a bloody fist fight to an undiagnosed chronic case of HCV in the other combatant.[18] Although the relative risk of HCV infection associated with exposure to bleeding caused by intimate partner violence is substantially smaller than that associated with injection drug use, its importance is increased by the fact that bleeding caused by intimate partner violence is substantially more prevalent than injection drug use. For example, in this study the prevalence of bleeding caused by intimate partner violence was more than 10 times greater than that of injection drug use—37% compared with 3%.

Sharing straws to snort drugs and sharing razors also predicted HCV status. A significant association between sharing straws and HCV infection was reported by D'Souza et al. in high-risk STD clinic patients after the authors controlled for injection drug use and heroin use,[8] but Gunn et al. failed to observe a significant relation between snorting cocaine and HCV in non-IDU patients.[9] Sharing razors has been implicated in the transmission of HCV in a psychiatric inpatient population,[25] but we are not aware of any previous reports documenting that it is a risk factor among STD clinic patients. This study suggests that STD clinic patients should be advised, as recommended by Centers for Disease Control and Prevention, not to share razors.[26]

Finally, risk of HCV remained significantly elevated among Black STD clinic patients even after adjustment for many parenteral and sexual risk factors. This could be related to confounding factors that were not taken into consideration in this analysis, such as bleeding caused by violence perpetrated by someone other than an intimate partner.[27] Alternatively,

TABLE 3—Multivariate Logistic Regression Analyses Predicting HCV Infection Among Patients of an STD Clinic (N = 515): Western New York State, 2001–2004

	Model 1		Model 2	
	AOR (95% CI)	*P*	AOR (95% CI)	*P*
Black race	2.72 (1.50, 4.95)	.001	2.39 (1.31, 4.38)	.005
Injection drug use	19.51 (10.48, 36.30)	<.001	20.17 (10.76, 37.82)	<.001
Shared razors	7.08 (1.83, 27.33)	.005	7.81 (1.97, 30.99)	.003
Shared toothbrushes	0.55 (0.18, 1.67)	.294	0.56 (0.18, 1.69)	.299
Shared straws to snort drugs	1.76 (1.02, 3.03)	.041	1.75 (1.01, 3.02)	.045
Tattooed under nonsterile conditions	1.93 (0.63, 5.94)	.250	1.87 (0.62, 5.65)	.265
Frequent casual sexual intercourse	1.03 (0.84, 1.27)	.781	1.01 (0.82, 1.24)	.966
Sexual intercourse with high-risk persons	1.06 (0.40, 2.77)	.910	1.20 (0.46, 3.17)	.708
Exposure to blood during sexual activity	1.24 (0.45, 3.47)	.676	1.15 (0.41, 3.20)	.796
Intimate partner violence				
Minor assaults[a]	0.80 (0.17, 3.83)	.780	0.66 (0.14, 3.18)	.604
Severe assaults[b]	1.40 (0.27, 7.38)	.690	0.74 (0.13, 4.29)	.740
Injuries[c]	1.85 (0.44, 7.76)	.403	1.11 (0.25, 4.92)	.893
Bleeding	. . .		5.54 (1.35, 22.84)	.018

Note. AOR = adjusted odds ratio; CI = confidence interval; STD = sexually transmitted disease. Age was entered as a covariate; it was not significant in the final models. Ellipses indicate the variable was not included in the model.
[a]For example, slapping or shoving.
[b]For example, beating up or using a knife or gun.
[c]For example, needing to see a doctor or breaking a bone.

it may reflect racial differences in anti-HCV seroreversion rates. Cohort studies have suggested that individuals who successfully eliminate HCV RNA may have a gradual loss of HCV antibodies[28] and that Blacks are less likely than are non-Blacks to eliminate HCV RNA.[29]

Strengths of the study were its large sample, complete ascertainment and confirmation of anti-HCV status, detailed assessment of a number of sexual and direct blood exposures, access to clinic data that permitted examination of nonresponse bias and provided supplementary data on injection drug use, and use of a computer-assisted self interview that provided privacy for the report of sensitive information.

Limitations

This study, however, has limitations that should be kept in mind when one is evaluating its findings. Most important, its cross-sectional design does not allow any conclusions to be drawn about the temporality of the observed associations, and some of the risky behaviors observed could have occurred after patients had acquired their HCV infection. Accuracy of recall is always an issue in retrospective studies, and it is a special concern in this study because respondents were asked to recall behaviors that may have occurred frequently and over many years. We sought to improve memory by asking multiple questions about exposures to blood and sores during sexual activity and incidents of intimate partner violence that might have caused bleeding. Some exposures to blood (e.g., injection drug use and transfusions prior to 1992) are of such high relevance that whether they ever occurred is likely to be accurately recalled. Quantification of other direct blood exposures and risky sexual behaviors was done by using broad categories, reducing the demand characteristics of these measures.

The potential for differential recall bias should also be considered. Individuals with a diagnosis of HCV infection (cases) may recall events that may have led to their exposure more accurately than may those without such a diagnosis (controls). The likely effect of such differential recall is to strengthen the apparent relation of known risk factors, such as injection drug use and transfusions prior to 1992, to HCV infection. By contrast, bleeding associated with intimate partner violence has not been previously associated with HCV, making differential recall of this behavior less likely. Finally, the presence of additional unknown risk factors cannot be ruled out, and residual confounding may have contributed to our findings.

Conclusions

To our knowledge, ours is the first study to associate exposure to bleeding caused by intimate partner violence with the transmission of HCV. It is important that additional studies be undertaken to investigate this potential risk, so that, if it is confirmed, this information can be integrated into programs to prevent HCV transmission and intimate partner violence. These findings also suggest that greater attention should be given to the potential for transmitting HCV via bleeding caused by other types of interpersonal violence. ■

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Contributors

M. Russell developed the research proposal, was responsible for overall management of the project, conceptualized the research questions, and led the writing. M.-J. Chen analyzed the data and contributed to the writing. T.H. Nochajski contributed to development of the interview, supervised the field work, developed the database, and contributed to the writing. M. Testa contributed expertise in intimate partner violence to the study design and writing. S.J. Zimmerman contributed expertise in ascertainment of anti–HCV status and supervised the lab work. P.S. Hughes recruited and interviewed most of the participants and contributed to interpretation of the interview data.

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Human Participant Protection

This study was approved by institutional review boards at the Research Institute on Addictions, Buffalo, NY, and the Pacific Institute for Research and Evaluation, Berkeley, CA.

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