Drug and Alcohol Dependence 105 (2009) 215–220

Contents lists available at ScienceDirect

Drug and Alcohol Dependence

journal homepage: www.elsevier.com/locate/drugalcdep

Serosorting for hepatitis C status in the sharing of injection equipment among Seattle area injection drug users

Richard D. Burt[a,*], Hanne Thiede[a], Holly Hagan[b]

[a] Public Health – Seattle & King County, 400 Yesler Way, Seattle, WA 98104, United States
[b] College of Nursing, New York University, 246 Greene St., New York, NY 10003, United States

ARTICLE INFO

Article history:
Received 24 April 2009
Received in revised form 2 July 2009
Accepted 7 July 2009
Available online 31 August 2009

Keywords:
Injection drug users
Hepatitis C
Serosorting

ABSTRACT

Background: Hepatitis C virus (HCV) is a major health problem among injection drug users (IDU). One potential means of reducing risk of HCV transmission among IDU is serosorting, whereby IDU preferentially share injection equipment with persons of like HCV status.
Methods: We surveyed Seattle area IDU recruited by respondent-driven sampling as part of the National HIV/AIDS Behavioral Surveillance system in 2005.
Results: Of 337 participants, 91% reported ever having been tested for HCV. Fifty-three percent of participants who shared any injection equipment in the last 12 months reported knowing the HCV status of the last person with whom they shared injection equipment. Thirty-seven percent of self-reported HCV-positive participants reported that their last injection equipment sharing partner was also HCV-positive and 7% reported a HCV-negative partner. Among self-reported HCV-negative participants, 11% reported a HCV-positive partner and 23% a negative partner. The disproportionate tendency to share injection equipment with a partner of like HCV status persisted after control for characteristics associated with HCV positivity in stratified and logistic regression analyses. Among participants sharing injection equipment, 39% reported that they had intentionally shared injection equipment with a partner based on knowledge of their concordant HCV status.
Conclusions: We conclude that a measurable degree of serosorting by HCV status is occurring among Seattle area IDU. Promotion of serosorting among HCV-positive IDU may be a useful harm reduction strategy for IDU who continue to practice sharing injection equipment. If judged efficacious, serosorting would provide a further rationale to encourage and support HCV testing among IDU.
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1. Introduction

Hepatitis C virus (HCV) infection is widespread among injection drug users (IDU). Data from the early and mid 1990s indicated virtually universal infection and acquisition within a few months of initiation of injection (Garfein et al., 1996; Lorvick et al., 2001; Thomas et al., 1995). Subsequent publications have found somewhat lower prevalence and incidence among younger IDU (Garfein et al., 2007; Hahn et al., 2002; Thorpe et al., 2002). Recently, data has emerged suggesting decreasing HCV transmission among IDU in some locations (Burt et al., 2007; Crofts and Aitken, 1997; Des Jarlais et al., 2005; Goldberg et al., 2001; MacDonald et al., 2000; Tseng et al., 2007; van de Laar et al., 2005; van den Berg et al., 2007). Nonetheless, HCV prevalence levels remain high among IDU and the burden of disease substantial (Centers for Disease Control and Prevention, 2007a).

While testing for HIV status is a cornerstone of HIV prevention programs (Centers for Disease Control and Prevention, 2007b), testing IDU for HCV has received less emphasis. There is convincing evidence that knowledge of HIV positive status is associated with practices which reduce HIV transmission risk (Des Jarlais et al., 2004; Kamb et al., 1998; Marks et al., 2005; Weinhardt et al., 1999). The lack of data documenting that knowledge of HCV status has led to risk reduction or lower HCV transmission among IDU contributed to the decision of U.S. Preventive Serves Task Force to conclude that there was insufficient evidence to recommend for or against HCV screening in high risk populations, including IDU (U.S.Prevention Services Task Force, 2004).

One potential benefit of HCV testing among IDU is that it could allow IDU to serosort, that is to selectively share injection equipment with persons of like HCV status. While serosorting for HIV among sexual partners has been extensively investigated in men who have sex with men (Hart et al., 2005; Mao et al., 2006; Parsons et al., 2005), data on serosorting for HCV among IDU or assessing its effectiveness in reducing HCV transmission are scant (Hagan et

* Corresponding author. Tel.: +1 206 296 4580; fax: +1 206 205 5281.
E-mail address: richard.burt@kingcounty.gov (R.D. Burt).

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doi:10.1016/j.drugalcdep.2009.07.005

al., 2006; Kwiatkowski et al., 2002; Miller et al., 2003; Ompad et al., 2002; Vidal-Trecan et al., 2000).

In 2005 the National HIV/AIDS Behavioral Surveillance (NHBS) system surveyed IDU in 23 large metropolitan areas in the U.S., including Seattle (the NHBS-IDU1 survey) (Lansky et al., 2007). Among Seattle area NHBS-IDU1 participants, we report the prevalence of HCV testing, self-reported HCV status, participants' knowledge of the HCV status of the last person with whom they shared injection equipment and the degree of association between participants' HCV status and the HCV status of the last person with whom they shared injection equipment.

2. Methods

2.1. Recruitment and data collection

The methodology for the 2005 NHBS-IDU1 survey recruitment and its implementation in Seattle have been described (Burt and Thiede, 2007; Lansky et al., 2007). Recruitment was conducted by respondent-driven sampling (RDS), a form of coupon-based chain referral (Heckathorn, 2002; Salganik and Heckathorn, 2004). Participants were required to be at least 18 years old, have injected in the previous year and able to complete the survey in English. Recruitment began with community recruitment of 19 initial participants (seeds). After completing an interview, they were given 3 coupons with which to recruit their injecting peers. Eligible recruits who completed a survey questionnaire were paid $20 and, in turn, asked to distribute 3 coupons to their IDU peers. Participants were paid $10 for each eligible person they referred to the survey. Recruitment began 5/25/05 and continued through 1/31/06. Study interviews were conducted in person using hand-held computers. The current analysis is based on 337 NHBS-IDU1 study participants who were eligible for the study, provided informed consent, completed an interview, and provided information on their own HCV status and that of the last person with whom they had shared injection equipment. Study procedures were approved by the institutional review board of the state of Washington.

2.2. Variables for data analysis

HCV status was determined exclusively by self-report; serologic testing was not conducted. It was elicited by the question "Has a doctor, nurse or other health care provider ever told you that you had hepatitis?", with a follow-up question determining whether hepatitis A, B or C was diagnosed among those responding 'yes'. This question did not distinguish participants who tested HCV-negative from those who had not been tested. It would be anticipated that participants' self-reported HCV status rather than their serologic status that would be relevant to any serosorting behavior they might be practicing. Participants' area of residence was derived from the zip code they reported living in.

A series of questions was asked about the characteristics of the last person with whom participants had shared any injection equipment (including syringes, cookers, cottons and water) or practiced backloading. Such persons will be referred to as "last injection equipment sharing partners". Participants were asked if they knew the HCV status of their last injection equipment sharing partner and what that status was. A variable describing the HCV status of the last injection equipment sharing partner was constructed to include categories for participants reporting HCV-positive partners, HCV-negative partners, partners of unknown HCV status and a category for participants reporting no injection equipment sharing partners within the previous 12 months. The questionnaire was structured in such at way that for some participants there was ambiguity as to the identity of their last injection equipment sharing partner. Data from these participants were excluded from analysis.

2.3. Data analysis

To identify potentially confounding variables, we evaluated a collection of variables for their association with participants' HCV status in our study population in logistic regression models. The variables investigated included socio-demographic characteristics: age, race, gender, area of residence, education, current income, incarceration history and current homelessness. Also, a number of drug and sexual behavior variables were evaluated: the number of years participants had been injecting, injection frequency, drug most frequently injected, recent male-to-male sex, exchange sex and number of sexual partners. The strongest independent associations with participants' HCV status were found for years injecting ($p < 0.001$), area of residence ($p = 0.002$) and injection frequency ($p = 0.05$). No other variable was significantly associated with HCV status after control for these variables ($p \geq 0.09$ for all other variables).

To control for potential confounding, we first used stratified analyses to evaluate associations between participants' HCV status and that of their last injection equipment sharing partner after stratification by the length of participants' injection history, area of residence and injection frequency. Mantel–Haenszel calculations were used to derive an estimate for the p-value of a common odds ratio across strata and a Breslow–Day test was used to evaluate homogeneity of the odds ratio across strata (Breslow and Day, 1980). The Mantel–Haenszel and Breslow–Day calculations were necessarily restricted to those participants reporting a last injection equipment sharing partner who was either HCV-positive or negative.

Logistic regression analysis was used to simultaneously control for multiple potentially confounding variables (Breslow and Day, 1980). Participants' own HCV status (positive vs. negative/unknown) was the outcome variable and their last injection equipment sharing partners' HCV status was the primary independent variable. Participants who reported no sharing of injection equipment were chosen as the baseline group; their HCV prevalence of 62% matched that of the study population as a whole. Statistical significance was evaluated by likelihood ratio tests, after control for the three potentially confounding variables noted above. The inclusion of any of the additional variables to the models made no material difference in the evaluation of the association of participant's HCV status with that of their last injection equipment sharing partner. Analyses were conducted in SPSS (SPSS, 2004).

3. Results

Ninety percent of the Seattle NHBS-IDU1 study population reported ever having been tested for HCV and 62% reported that they were positive for HCV. Seventy-five percent of participants reported sharing at least one item of injection equipment (or backloading) in the previous 12 months. Fifty-three percent of participants who had shared injection equipment reported that they knew the HCV status of their last injection equipment sharing partner.

There was a strong association between participants' self-reported HCV status and the HCV status the status they reported for their last injection equipment sharing partner (Table 1). Thirty-seven percent of HCV-positive participants reported that their last injection equipment sharing partner was also HCV-positive, and 7% reported their last injection equipment sharing partner was negative. Among HCV-negative participants, 11% reported a HCV-positive injection equipment sharing partner and 23% a HCV-negative partner. In addition, HCV-positive participants were somewhat less likely than HCV-negative participants to report an injection equipment sharing partner whose HIV status they did not know (31% vs. 41%). Equal proportions (25%) of HCV-positive and negative participants reported that they had not shared injection equipment with anyone in the previous 12 months.

Information evaluating whether the observed association in HCV status among injection equipment sharing partners was a product of intentional selection of partners on the basis of their HCV status was obtained by a question: "In the past 12 months, have you ever decided to share a needle with someone specifically because you knew that you both had the same HCV results?". This question specifies sharing a *needle* rather than sharing any injection equipment. Fifty-one participants (39% of the 129 participants who reported sharing a needle) reported such intentional serosorting (Table 2). Participants reporting themselves HCV-positive were more likely to report intentional serosorting than those reporting themselves negative (21% vs. 6%).

Table 1
Participants' self-reported HCV status by the reported HCV status of their last injection equipment sharing partner, among Seattle area IDU participating in the 2005 NHBS-IDU1 survey.

Last injection equipment sharing partner's HCV status	Participant's HCV status			
	HCV-negative/unknown		HCV-positive	
	N	%	*N*	%
HCV-negative	29	23	14	7
HCV-positive	14	11	78	37
HCV unknown	53	41	65	31
No sharing	32	25	52	25
Totals	128	(38)	209	(62)
p-Value[a]			$p < 0.001$	

[a] Evaluating the significance of difference between HCV-positives and HCV-negatives/unknowns.

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