Electronic Matching of HIV/AIDS and Hepatitis C Surveillance Registries in Three States

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ABSTRACT

Objectives. Both HIV and hepatitis C virus (HCV) can be transmitted through percutaneous exposure to blood in similar high-risk populations. HCV and HIV/AIDS surveillance databases were matched in Colorado, Connecticut, and Oregon to measure the frequency of co-infection and to characterize co-infected people.

Methods. We defined a case of HCV infection as a person with a reactive antibody for hepatitis C, medical diagnosis, positive viral-load test result, or positive genotype reported to any of three state health departments from the start of each state's hepatitis C registry through June 30, 2008. We defined a case of HIV/AIDS as a person diagnosed and living with HIV/AIDS at the start of each state's respective hepatitis C registry through June 30, 2008. HIV/AIDS and hepatitis C datasets were matched using Link King, public domain record linkage and consolidation software, and all potential matches were manually reviewed before acceptance as a match.

Results. The proportion of reported hepatitis C cases co-infected with HIV/AIDS was 1.8% in Oregon, 1.9% in Colorado, and 4.9% in Connecticut. Conversely, the proportion of HIV/AIDS cases co-infected with hepatitis C was consistently higher in the three states: 4.4% in Oregon, 9.7% in Colorado, and 23.6% in Connecticut.

Conclusions. Electronic matching of registries is a potentially useful and efficient way to transfer information from one registry to another. In addition, it can provide a measure of the public health burden of HIV/AIDS and hepatitis C co-infection and provide insight into prevention and medical care needs for respective states.

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In the United States, an estimated 3.2 million people have chronic hepatitis C virus (HCV) infection[1] and an estimated 1.1 million people are living with human immunodeficiency virus (HIV).[2] Co-infection of HIV and HCV results in more rapid progression of both infections[3,4] and complicates treatment.[5] Because both HIV and HCV viruses can be transmitted through percutaneous exposure to blood, similar at-risk populations are affected, notably injection drug users (IDUs), and estimating the number of co-infected people can help steer public health initiatives.

At the local level, assessing the number and characteristics of co-infected individuals is an important public health endeavor. Prevention and care planning groups can use these data to target and evaluate their activities. The objectives of this study were to use surveillance data to measure HIV/acquired immunodeficiency syndrome (AIDS) and HCV co-infections; to characterize the co-infected populations; and to compare similarities and differences of the co-infected populations in Colorado, Connecticut, and Oregon.

METHODS

Data sources

A case of HCV infection was defined as a person with a reactive antibody for hepatitis C, medical diagnosis, positive viral-load test result, or positive genotype reported to any of three state health departments (Colorado, Connecticut, and Oregon) from the start of the state's hepatitis C registries through June 30, 2008. A case of HIV/AIDS was defined as a person diagnosed and living with HIV/AIDS at the start of each state's respective hepatitis C registry through June 30, 2008 (Table 1). Each state conducted selective follow-up of cases to collect supplemental information not initially reported, including demographic and risk information. Risk factor data collection is always attempted for HIV/AIDS cases but not always collected for chronic HCV-infected cases. Therefore, we used the HIV/AIDS risk to characterize the co-infected population. HIV/AIDS risk is mutually exclusive based on a hierarchy: IDUs, men who have sex with men (MSM), IDU/MSM, and heterosexuals. MSM are defined as males who have sexual contact with other males, and heterosexual risk is defined as heterosexual contact with a person known to have HIV infection or at least with a person at increased risk of HIV infection (e.g., history of MSM, IDU, or other risk).

Analysis

Separate databases were prepared for HIV/AIDS and HCV infection to include cases meeting the respective definitions of each disease. The number of cases of HIV/AIDS, HCV infection, and matched cases identified by each of the health departments is shown in Table 1. HIV/AIDS and HCV datasets were matched using Link King, public domain record linkage and consolidation software.[6] All software defaults, including name rarity and deterministic weights, were used. Name rarity is a ranking assigned by the software during the matching comparison to assist with determining if a case is a match. According to the Link King user manual, a name with a rarity rating of 1 is considered the most "common" and names with a rarity rating of 0.1 are most "rare." A rarity score ≤0.3 is used as decision criteria in one area of the deterministic protocol.

Deterministic weights are based on the following criteria and cases were matched using the medium "blocking level." Per the Link King user manual, medium-level blocking identifies matches and assigns "weights" based on any of the following criteria: (*1*) last names are phonetic equivalents and birthdates match; (*2*) first names are phonetic equivalents and birthdates and gender match; (*3*) first and last names are phonetic equivalents, gender matches, and the year of birth matches; (*4*) first and last names are phonetic equivalents, gender matches, and the month of birth matches; (*5*) first and last names are phonetic equivalents, gender matches, and the day of birth matches; (*6*) first and last names are phonetic equivalents and at least one of the following conditions is met: birth

Table 1. Comparison of HIV/AIDS and HCV surveillance databases in Colorado, Connecticut, and Oregon, 2009

Variable	*Colorado*	*Connecticut*	*Oregon*
Year registry started			
AIDS	1985	1982	1981
HIV	1985	2002	2001
HCV	1993	1994	2005
Total cases reported			
HIV/AIDS	16,016	19,014	10,550
HCV	73,406	47,143	16,535
HIV/AIDS cases alive at start of HCV registry and eligible for matching			
HIV/AIDS	14,038	9,845	6,849
Rate[a] per 100,000 person-years of cases eligible for matching			
HIV/AIDS	26.98	45.29	26.69
HCV	141.09	112.30	64.43

[a]Rates based on the 1990 U.S. Census for the registry years in the 1990s and the 2000 U.S. Census for the registry years in the 2000s.

HIV = human immunodeficiency virus

AIDS = acquired immunodeficiency syndrome

HCV = hepatitis C virus

Table 2. Number and percentage of HIV/AIDS and HCV co-infected[a] cases by gender, race/ethnicity, age, and HIV/AIDS transmission category in Colorado, Connecticut, and Oregon, 2009

	Colorado	*Connecticut*	*Oregon*
Characteristic	N *(percent)*	N *(percent)*	N *(percent)*
Total *N* (percent)	1,368 (9.7)	2,327 (23.6)	304 (4.4)
Gender			
Male	1,152 (84.2)	1,621 (69.7)	252 (82.9)
Female	216 (15.8)	706 (30.3)	52 (17.1)
Race/ethnicity			
Non-Hispanic white	770 (56.3)	723 (31.1)	249 (81.9)
Non-Hispanic black	244 (17.8)	747 (32.1)	21 (6.9)
Hispanic	316 (23.1)	850 (36.5)	22 (7.2)
Asian/Pacific Islander	6 (0.4)	3 (0.1)	4 (1.3)
American Indian/Alaska Native	20 (1.5)	0 (0.0)	6 (2.0)
Multirace	10 (0.7)	4 (0.2)	2 (0.7)
Unknown	2 (0.2)	0 (0.0)	0 (0.0)
Age group (in years)[b]			
<13	1 (0.1)	3 (0.1)	0 (0.0)
13–29	130 (9.5)	133 (5.7)	21 (6.9)
30–39	552 (40.4)	714 (30.7)	63 (20.7)
40–49	524 (38.3)	1,048 (45.0)	139 (45.7)
50–64	149 (10.9)	408 (17.5)	74 (24.3)
≥65	12 (0.9)	21 (0.9)	7 (2.3)
HIV transmission category			
IDU	472 (34.5)	1,769 (76.0)	108 (35.5)
MSM	375 (27.4)	108 (4.6)	93 (30.6)
MSM/IDU	353 (25.8)	63 (2.7)	70 (23.0)
Heterosexual	74 (5.4)	186 (8.0)	12 (4.0)
Other/unknown	94 (6.9)	201 (8.6)	21 (6.9)

[a]Co-infected refers to matched HIV/AIDS and HCV cases divided by total eligible HIV/AIDS cases.

[b]Age group refers to age at co-infection or second reported virus infection to the health department.

HIV = human immunodeficiency virus

AIDS = acquired immunodeficiency syndrome

HCV = hepatitis C virus

IDU = injection drug user

MSM = men who have sex with men

month and year match, or birth month and day match, or birth day and year match. All cases presented as potential matches were manually reviewed before acceptance as a match.

RESULTS

The proportion of cases in the HCV registries co-infected with HIV/AIDS was 1.8% in Oregon, 1.9% in Colorado, and 4.9% in Connecticut. In contrast, the proportion of reported HIV/AIDS cases co-infected with HCV was consistently higher in the three states: 4.4% in Oregon, 9.7% in Colorado, and 23.6% in Connecticut (Table 2).

In the three states, a higher proportion of co-infected people were male (69.7%–84.2%), and the most common age groups at co-infection or second reported virus infection to the health department were between 30 and 49 years of age: 78.7% in Colorado, 75.7% in Connecticut, and 66.4% in Oregon (Table 2). In Colorado and Oregon, the race/ethnicity of co-infected cases was predominantly non-Hispanic white, 56.3% and 81.9%, respectively. Connecticut showed slightly different demographics: 36.5% of the co-infected were Hispanic, 32.1% were non-Hispanic black, and 31.1% were non-Hispanic white. Like Connecticut, Colorado also had a disproportionate percentage (23.1%) of Hispanic co-infected cases (Table 2).

The most common risk of HIV/AIDS infection for the matched co-infected cases in all three states was injection drug use, with 60.3% in Colorado, 78.7% in Connecticut, and 58.5% in Oregon. In Colorado and

Oregon, the frequency of reported MSM was higher (27.4% and 30.6%, respectively) than in Connecticut (4.6%) among co-infected individuals (Table 2). Injection drug use was the predominant mode of transmission for HIV/AIDS cases in Connecticut during the time period analyzed, with 39.7% of all HIV/AIDS cases' risk attributed to injection drug use compared with 20.1% in Oregon and 20.8% in Colorado (data not shown).

In Connecticut, among cases with HIV/AIDS infection and not HCV co-infected, heterosexual sex was the most frequently reported mode of transmission (28.1%). Colorado and Oregon showed a slightly different picture, with MSM as the most frequently reported mode of transmission among cases with HIV/AIDS infection and not HCV co-infected (68.0% and 63.0%, respectively) (Table 3).

DISCUSSION

We found that the frequency of HCV infection among people with HIV/AIDS was higher (4%–24%) than HIV/AIDS was among people with HCV (2%–5%). Because of the frequency of co-infection in the population, screening and referral for medical management for HCV infection is a standard recommendation for all people diagnosed with HIV infection.[7] Treatment of HCV among HIV-infected individuals is supported by the Ryan White HIV/AIDS Treatment Modernization Act.[8]

While the exact frequencies varied, characteristics of co-infected cases were somewhat similar. In all three states, a higher proportion of co-infected cases were male rather than female. Correspondingly, rates have been higher among males than females in both HCV and HIV/AIDS surveillance data,[1,9] and the National Survey on Drug Use and Health found that males were twice as likely as females to have injected drugs in the past year during the 2005 and 2007 time periods.[10] Also similar in Connecticut and Colorado was the disproportionate burden of co-infection among Hispanic people, relative to their frequency in the population. Based on the 2007 population estimates from the U.S. Census Bureau,[11] only 19.9% of Colorado's and 11.5% of Connecticut's populations are Hispanic, but 23.1% and 36.5%, respectively, constituted the matched cases in these states.

Finally, and as expected, injection drug use was the most common risk factor among co-infected cases in all three states. This finding was previously described by Alter et al., who determined that prevalence of HCV among HIV-positive people varied by risk factor and was higher among those who were IDUs than among those with other risk factors.[12]

Risk factor information collected as part of disease surveillance should not be interpreted necessarily as the actual or most likely mode of infection transmission. Instead, more accurate risk information may be documented in a medical record or reported on interview with the health department. Injection drug use was less frequently reported in Colorado and Oregon and the proportion of MSM appeared higher. While there have been reports of increasing risk behaviors[13] and prevalence of HCV infection among HIV-positive MSM,[14] it is possible that some deny injection drug use. Continued monitoring of HCV infection among HIV-positive MSM and others is warranted.

We observed a wide range in the frequency of co-infection among cases reported with HIV/AIDS and with HCV by state. This range may be true variation or possibly associated with the different dates of initiation of surveillance activities. Specifically, Oregon had the lowest proportion of HCV infection among HIV/AIDS cases (and, especially, of HIV/AIDS among HCV infection cases) and the most recent initiation of HCV infection reporting.

Table 3. HIV/AIDS mode of transmission for nonmatched[a] HCV cases in Colorado, Connecticut, and Oregon, 2009

HIV transmission category	*Colorado* N *(percent)*	*Connecticut* N *(percent)*	*Oregon* N *(percent)*
IDU	772 (6.1)	1,991 (26.5)	622 (0.5)
MSM	8,621 (68.0)	1,767 (23.5)	4,124 (63.0)
MSM/IDU	972 (7.7)	89 (1.2)	580 (8.9)
Heterosexual	1,063 (8.4)	2,113 (28.1)	658 (10.1)
Other/unknown	1,242 (9.8)	1,558 (20.7)	561 (8.6)

[a]Nonmatched cases were cases in the HIV/AIDS registry that did not match a case in the HCV registry.

HIV = human immunodeficiency virus

AIDS = acquired immunodeficiency syndrome

HCV = hepatitis C virus

IDU = injection drug user

MSM = men who have sex with men

CONCLUSIONS

The three states we examined all have mandatory reporting of HIV/AIDS and HCV infection by laboratories. Population-based surveillance of infectious diseases is the mechanism health departments use to measure disease burden and take action in preventing further disease.[15] Electronic record reporting is an effective way of ascertaining cases, but health

department follow-up is still needed to supplement data collection.[16] However, for HCV infection, the number of new reports and the challenges in conducting case follow-up limit the ability of surveillance systems for HCV infection to collect critical information for prevention, including risk factors.[17] For example, in Connecticut, the source of infection is known for 90% of HIV/AIDS cases but only for 4% of HCV cases due to the often lengthy period of time between infection and testing and limited capacity for case investigation (Unpublished data, Connecticut Department of Public Health, March 2009). While the federal government has supported HIV/AIDS surveillance financially, HCV surveillance has not had similar levels of fiscal support. Because of the differences in fiscal support, matching hepatitis and HIV registries can be a valuable tool to enhance risk and race/ethnicity data in the HCV registries. It supplements missing information and creates efficiencies in surveillance. Most importantly, it can provide a direct measure of the public health burden of co-infection and provide insight into prevention and medical care needs.

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