Undiagnosed HIV and HCV Infection in a New York City Emergency Department, 2015

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Objectives. To measure undiagnosed HIV and HCV in a New York City emergency department (ED).

Methods. We conducted a blinded cross-sectional serosurvey with remnant serum from specimens originally drawn for clinical indications in the ED. Serum was deduplicated and matched to (1) the hospital's electronic medical record and (2) the New York City HIV and HCV surveillance registries for evidence of previous diagnosis before being deidentified and tested for HIV and HCV.

Results. The overall prevalence of HIV was 5.0% (250/4990; 95% confidence interval [CI] = 4.4%, 5.7%); the prevalence of undiagnosed HIV was 0.2% (12/4990; 95% CI = 0.1%, 0.4%); and the proportion of undiagnosed HIV was 4.8% (12/250; 95% CI = 2.5%, 8.2%). The overall prevalence of HCV (HCV RNA ≥ 15 international units per milliliter) was 3.9% (196/4989; 95% CI = 2.8%, 5.1%); the prevalence of undiagnosed HCV was 0.8% (38/4989; 95% CI = 0.3%, 1.3%); and the proportion of undiagnosed HCV was 19.2% (38/196; 95% CI = 11.4%, 27.0%).

Conclusions. Undiagnosed HCV was more prevalent than undiagnosed HIV in this population, suggesting that aggressive testing initiatives similar to those directed toward HIV should be mounted to improve HCV diagnosis. (*Am J Public Health.* 2018;108:652–658. doi:10.2105/AJPH.2018.304321)

See also Anderson and White, p. 591.

HIV diagnosis is the gateway to effective treatment and prevention. Delayed diagnosis prevents the timely initiation of treatment that averts disease progression and forward transmission.[1] In 2008, to reduce the number of New Yorkers living with HIV who were not aware of their serostatus, the city health department launched the first phase of its municipal HIV testing campaign, The Bronx Knows, to encourage awareness of HIV; increase testing, diagnosis, and linkage to care; and provide support to local clinics, hospital emergency departments (EDs), and laboratories to facilitate routine testing.[2] In the following years, important legislation,[3] policy,[4] therapeutic developments, and guidelines[5] were introduced, culminating locally in the launch of New York State's End the Epidemic initiative, whose goal is to reduce the number of new HIV infections statewide to 750 by 2020.[6]

Undiagnosed HCV represents a similarly lost opportunity for care, treatment, and prevention, arguably even more so in the present era of well-tolerated drugs with cure rates exceeding 90%,[7–9] and evidence demonstrating successful implementation of HCV screening in EDs with detection of high levels of undiagnosed HCV.[10–15] Recent increases in new HCV diagnoses among persons born before and after the 1945-to-1965 baby-boomer generation and increases in injection drug use among persons of all ages, coupled with increases in cirrhosis, liver cancer, and deaths from HCV infection, have prompted renewed interest in further expanding testing to identify undiagnosed HCV and link patients to care.[16,17]

The Centers for Disease Control and Prevention (CDC) estimates that 14% of HIV-infected persons and 50% of HCV-infected persons are undiagnosed or unaware of their infections.[18,19] To measure undiagnosed HIV and HCV infections, we conducted a blinded serosurvey in a large Bronx ED in 2015.

METHODS

This was a cross-sectional blinded seroprevalence survey of remnant serum drawn from unique individuals presenting to a New York City ED.

Population and Setting

We conducted the serosurvey in the adult ED of an academic tertiary-care hospital in the Bronx, New York, with more than 125 000 visits in 2015. The Bronx is the poorest urban county in the United States. More than half of the population in the hospital's catchment area is of non-White race/ethnicity; 35% are foreign-born; more than 30% have an income below the federal poverty level; unemployment is the highest in the city (12.7% vs 9.2%); and 46% of

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persons with health insurance are covered by Medicaid. The Bronx has the highest age-adjusted rate of premature death in the city (225.6/100 000 population) and the highest proportion of deaths attributable to accidental overdose (3.2% vs 1.9% citywide).[20]

Specimen and Data Sources

Serum or whole blood remaining from specimens drawn for clinical indications in the ED was salvaged for consecutive visit dates between March 8, 2015, and May 8, 2015. The remnant was drawn off its original tube, pipetted into a cryovial, labeled with a unique serosurvey ID number, accessioned, and frozen. Identifiers attached to the blood were matched by name, date of birth, and medical record number to the patient's electronic medical record for demographic and clinical data. The resulting data were deduplicated and matched to the New York City HIV and HCV surveillance registries to ascertain previously diagnosed and reported infection by using LinkPlus 2.0 (CDC, Atlanta, GA), a probabilistic record linkage program for cancer registry linkage and deduplication.[21]

After specimen processing, registry matching, and deduplication, all personal identifiers were removed from the data and specimens. The first 5004 consecutive specimens belonging to unique individuals, representing their first visit during the serosurvey, and appearing to have sufficient volume to test for both HIV and HCV, were pulled and transferred to a commercial laboratory for diagnostic testing.

HIV and HCV Testing

Specimens were screened for HIV with a fourth-generation combination Antigen Antibody immunoassay (Architect HIV Ag/Ab Combo, Abbott Laboratories, Lake Bluff, IL). Specimens that were repeatedly reactive on screening were tested with a second-generation rapid HIV-1/HIV-2 differentiation assay (BioRad Multispot HIV-1/HIV-2 Rapid Test, BioRad Laboratories, Redmond, WA); those that were negative on Multispot for HIV-1 or HIV-2 or indeterminate for HIV-1 were tested for HIV-1 RNA by qualitative HIV-1 RNA Transcription-Mediated Amplification assay (Hologic Aptima HIV-1 RNA Assay, Hologic Laboratories, Bedford, MA) to rule out acute HIV-1.

Specimens were screened for HCV with the VITROS anti-HCV immunodiagnostic test for immunoglobulin G to HCV (Ortho-Clinical Diagnostics, Felindre Meadows, Pencoed, Bridgend, United Kingdom). Results were reported as anti-HCV reactive or nonreactive, with signal-to-cutoff values of greater than or equal to 1.0 classified as reactive and less than 1.0 as nonreactive.

Specimens testing reactive on immunodiagnostic screening and having sufficient remaining volume were queued for quantitative HCV RNA polymerase chain reaction testing with the COBAS Ampliprep/COBAS TaqMan HCV Test, version 2.0 (Roche Molecular Systems, Branchburg, NJ). Specimens with greater than or equal to 15 international units per milliliter were classified as positive for HCV RNA, and specimens with less than 15 international units per milliliter were classified as HCV RNA not detected.

Outcome Measures

The outcome measures are defined here:

(1) $$\text{HIV prevalence} = \frac{\text{HIV-positive}}{\text{Serosurvey population}}$$

(2) Prevalence of undiagnosed HIV

$$= \frac{\text{Undiagnosed HIV-positive}}{\text{Serosurvey population}}$$

(3) Proportion of undiagnosed HIV

$$= \frac{\text{Undiagnosed HIV-positive}}{\text{HIV-positive}}$$

(4) Prevalence of HCV infection

$$= \frac{\text{HCV RNA-positive}}{\text{Serosurvey population}}$$

(5) Prevalence of undiagnosed HCV infection

$$= \frac{\text{Undiagnosed HCV RNA-positive}}{\text{Serosurvey population}}$$

(6) Proportion of undiagnosed HCV infection

$$= \frac{\text{Undiagnosed HCV RNA-positive}}{\text{HCV RNA-positive}}$$

Statistical Analysis

We used univariate and bivariate methods to analyze the HIV and HCV test results by demographic characteristics and previous HIV or HCV diagnosis. We considered those testing positive who did not match to a registry record to be undiagnosed.

Fifty-eight patients that tested anti-HCV–positive were not tested for HCV RNA because their specimens did not contain sufficient remaining volume for RNA polymerase chain reaction. We imputed their HCV RNA results with the SAS version 9.2 Proc MI (SAS Institute, Cary, NC) procedure according to anti-HCV antibody serostatus, gender, race/ethnicity, and age. We analyzed the resulting data sets with SAS Proc MIAnalyze to estimate the prevalence of anti-HCV–positive HCV, the prevalence and proportion of undiagnosed HCV, and the corresponding 95% confidence intervals (CIs).

RESULTS

A total of 16 340 unique individuals presented to the ED during the serosurvey; 10 357 persons (63.4% of all ED visitors) had blood drawn. The population having blood drawn in the ED was similar to the ED population overall—38.6% male, 61.4% female, 32.2% Black, and 53.4% Hispanic. Of these, 75.7% were in the age range (13–64 years) recommended by New York State for HIV testing; 38.2% belonged to the birth cohort (1945–1965) recommended by CDC for HCV testing.

HIV Infection

Of the 4990 specimens with sufficient volume to complete the 1-, 2-, or 3-step HIV-testing algorithm, 308 specimens screened repeatedly reactive; 248 were confirmed positive for HIV-1 antibody, 56 were negative, and 4 were indeterminate. The 60 specimens repeatedly reactive on screening but negative or indeterminate on supplemental or confirmatory antibody testing received HIV-1 qualitative RNA polymerase chain reaction testing. Two had detectable HIV RNA consistent with acute HIV-1 infection. All HIV infections detected in the serosurvey were HIV type 1 (i.e., no HIV-2 infections were detected by the supplemental or confirmatory differentiation assay).

The overall HIV prevalence was 5.0% (95% CI = 4.4%, 5.7%). The prevalence among men (7.2%; 95% CI = 6.1%, 8.4%) was significantly higher than the prevalence among women (3.7%; 95% CI = 3.0%, 4.4%; $P < .001$). Persons aged 40 to 59 years had significantly higher prevalence than persons in younger and older age groups, and Blacks had significantly higher prevalence than persons of other race/ethnicity (Table 1).

The registry match showed that 12 of the positive HIV specimens (including the 2 acute infections) belonged to undiagnosed persons. The prevalence of undiagnosed HIV was 0.2% (95% CI = 0.1%, 0.4%); the proportion of undiagnosed HIV was 4.8% (95% CI = 2.5%, 8.2%). There were no significant differences in the prevalence or proportion of undiagnosed HIV by gender, age, or race/ethnicity.

HCV Infection

Of the 4989 specimens with sufficient volume remaining after HIV testing to complete the antibody step (first step) of the 2-step HCV testing algorithm, 372 were found to have antibody to HCV above the signal-to-cutoff ratio of the test kit, indicating exposure to or infection with HCV. The overall anti-HCV prevalence was 7.5% (95% CI = 6.7%, 8.2%).

Among the 314 anti-HCV–positive specimens with sufficient volume for HCV quantitative RNA polymerase chain reaction testing, 167 (55%) had RNA levels above the lower limit of detection of the kit (≥ 15 IU/mL). We imputed RNA results for the 58 patients not having sufficient volume for RNA testing on the basis of their anti-HCV serostatus, gender, race, and age.

The overall prevalence of HCV infection was 3.9% (95% CI = 2.8%, 5.1%). The prevalence among men (6.2%; 95% CI = 4.4%, 8.1%) was significantly higher than the prevalence among women (2.5%, 95% CI = 1.5%, 3.5%; $P < .001$). Persons born between 1945 and 1965 had significantly higher prevalence than persons in younger and older age groups, and there were no differences in prevalence by race/ethnicity (Table 2).

The HCV registry match showed that 38 of the RNA-positive specimens belonged to undiagnosed persons. The overall prevalence of undiagnosed HCV infection was 0.8% (95% CI = 0.3%, 1.3%); it was higher among men (1.2%; 95% CI = 0.3%, 2.0%) than women (0.5%; 95% CI = 0.2%, 0.9%), and highest in the cohorts born from 1929 to 1944 (1.2%; 95% CI = 0.3%, 2.0%) and 1945 to 1965 (1.2%; 95% CI = 0.4%, 2.0%). The proportion of undiagnosed RNA-positive HCV infection was 19.2% (95% CI = 11.4%, 27.0%); undiagnosed RNA-positive HCV was higher among persons aged 21 to 39 years (34.7%) and 70 to 85 years (34.1%). There were no significant differences by gender or race/ethnicity.

HIV and HCV Coinfection

Among 4975 patients with results for both viruses, 207 (4.2%) had HIV infection only,

TABLE 1—HIV Prevalence, Prevalence of Undiagnosed HIV, and Proportion of Undiagnosed HIV, by Demographic Characteristics, in an Emergency Department Population in New York City: 2015

		HIV-Infected			HIV Prevalence		Prevalence of Undiagnosed HIV		Proportion of Undiagnosed HIV	
Characteristic	Total No. (Column %)	Diagnosed, No.	Undiagnosed, No.	Subtotal, No.	No. Infected/Total No., % (95% CI)	*P*	No. Undiagnosed/Total No., % (95% CI)	*P*	No. Undiagnosed/Total No. HIV Infected, % (95% CI)	*P*
Total	4990 (100.0)	238	12	250	5.0 (4.4, 5.7)		0.2 (0.1, 0.4)		4.8 (2.5, 8.2)	
Gender										
Male	1926 (38.6)	131	7	138	7.2 (6.1, 8.4)		0.4 (0.2, 0.8)		5.1 (2.1, 10.2)	
Female	3064 (61.4)	107	5	112	3.7 (3.0, 4.4)	< .001	0.2 (0.0, 0.4)	.17	4.5 (1.5, 10.1)	.82
Age, y										
21–29	795 (15.9)	18	2	20	2.5 (1.5, 3.9)		0.2 (0.0, 0.6)[a]		6.4 (1.3, 17.5)[a]	
30–39	768 (15.4)	26	1	27	3.5 (2.3, 5.1)	.25				
40–49	783 (15.7)	50	3	53	6.8 (5.1, 8.8)	< .001	0.4 (0.2, 0.8)[a]	.29[a]	4.9 (2.0, 9.8)[a]	.69[a]
50–59	984 (19.7)	86	4	90	9.2 (7.4, 11.1)	< .001				
60–69	840 (16.8)	49	0	49	5.8 (4.4, 7.6)	.001	0.1 (0.0, 0.4)[a]	.61[a]	3.3 (0.4, 11.5)[a]	.47[a]
70–79	566 (11.3)	8	2	10	1.8 (0.8, 3.2)	.36				
80–85	254 (5.1)	1	0	1	0.4 (0.0, 2.2)	.07				
Race/ ethnicity										
Black	1605 (32.2)	110	5	115	7.2 (6.0, 8.5)		0.3 (0.0, 0.7)		4.4 (1.4, 9.9)	
Hispanic	2663 (53.4)	106	5	111	4.2 (3.4, 5.0)	< .001	0.2 (0.1, 0.4)	.42	4.5 (1.5, 10.2)	.95
White	318 (6.4)	9	0	9	2.8 (1.3, 5.3)	.006	0.0 (0.0, 1.1)	> .99	0.0 (0.0, 33.6)	> .99
Other or unknown	404 (8.1)	13	2	15	3.7 (2.1, 6.1)	.01	0.5 (0.1, 1.8)	.58	13.3 (1.7, 40.5)	.16

Note. CI = confidence interval.

[a]Age groups 21–29 and 30–39 years, 40–49 and 50–59 years, and 60–69, 70–79, and 80–85 years were collapsed because of the small number of undiagnosed HIV infections.

TABLE 2—Prevalence of HCV Infection, Prevalence of Undiagnosed HCV, and Proportion of Undiagnosed HCV, by Demographic Characteristics, in an Emergency Department Population in New York City: 2015

Characteristic	Total No. (Column %)	HCV Infection[a,b]			Prevalence of HCV Infection[a]		Prevalence of Undiagnosed HCV		Proportion of Undiagnosed HCV	
		Diagnosed, No.	Undiagnosed, No.	Subtotal, No.	No. Infected/Total No., % (95% CI)	*P*	No. Undiagnosed/Total No., % (95% CI)	*P*	No. Undiagnosed/Total No. HCV Infected, % (95% CI)	*P*
Total	4989 (100.0)	158	38	196	3.9 (2.8, 5.1)		0.8 (0.3, 1.3)		19.2 (11.4, 27.0)	
Gender										
Male	1925 (38.6)	60	16	77	6.2 (4.4, 8.1)		1.2 (0.3, 2.0)		21.0 (11.5, 30.5)	
Female	3064 (61.4)	97	22	120	2.5 (1.5, 3.5)	< .001	0.5 (0.2, 0.9)	.05	18.1 (7.8, 28.5)	.64
Age, y										
21–29	796 (16.0)	0	3	3	0.4 (0.0, 0.8)		0.3 (0.0, 0.6)[c]		34.7 (6.3, 63.1)[c]	
30–39	770 (15.4)	8	2	9	1.2 (0.4, 2.1)	.06				
40–49	779 (15.6)	16	2	18	2.3 (1.2, 3.5)	.87	0.5 (0.0, 1.1)[c]	.62[c]	11.6 (1.7, 21.6)[c]	.04[c]
50–59	984 (19.7)	52	8	60	6.1 (3.6, 8.6)	< .001				
60–69	842 (16.9)	62	15	77	9.1 (6.3, 12.0)	< .001	1.5 (0.6, 2.3)[c]	< .001[c]	22.9 (13.9, 32.0)[c]	.76[c]
70–79	564 (11.3)	18	9	27	4.7 (2.6, 6.8)	< .001				
80–85	254 (5.1)	1	1	2	1.0 (0.0, 2.2)	.14				
Year of birth										
1929–1944	805 (16.1)	19	9	28	3.5 (2.0, 5.1)		1.2 (0.3, 2.0)		33.0 (15.4, 50.6)	
1945–1965	1904 (38.2)	116	23	139	7.3 (5.0, 9.6)	< .001	1.2 (0.4, 2.0)	.03	16.3 (8.5, 24.0)	.17
1966–1994	2283 (45.8)	22	6	28	1.2 (0.7, 1.8)	< .001	0.3 (0.0, 0.6)	.01	19.8 (0.2, 39.4)	.67
Race/ ethnicity										
Black	1604 (32.2)	60	14	74	4.6 (3.1, 6.1)		0.9 (0.3, 1.4)		18.4 (9.3, 27.6)	
Hispanic	2665 (53.4)	80	21	101	3.8 (2.4, 5.1)	.70	0.8 (0.1, 1.5)	.72	19.9 (7.2, 32.6)	.80
White	316 (6.3)	8	1	9	3.0 (0.9, 5.1)	.49	0.3 (0.0, 1.8)	.40	10.8 (0.0, 31.3)	.50
Other or unknown	404 (8.1)	10	3	13	3.1 (1.4, 4.8)	.58	0.7 (0.2, 2.2)	.72	24.0 (0.2, 47.8)	.50

Note. CI = confidence interval.

[a]HCV infection: HCV RNA viral load ≥ 15 IU/mL.

[b]Sum may not equal total because of rounding of multiple imputation results.

[c]Age groups 21–29 and 30–39 years, 40–49 and 50–59 years, and 60–69, 70–79 and 80–85 years were collapsed because of the small number of undiagnosed HCV infections.

158 (3.2%) had HCV infection only, 39 (0.8%) had HIV–HCV coinfection, and 4571 (91.9%) had neither infection (Table 3). Coinfection with HIV and HCV was more common among men (1.3%) than women (0.4%), persons aged 60 to 69 years (1.9%) than other age groups, and Blacks (1.0%) than other racial/ethnic groups. Of the 12 persons with undiagnosed HIV, 2 (16.6%) also had undiagnosed HCV.

DISCUSSION

Seven years after implementation of The Bronx Knows [its serostatus] and 5 years after New York State law mandated the offer of voluntary HIV testing in EDs, the proportion of undiagnosed HIV infection (4.8%) in 1 ED is close to the 2014 citywide estimate of 6.7% calculated with a CDC statistical algorithm.[22] Our estimate is lower than the 2010 estimate of 14% according to a serosurvey conducted in another academic tertiary care center ED in the Bronx. Although this ED served a demographically and socioeconomically similar population, the 2 EDs may differ in unmeasured ways that affect HIV and HCV prevalence and the proportion undiagnosed.[23] Routinely offering voluntary HIV testing in this ED is appropriate because the prevalence of undiagnosed HIV exceeds the threshold at which CDC recommends routine screening (0.1%).[24] Moreover, EDs may serve populations not presenting to other health care settings, including those with acute HIV infection.[25]

Factors that may have contributed to the low proportion of undiagnosed HIV include the following:

- State legislation mandating the offer of voluntary testing by all health care providers;
- Social marketing to increase individual interest and awareness;
- Public health detailing to health care providers;
- Supplemental funding to hospitals and clinics for test kits, laboratory equipment, and staff[2];
- Increasing provider and public awareness of the importance of early diagnosis;
- Steady improvements in initiation of care and exposure to antiretroviral therapy;
- Increasing viral suppression among persons living with HIV/AIDS; and
- Declining HIV incidence.

TABLE 3—HIV and HCV Coinfection in an Emergency Department Population in New York City: 2015

Characteristic	Total No. (Column %)	HIV Infection Only, No. (Row %)	HCV Infection Only,[a] No. (Row %)	HIV–HCV Coinfection, No. (Row %)	Both Negative, No. (Row %)
Total	4975 (100.0)	207 (4.2)	158 (3.2)	39 (0.8)	4571 (91.9)
Gender					
Male	1920 (38.6)	110 (5.7)	94 (4.9)	26 (1.3)	1690 (88.0)
Female	3055 (61.4)	97 (3.2)	64 (2.1)	13 (0.4)	2881 (94.3)
Age, y					
21–29	794 (16.0)	20 (2.5)	2 (0.3)	0 (0.1)	772 (97.2)
30–39	767 (15.4)	24 (3.1)	6 (0.8)	3 (0.5)	734 (95.7)
40–49	777 (15.6)	45 (5.7)	12 (1.5)	6 (0.8)	714 (92.0)
50–59	981 (19.7)	76 (7.7)	48 (4.9)	12 (1.2)	845 (86.2)
60–69	838 (16.8)	33 (3.9)	61 (7.3)	16 (1.9)	728 (86.9)
70–79	564 (11.3)	10 (1.8)	27 (4.7)	0 (0.0)	527 (93.5)
80–85	254 (5.1)	1 (0.4)	2 (1.0)	0 (0.0)	251 (98.6)
Race/ethnicity					
Black	1601 (32.2)	100 (6.2)	58 (3.6)	15 (1.0)	1428 (89.2)
Hispanic	2656 (53.4)	90 (3.4)	82 (3.1)	18 (0.7)	2466 (92.8)
White	316 (6.4)	7 (2.2)	8 (2.4)	2 (0.6)	300 (94.8)
Other or unknown	402 (8.1)	11 (2.7)	10 (2.4)	3 (0.7)	378 (94.1)

[a]HCV infection: HCV RNA viral load ≥ 15 IU/mL.

Could and should a similar investment be made to reduce undiagnosed HCV in NYC, and should it disregard age? Undiagnosed HCV in our serosurvey (proportion of undiagnosed HCV: 19.2%) was similar to that in Baltimore, Maryland (proportion of undiagnosed anti-HCV–positive 31.3% according to medical record abstraction), but lower than that in Cincinnati, Ohio (proportion of undiagnosed anti-HCV–positive 65.6% according to self-report). In these 2 EDs, 25% and 43% of undiagnosed anti-HCV–positive patients would have been missed by birth cohort screening[10,11]; in our serosurvey, 45% would have been missed by birth cohort screening. The results suggest that the time has come to mount an HCV-screening initiative without age restriction.

The literature suggests that ED screening for both HIV and HCV can be feasible and efficient,[12–14] particularly when blood is being drawn for indications associated with the ED visit. As in the case with HIV, EDs must address the issue of linkage to care after diagnosis, a particular challenge in a setting whose primary objective is to treat emergent, not chronic, conditions, but which is an ideal place in which to detect the latter. Most sites reporting successful implementation of HCV screening by using opt-out models with standing orders, automatic electronic medical record prompts, and staff to manage patient progress through the care continuum have reported suboptimal linkage to care.[12,15] Linkage to HCV care may require dedicated resources, at least until the anticipated bolus of previously undiagnosed cases is diagnosed, linked, and treated. Lessons from HIV are both instructive and sobering: routine HIV screening is not truly routine[27]; linkage continues to challenge even experienced providers[28,29]; and linkage and treatment initiation vary widely across sites.[30,31]

New York City is working toward making HCV screening routine in health care settings and ensuring that diagnosis is followed by linkage to care. Recent New York State legislation on HCV testing echoes recommendations by CDC and the US Preventive Services Task Force.[32,33] New York City Council, Department of Health and Mental Hygiene, and private funding have underwritten various public awareness and treatment campaigns; the Department of Health and Mental Hygiene has increased community capacity building and public health detailing to improve provider education on HCV; and the projects Check HepC and INSPIRE provide testing, care navigation, treatment, and follow-up to HCV-infected persons. HepCX has assembled a cadre of 34 "Hep C Champions"—health care providers and institutions committed to testing, care, treatment, and diffusion of innovation—serving as NYC change agents. More extensive, reliable funding and stronger advocacy would allow these programs to expand in a way similar to the HIV End the Epidemic initiative.[6] Linkage to HIV care and treatment from the ED was a challenge that was successfully met in NYC; the same model could be implemented for HCV.

Strengths and Limitations

The chief strength of this serosurvey is the large proportion of patients routinely having blood drawn in this busy ED and their demographic similarity to the overall population presenting to the ED. The primary advantage of any serosurvey that uses deidentified remnant material is that it does not rely on patient consent or provider initiation of voluntary HIV testing. Therefore, results are not affected by differential risk perception. An additional strength is that we tested for both HIV and HCV and ascertained the proportion coinfected. That 2 of 12 (16.6%) previously undiagnosed persons had acute HIV infection was an important finding that underscores the potential role of the ED in detection during peak viremia and highest transmissibility.[34]

Our first limitation was that the serosurvey was conducted in an ED in the Bronx. Our findings may not be generalizable to other EDs in NYC or even other EDs in the Bronx, despite apparent demographic similarities. The second limitation is the serosurvey's age. It was conducted in 2015, after major initiatives had been mounted and funding dedicated to combat undiagnosed HIV, but just as New York State initiatives and funding were implemented to encourage routine HCV screening in EDs. A repeat serosurvey in 2018 to 2020 would provide important

data on the impact of these initiatives. The third limitation is intrinsic to any surveillance analysis—despite the stringent criteria used for matching and expert clerical review of uncertain matches, errors occur that can affect calculation of the proportion undiagnosed. A fourth limitation is that diagnosis and case ascertainment are based on continuously evolving diagnostic tests, reporting regulations, and surveillance practices. The HIV registry has been maintained since 1981 and contains AIDS diagnoses dating back to 1976. HIV antibody testing has undergone 4 generational changes since 1985, and Western blot confirmatory testing has been supplanted by supplemental testing that distinguishes between antibodies to HIV types 1 and 2. Qualitative RNA testing to rule out acute HIV infection was introduced only during the past decade and is still not available everywhere.

Testing and surveillance for HCV have also evolved since the HCV registry was started in 1994. Anti-HCV–positive tests were reportable at the time of this serosurvey only if the signal-to-cutoff ratio of the specific kit had been reached or exceeded, and confirmatory RNA testing was required.[33] Our registry match accepted all persons classified as anti-HCV–positive in the HCV registry, regardless of the presence and result of RNA testing in the registry and regardless of the era of reporting. Similarly, the serosurvey accepted as anti-HCV–positive all those whose serosurvey specimen had antibody to HCV that met or exceeded the kit's signal-to-cutoff value. It is therefore possible that false positives have been counted as HCV matches or HCV infections.

Conclusions

With our serosurvey, we found that undiagnosed HIV in this Bronx Emergency Department was lower than previous national and local estimates, possibly attributable both to the changing epidemiology of HIV in the Bronx and to aggressive initiatives to improve testing, linkage to care, and viral suppression. This first HCV serosurvey in NYC showed that HCV prevalence in 1 busy ED was almost double the 2.4% NYC-wide prevalence estimated with the HCV registry, with almost one fifth of HCV infections undiagnosed.[35] Although HCV prevalence was highest in persons born in 1945 to 1965, undiagnosed HCV was high at both ends of the age spectrum. These findings argue in favor of an HCV testing initiative similar to that introduced by New York State to combat HIV with its 2010 testing and linkage to care legislation, Department of Health HIV testing initiatives, and 2014 End the Epidemic campaign, and without age restriction. AJPH

CONTRIBUTORS

L. V. Torian conceptualized and supervised the study, and led the specimen and data collection, analysis, interpretation, and the writing of the article. U. R. Felsen coordinated laboratory and data activities at the study site. Q. Xia performed the data analysis. Q. Xia, F. Laraque, E. J. Rude, H. Rose, A. Cole, A. Bocour, G. J. Williams, R. F. Bridgforth, L. A. Forgione, and H. Doo participated in specimen or data collection and interpretation. G. J. Williams and R. F. Bridgforth managed the laboratory testing. S. L. Braunstein, D. C. Daskalakis, and B. S. Zingman provided administrative leadership and programmatic support and assisted in interpretation of data. All authors participated in the review and revision of the article and approved the final version.

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HUMAN PARTICIPANT PROTECTION

The serosurvey was classified as public health surveillance by the New York City DOHMH institutional review board and as non–human participant research by the Albert Einstein College of Medicine institutional review board.

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