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18–30 year-olds more likely to link to HCV care: an opportunity to decrease transmission

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Abstract

BACKGROUND—Hepatitis C (HCV) incidence among 18–30 year-olds is increasing and guidelines recommend treatment of active injection drug users to limit transmission.

OBJECTIVE—(1) To measure linkage to HCV care among 18–30 year-olds and identify factors associated with linkage; (2) To compare linkage among 18–30 year-olds to that of patients >30 years.

METHODS—We used the electronic medical record at an urban safety net hospital to create a retrospective cohort with reactive HCV antibody between 2005 and 2010. We report seroprevalence and demographics of seropositive patients, and used multivariate logistic regression to identify factors associated with linkage to HCV care. We defined linkage as having evidence of HCV RNA testing after reactive antibody.

RESULTS—32,418 individuals were tested including 8,873 between 18–30 years. The seropositivity rate among those ages 18–30 was 10%. In multivariate analysis, among those 18–30,

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diagnosis location (Outpatient vs. Inpatient/ED) (OR 1.78, 95% CI 1.28–2.49) and number of visits after diagnosis (OR 5.30, 95% CI 3.91–7.19) were associated with higher odds of linking to care. When we compared linkage in patients ages 18–30 to that among those older than 30, patients in the 18–30 years age group were more likely to link to HCV care than those in the older cohort even when controlling for gender, ethnicity, socioeconomic status, birthplace, diagnosis location and duration of follow-up.

CONCLUSION—18–30 year-olds are more likely to link to HCV care than their older counterparts. During the interferon-free treatment era, there is an opportunity to prevent further HCV transmission in this population.

Keywords

Diagnosis; Hepatitis C; Linkage to care; Outcome

INTRODUCTION

The availability of effective, oral therapies to cure hepatitis C (HCV) infection has generated excitement about the potential to eradicate HCV in the United States (U.S.) (1–4). At this time, nearly every incident case of HCV infection in the U.S. occurs among young substance users. In recent years there has been an increase in the rate of HCV infection among 15–30 year olds, with incidence as high as 116 per 100,000 in Massachusetts (5). Surveillance data demonstrate a national rise in cases of acute HCV infection among those under age 30, and data from four states (West Virginia, Virginia, Tennessee and Kentucky) demonstrate a 364% increase in the number of acute HCV infections among such youth (6). These epidemiologic insights make clear that it is not possible to eradicate HCV without addressing the treatment needs of youth. In fact, the American Association for the Study of Liver Diseases (AASLD)/Infectious Diseases Society of America (IDSA)/International Acquired Immunodeficiency Syndrome Society (IAS) –USA guidelines recommend treating active drug users (7). Developing a successful treatment strategy requires an understanding of the cascade of HCV care among those under age 30. Previous studies have described the HCV treatment cascade in the general population(8–10), but less is known about linkage to care and HCV therapy specifically among youth.

We sought to: (1) Report HCV seroprevalence among a cohort of youth aged 18–30 seen at an urban safety net hospital in the North Eastern U.S. (2) Describe the rate of linking to HCV care among those with known reactive HCV antibody; (3) Identify factors associated with linkage to care; (4) Compare linkage to care rates among HCV-infected patients less than 30 years old to those older than 30 years of age. We used HCV RNA testing as a marker for linkage to care given that the Centers for Disease Control and Prevention (CDC) recommends HCV RNA testing after any reactive HCV antibody (11). As more effective and better-tolerated HCV treatment is introduced, this information could provide a foundation to address the high rate of HCV among young IV drug users.

MATERIALS AND METHODS

Study Design and data collection

We used the electronic medical record at Boston Medical Center (BMC) to create a retrospective cohort of individuals with reactive HCV antibody identified between January 1st, 2005 and December 31st, 2010. The dataset contains demographic information, dates and location of all clinic visits and results of laboratory studies. We stratified that cohort by age (18–30 years vs. >30years), and used the cohort of patients aged 18–30 years to investigate the factors associated with linkage to HCV care among that group. We also measured indicators of HCV care quality, as defined by the Centers for Medicare and Medicaid Services (CMS), including rates of Hepatitis A and B vaccination, HCV genotyping, and HCV treatment (12). Finally, we used multivariate modeling to compare linkage to care rates among the younger patients and those aged >30 years.

Site

BMC is a private, not-for-profit, urban medical center and the largest safety net hospital in New England. Approximately 70% of BMC's patients are from underserved populations including ethnic and racial minorities as well as uninsured or underinsured individuals.

Study population

Inclusion criteria included: (1) HCV diagnosis by serum HCV antibody between January 1st, 2005 and December 31st, 2010; and (2) Diagnosis in the following three sites at BMC: outpatient clinic (OC), the inpatient wards (IP), or the emergency department (ED). We then stratified the cohort based on age at baseline (18–30 years vs. >30 years). Analyses of factors associated with linkage to HCV care among youth used only the cohort of those aged 18–30 years. Comparisons of linkage among youth and older patients include all patients.

Outcome

The main outcome was linkage to HCV care, defined as HCV RNA testing after identification of reactive serum HCV antibody (11). Covariates for multivariable analysis included age at diagnosis, insurance type (public vs. private), birthplace (U.S. vs. foreign born), number of visits after diagnosis, and follow-up time after diagnosis.

Statistical analysis

We used descriptive statistics to describe the proportion of patients diagnosed in each site (OC, IP and ED). We also determined the proportion of patients who had genotyping, Hepatitis A or B vaccination and treatment initiation. Hepatitis A or B vaccination was determined by vaccination or documented immunity. Genotype testing was evaluated in all patients with positive HCV RNA. We defined HCV treatment initiation by the presence of a prescription for HCV targeted therapy on the medical list. We used multivariable logistic regression to identify factors associated with linkage to care among individuals between 18–30 years of age. Significant variables in univariate analysis and confounders were included in the multivariable model. Then, we expanded the analysis to include the entire cohort (all ages) to compare linkage among younger and older HCV-infected patients and used

multivariable logistic regression to estimate the odds ratio of linking to HCV care. All p-values were two-sided. Statistical analyses were performed using STATA 12 (STATA, College Station, TX).

Ethics

This study was approved by the Boston University Medical Center Institutional Review Board.

RESULTS

Study population

32,418 patients had HCV serology testing between January 1st, 2005 and December 31st, 2010 (Figure 1). Of the 32,418 patients who were tested for HCV, 5,140 were HCV antibody positive and tested in the IP, OC and ED setting (16% seropositivity). Of these 5,140 patients, 863 were aged 18–30 years and were included in the younger cohort. The remainder (4,277) constituted the cohort of those aged >30 years. Among the 8,873 individuals between 18–30 years who were tested for HCV, the seropositivity was 10%.

Of the 863 individuals with reactive HCV antibody and age between 18–30 years, the mean age was 25; 407 patients (47%) were male. Six hundred twenty three (72%) were White, 43 (5%) were Black, 152 (18%) were Latino, and 18 (2%) were Asian. Two hundred twenty three (26%) were diagnosed in the inpatient setting, 594 (69%) in the outpatient clinic, and 46 (5%) in the emergency department. Eighty one (9%) patients were HIV-coinfected and the mean length of follow-up time was 14 months, with a median of 11 visits after diagnosis. Four hundred seventy four (55%) had public insurance, and 697 (81%) of patients were born in the U.S. (Table 1).

Among the 4,277 with reactive HCV antibody and who were older than 30 years, the mean age was 48. Similar to the younger cohort, the majority (74%) were diagnosed in the outpatient clinic. In contrast to the younger cohort that was predominantly composed of white females, the older cohort had a larger proportion of Blacks (35% vs. 5%) and was predominantly male (69% vs. 47%). The proportion of HIV-coinfected patients was similar between the two groups (9%) (Table 1). The older cohort had higher median number of follow-up visits than the younger cohort (19 vs. 11) and greater median follow-up time after diagnosis (10 vs. 7 months).

HCV-related care

Among those aged 18 to 30 years, a total of 405 (47%) linked to HCV care, 100 (12%) had HCV genotyping, and 33 (4%) were treated for HCV (Table 2). Eighty-five (10%) had hepatitis A vaccination, and 261 (30%) had hepatitis B vaccination (Table 2). Three hundred ten (52%) patients diagnosed in the outpatient clinic linked to care, compared to 28% and 37% of patients identified in the emergency department and inpatient, respectively. The cohort older than 30 years of age had a lower rate of linkage to care (42%, p-value 0.004) as well as lower rates of vaccination (Table 2).

Independent variables associated with linkage to care

In multivariate analysis among those aged 18–30 years, diagnosis location (OP vs. IP/ED) (OR 1.78, 95% CI 1.28–2.49) and number of visits after diagnosis (dichotomized at the median number of visits) (OR 5.30, 95% CI 3.91–7.19) were associated with linkage to care (Table 3). In a separate multivariate analysis using the 5,140 individuals with reactive serology, we found that age between 18–30 years (compared to >30 years) was an independent predictor of linkage to care (OR, 1.42, 95% CI 1.21–1.67). Other independent predictors of linkage to care included Latino ethnicity (OR 0.84, 95% CI 0.73–0.97), diagnosis in the outpatient when compared to inpatient or ED (OR 1.88, 95% CI 1.64–2.15), and number of clinical visits after HCV diagnosis (OR 2.80, 95% CI 2.48–3.16) (Table 4).

DISCUSSION

We found that at an urban safety net hospital, screening for HCV among those aged 18–30 years yielded a high case detection rate (10% seropositivity). Although fewer than half of those HCV-infected patients linked to HCV care after diagnosis, compared to those older than 30 years of age, young HCV-infected patients were more likely to initiate HCV-related care. When younger patients with HCV infection do link to care, opportunities remain to improve their outcomes. For example, only 10% and 30% of the cohort had hepatitis A and B vaccinations, respectively, only 12% had HCV genotyping, and very few initiated HCV treatment.

These data add to the discussion about testing for and treating HCV in young adults, by showing that screening for HCV outside the birth cohort of those born between 1945–1964 can yield very high case identification rates (10% positivity), and that those identified link to care at a higher rate than their older counterparts. Currently, there are limited guidelines for screening for HCV among those under the age of 30 (13). One concern that limits enthusiasm for testing young adults is that youth are assumed to have low rates of linkage to HCV care. Our findings demonstrate, however, that in at least in one setting, young individuals with HCV link to care at a higher rate than those older than age 30. While not all young patients will be prepared for immediate HCV therapy, engaging them in HCV care provides an opportunity for secondary prevention. For example, higher rates of linkage to care create an opportunity for risk reduction counseling among youth, as studies have shown that individuals with HCV are more likely to quit injection drug use when informed of their diagnosis (14). Further, given that more than half of our cohort of young HCV-infected patients were female (53%), linking this population to care and initiating treatment could potentially decrease the rate of HCV maternal-to-child transmission.

The underlying reason that those under age 30 years linked to care more frequently is not clear and the finding differs from a previous study that found that older patients were more likely to link to HCV care (15). It is possible that young HCV-infected patients have fewer comorbidities than their older counterparts, and providers are therefore able to focus on HCV-related care. Another possibility is that younger HCV-infected patients diagnosed in health care facilities, especially primary care settings, are more likely to consider treatment given that they have an established source of health care and a relationship with a health care provider. This hypothesis is supported by data demonstrating that reporting a “usual source

of health care” is one of the factors independently associated with interest in HCV treatment among young HCV-infected patients (16). Individuals with access to health care are probably more likely to link to HCV care, where they might consider and initiate treatment. Previous studies demonstrating that younger age is associated with a lower likelihood of linking to care were all conducted in substance abuse treatment centers. For example one prospective study conducted in the Bronx, New York, reports that individuals over the age of 40 are more likely to link to care as measured by arrival at a clinic appointment (AOR=1.06, 95% CI: 1.00–1.12) (15). While both our cohort and the Bronx cohort include an urban HCV-infected population, individuals in the Bronx study were recruited from a methadone maintenance clinic. Many of the younger patients in that study had no established care provider and therefore needed to navigate a referral process and establish a new relationship with a treating provider. In contrast, patients in our study were screened within a healthcare setting and the large majority continued to have regular interaction with the healthcare center after initial HCV diagnosis, providing multiple opportunities for linkage.

The finding that linkage to care may be better when conducting screening within a healthcare center has important implications for decision making about HCV screening in youth. Typically, HCV screening efforts focus on substance abuse treatment centers because those locations are high-yield screening venues. Our data suggest that expanding to primary care centers may provide additional value. Though HCV-infected youth with a history of recent or active injection drug use might be less likely to present to a primary care setting and case detection rates could be lower than they are in treatment centers, patients who are identified in a primary care center may be more likely to engage with HCV therapy and the benefits of screening could be greater.

In addition, these data could inform the design of interventions to improve case detection and linkage to HCV care among youth. We found that youth tested in the outpatient setting had a higher rate of linkage to care than those tested as an inpatient or in the emergency department. We also found that despite a higher rate of linkage to care, the younger cohort of HCV-infected patients also has a lower rate of HCV treatment initiation, likely related to patients having early stage HCV infection, and clinicians being concerned about treatment adherence and elevated risk of HCV reinfection given ongoing high-risk behaviors. These findings demonstrate that efforts to identify and link HCV infected youth to care should be accompanied by measures to improve follow-up, such as patient navigation programs or medical case management. Patient navigation and medical case management have been shown to improve linkage to care rate in other chronic illnesses at safety net hospitals (17), and previous simulation work suggests that they are highly cost-effective (18).

There are limitations of our study. It is a retrospective analysis carried out at a single site and its design may limit its generalizability; however, our site is the largest safety net hospital in New England and it represents the experience of many youth with high-risk HCV behaviors. Larger cohorts from integrated healthcare systems, or private payers are important, but they may not reflect the care provided to high-risk youth who are more likely to be uninsured or on Medicaid (19). Another limitation is that individuals who were tested for HCV serum antibody at BMC may have received HCV RNA testing, genotyping and treatment at an outside facility. Furthermore, we used HCV RNA testing as a marker for linkage to care, but

it is possible that some patients had HCV RNA testing without being linked to care. Also, since history of mental illness and history of substance use were not well documented in the medical record, we were not able to control for them in the multivariate analysis. Our data were also gathered during the interferon era, thus the introduction of more tolerable and efficacious treatment could influence the rate of linkage to care in the future.

In conclusion, our study showed that at an urban safety net hospital with a large underserved population, screening for HCV among 18–30 year olds yielded a very high case identification rate and that youth were more likely to link to HCV care when compared to older individuals. These findings suggest that during the interferon-free era of HCV treatment, there is an opportunity to decrease further HCV transmission by focusing on this young population that appears to initiate HCV related care at a higher rate when compared to older individuals. Future studies are needed on the rate of linkage to care and treatment initiation during the interferon-free era and personalized medicine.

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Figure 1.

Study flow diagram

HCV: Hepatitis C; ED: Emergency Department; IP: Inpatient setting; OC: Outpatient setting

Figure 2.
Cascade of HCV care among 18–30 years-olds
HCV: Hepatitis C, RNA: Ribonucleotide Acid

Table 1

Baseline characteristics

Characteristics	All N=5,140 N (%)	18–30 year-olds N =863 N (%)	> 30 year-olds N=4,277 N (%)	p-value
Age at HCV diagnosis				
Mean (SD)	44	25	48	<0.001
Median	45	25	48	
Range	18 – 105	18–30	31–105	
Type				
ED	138	46 (5)	92 (2)	<0.001
Inpatient	1,253	223 (26)	1,030 (24)	
Outpatient	3,749	594 (69)	3,155 (74)	
Male	3,370	407 (47)	2,963 (69)	<0.001
Race/Ethnicity				
White	2,386	623 (72)	1,763 (41)	<0.001
Black	1,524	43 (5)	1,481 (35)	
Latino	952	152 (18)	800 (19)	
Asian	144	18 (2)	126 (3)	
Other/Unknown	134	27 (3)	107 (3)	
History of HIV infection	470	81 (9)	389 (9)	0.79
Insurance				
Public	3,063	474 (55)	2,589 (61)	0.01
Private	1,220	233 (27)	987 (23)	
Other/Unknown	857	156 (18)	701 (16)	
Birth place				
US	3,852	697 (81)	3,155 (74)	<0.001
Non US	1,000	118 (14)	882 (21)	
Unknown	288	48 (6)	240 (6)	
No. visits after diagnosis				
Mean	33	24	34	<0.001
Median	17	11	19	
Range	(0 – 519)	(0 – 311)	(0 – 519)	
Follow-up time, months				
Mean	16	14	17	<0.001
Median	9	7	10	
Range	(0–82)	(0 – 77)	(0–82)	

HCV: Hepatitis C; HIV: Human Immunodeficiency Virus; SD: Standard Deviation; US: United States.

Table 2a

Hepatitis C general and treatment-related care among 18–30 year-olds (N=863)

Characteristics	Total (N=863) N (%)	Inpatient (N=221) N (%)	Outpatient (N=595) N (%)	Emergency (N=47) N (%)
HCV treatment-related care				
HCV RNA testing	405 (47)	82 (37)	310 (52)	13 (28)
Genotyping	100 (12)	13 (6)	83 (14)	4 (9)
Treatment	33 (4)	6 (3)	26 (4)	1 (2)
HCV general care				
Hepatitis A vaccination	85 (10)	7 (3)	76 (13)	2 (4)
Hepatitis B vaccination	261 (30)	35 (16)	211 (35)	15 (32)

HCV: Hepatitis C, RNA: ribonucleotide Acid.

Table 2b

Hepatitis C general and treatment-related care among individuals > 30 year-olds (N=4,277)

Characteristics	Total (N=4,277) N (%)	Inpatient (N=1,030) N (%)	Outpatient (N=3,155) N (%)	Emergency (N=92) N (%)
HCV treatment-related care				
HCV RNA testing	1,780 (42)	298 (29)	1,456 (46)	26 (28)
Genotyping	579 (14)	75 (7)	498 (16)	6 (7)
Treatment	215 (5)	20 (2)	194 (6)	1 (1)
HCV general care				
Hepatitis A vaccination	371 (9)	43 (4)	326 (10)	2 (2)
Hepatitis B vaccination	1,000 (23)	135 (13)	853 (27)	12 (13)

Table 3

Factors associated with Hepatitis C RNA testing among 18–30 year-olds (N=863)

Predictors	Univariate Odds Ratio (95% CI)	Univariate p-value	Adjusted Odds Ratio (95% CI)	Adjusted p-value
Age at HCV diagnosis 25 years	1.04 [0.79–1.36]	0.79	1.17 [0.86–1.60]	0.32
Male	0.76[0.58–0.99]	0.04	0.89[0.65 – 1.21]	0.45
Race/Ethnicity				
White	Reference		Reference	
Black	1.44[0.56 – 3.71]	0.44	1.41[0.47–4.19]	0.54
Latino	1.21 [0.65–2.25]	0.54	1.09 [0.54 – 2.18]	0.82
Asian	1.07[0.75 – 1.52]	0.72	0.96[0.58–1.58]	0.87
Other/Unknown	0.79 [0.36 – 1.74]	0.57	0.95[0.38–2.33]	0.90
Insurance				
Public	Reference		Reference	
Private	1.38[1.01–1.89]	0.04	1.36 [0.96–1.94]	0.08
Other/Unknown	1.11[0.77 – 1.59]	0.59	1.26 [0.84 – 1.91]	0.26
Birthplace				
US	Reference		Reference	
Non US	1.01[0.68 – 1.49]	0.96	1.00 [0.58 – 1.75]	0.99
Unknown	0.40 [0.21 – 0.77]	0.01	0.54[0.26–1.13]	0.10
Diagnosis location				
Outpatient	Reference		Reference	
Inpatient/ED	0.50 [0.37 – 0.68]	<0.001	0.56[0.40–0.78]	<0.001
Number of visits after diagnosis				
<11	Reference		Reference	
11	5.58[4.16–7.48]	<0.001	5.30 [3.91–7.19]	<0.001

* ED: Emergency department; HCV: Hepatitis C; HIV: Human Immunodeficiency Virus; US: United States; IQR: interquartile range.

* This analysis controls for age (in decades), gender, ethnicity, insurance type, birth place, the diagnosis location, and the clinical visits.

Table 4

Factors associated with Hepatitis C RNA testing using the full cohort (N= 5,140)

Predictors	Univariate Odds Ratio (95% CI)	Univariate p-value	Adjusted Odds Ratio (95% CI)	Adjusted p-value
Age between 18–30 years at HCV diagnosis	1.24[1.07 – 1.44]	0.004	1.42[1.21 – 1.67]	<0.001
Male	0.98[0.87 – 1.10]	0.70	1.03[0.91 – 1.16]	0.68
Race/Ethnicity				
White	Reference		Reference	
Black	1.26[0.90 – 1.76]	0.18	1.17[0.79 – 1.73]	0.42
Latino	0.98[0.86–1.12]	0.78	0.84 [0.73 – 0.97]	0.02
Asian	1.09[0.94 – 1.27]	0.25	0.96[0.78 – 1.18]	0.70
Other/Unknown	0.76 [0.53 – 1.10]	0.14	0.85[0.57 – 1.27]	0.43
Insurance				
Public	Reference		Reference	
Private	1.11[0.97–1.27]	0.12	1.08[0.94 – 1.24]	0.29
Other/Unknown	1.37 [1.18 – 1.60]	<0.001	1.46 [1.24 – 1.72]	<0.001
Birthplace				
US	Reference		Reference	
Non US	1.13[0.99 – 1.30]	0.08	1.09[0.89–1.33]	0.40
Unknown	0.44 [0.34 – 0.58]	<0.001	0.70[0.52 – 0.94]	0.02
Diagnosis location				
Outpatient	Reference		Reference	
Inpatient/ED	0.49[0.43 – 0.55]	<0.001	0.53[0.46 – 0.61]	<0.001
Number of visits after diagnosis				
<17	Reference		Reference	
17	2.81[2.50 – 3.15]	<0.001	2.80[2.48 – 3.16]	<0.001

ED: Emergency Department; HCV: Hepatitis C; US: United States

This analysis controls for age, gender, ethnicity, insurance type, birthplace, diagnosis location, and number of visits after diagnosis.