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Emergency Departments at the Crossroads of Intersecting Epidemics (HIV, HCV, Injection Drug Use, and Opioid Overdose) – Estimating HCV Incidence in an Urban Emergency Department Population

Yu-Hsiang Hsieh, PhD, MSc¹, Anuj V. Patel, MD¹, Gideon S. Loevinsohn, BS¹, David L. Thomas, MD, MPH, FIDSA², and Richard E. Rothman, MD, PhD^{1,2}

¹Department of Emergency Medicine, University School of Medicine, Baltimore, MD, United States

²Division of Infectious Diseases, Johns Hopkins, University School of Medicine, Baltimore, MD, United States

Abstract

High seroprevalence of HCV antibody (anti-HCV) is common among urban emergency department (ED) patients. Little is known regarding incidence of HCV infection in ED patients. We conducted a longitudinal chart-review (2003-2016) of a subset of ED patients between December 2015 and January 2016 (the ‘index period’) in an urban ED that began an ED-based HCV screening program since November 2015. Patients were eligible for inclusion if they presented to the ED during the ‘index period’ and had at least one negative anti-HCV test between 2003 and 2015, and at least one test after the ‘index visit’. Follow-up time (person-years) was calculated for each patient. Incidence ratio (IR) and corresponding 95% CI was used to present the relative incidence between groups.

2% (6/299) patients included had HCV seroconversion during 1706.0 person-years, resulting in an HCV incidence of 3.5/1,000 person-years (95% CI: 1.4, 7.3). Incidence was significantly higher in white patients (IR: 12.9), people who inject drugs (IR: 17.4), and patients with unknown/unaware HIV status (IR: 8.3).

The relatively high HCV incidence in urban ED patients, especially in subgroups disproportionately impacted by opioid use and/or HIV, indicate that EDs represent a critical venue for detecting HCV and should consider prevention services against these intersecting epidemics.

Please address correspondence to: Dr. Yu-Hsiang Hsieh, Johns Hopkins University Department of Emergency Medicine, 5801 Smith Avenue, Suite 3220 Davis Building, Baltimore, MD 21209, Phone: 410-735-6413, Fax: 410-735-6425, yhsieh1@jhmi.edu.

Contributors

Y.-H. H. designed the study. Y.-H. H. and A. V. P. had primary responsibility for the data collection. Y.-H. H. performed data analyses. Y.-H. H., R. E. R., A. V. P., G. S. L., and D. L. T. primarily interpreted results. Y.-H. H. and A. V. P. primarily drafted the manuscript. R. E. R., G. S. L., and D. L. T. performed critical editing of the manuscript.

Declaration of interests

We declare no competing interests.

Ethics committee approval

The Johns Hopkins University School of Medicine Institutional Review Board approved the identity-unlinked blood-borne pathogen seroprevalence study.

Keywords

HCV; Emergency Department; Incidence; HCV Testing; CDC Recommendations

Hepatitis C virus (HCV) infection has emerged as one of the leading infectious epidemics of the 21st century, with an estimated 30,500 new cases in 2014 in the U.S. and 1.75 million new cases in 2015 globally, translating to HCV incidence of 0.105/1,000 person-years (PYs) and 0.237/1,000 PYs, respectively.^{1,2} According to the Centers for Disease Control and Prevention (CDC), reported cases of clinically diagnosed acute hepatitis C doubled between 2011 and 2015, with nearly 2500 cases identified.¹ In addition to increased clinician attention to HCV detection, resulting from advances in HCV treatment, another possible explanation regarding the rapid increase in acute cases of HCV is the intersection of the epidemics of injection drug use (IDU), opioid abuse and HIV.³

While recent advances in treatment provide hope for those infected, significant challenge remain with regard to optimizing population-based strategies for detection, linkage and treatment.⁴ Similar to the early days of the HIV epidemic, current CDC's HCV testing recommendations have not yet called upon emergency departments (EDs) to help,⁴ yet as was ultimately realized with HIV, EDs can and have played a pivotal role. Several recent studies suggest that EDs may be an important component of the national strategy for helping curtail the HCV epidemic.^{5,6} Several recent urban ED-based studies, provide estimates of the HCV prevalence in ED populations.^{5,6} As yet however, no studies have described the *incidence* of HCV infection in the ED populations, information that could be critical for defining ED's future role in the national testing strategy.

Our aim in this study was to estimate the HCV incidence among patients presenting to an urban ED which had an observed HCV seroprevalence of 13.8% in 2013.⁶

Methods

To assess HCV incidence, we conducted a longitudinal chart review (2003 – 2016) of a subset of ED patients who were enrolled in a blood-borne pathogen study conducted between December 2015 and January 2016 (operationally defined as the 'index period') in an urban ED. The ED had a triage nurse-driven blood-based HCV testing program that was integrated into routine practice, which began November 2015. Opt-out HCV testing was provided to adult ED patients who had no prior diagnosis of hepatitis C. The HCV seroprevalence of the testing program was 6.5%. The study was approved by the university's Institutional Review Board.

Patients were deemed eligible for inclusion if they presented to the ED during the 'index period' and had at least one negative anti-HCV test between 2003 and 2015, and at least one test after the 'index visit'. Patients with reactive anti-HCV result at the first time point were excluded. Socio-demographic information and pertinent medical history, including HCV infection and HCV laboratory testing data, was obtained from the electronic medical records.

Time of HCV seroconversion was assumed to be the midpoint between the last negative and first positive anti-HCV tests. Person-time of each patient (PYs) was calculated from the time of the first test to either time of seroconversion, or the last negative test. Incidence ratios (IRs) were used to compare incidences between groups using SAS 9.4 (SAS Institute Inc., Cary, North Carolina) and their corresponding 95% CIs were estimated by mid-p exact test method using R version 3.4.2.

Results

299 of 5,039 unique ED patients during the 7-week “index period” were included. HCV incidence and socio-demographic characteristic of these patients is summarized (Table 1). Six (2.0%) patients experienced HCV seroconversion over 1706.0 PYs [incidence: 3.5/1,000 PYs (95% CI: 1.4, 7.3)]. Incidence was significantly higher in white patients (IR:12.9), IDU (IR: 17.4), and patients with unknown/unaware HIV status (IR:8.3) (Table 1). Of note, the incidence for patients born in CDC birthcohort 1945 – 1965 was at the same level with those born 1966 – 1975 and 1976 – 1985.

Discussion

As the first-ever HCV incidence study conducted in an ED setting, we found the incidence of HCV infection (3.5/1,000 PYs) amongst a subset of this population to be 33-time higher than the incidence in the general U.S. population (0.105),¹ comparable to that found among high-risk groups.^{7,8} In addition, we identified that factors associated with increased risk for acquisition of HCV infection included White race (possibly related to high rates of non-disclosure of IDU in that population), IDU and unknown/unaware of HIV status. We also observed that the incidence of HCV for those born outside of birthcohort (1966 – 1985) was nearly identical to that observed in the CDC-designated ‘birthcohort’ (1945 – 1965). Together with findings from ours and other previous seroprevalence studies,⁶ these data emphasize the extremely high burden of HCV in the ED population, as well as the need to expand existing CDC testing recommendations to include EDs as a venue for testing. Suggested strategies based on our data could include targeted testing in high-risk subgroups, as well as repeat testing (though the exact frequency with which repeat testing should occur requires further study). Unfortunately, the Center for Medicare and Medicaid Services currently specifically exclude reimbursement for ED-based HCV screening,⁹ discouraging EDs to test, and missing critical windows for interventions.

The high HCV incidence in our population, coincides with the emerging public health crisis of opioid overdose in Baltimore, where over 600 overdose deaths were reported in 2016 alone.¹⁰ With more than 140 million visits annually, U.S. EDs, especially urban EDs, serve as a window for identifying and calling attention to the public health problems of the communities they serve – in this case, the intertwined epidemics of HCV, IDU, and opioid misuse, in addition to the already recognized HIV epidemic. Notably, EDs have already successfully responded to the challenge as they did with HIV, by building prevention and intervention services for the populations they serve (many of which have limited, or fail to access conventional healthcare services and/or public health preventive programs). Recognizing the fact ED serve both high volumes and high-risk populations, strategies could

be advanced that allow EDs to provide bundled interventions (i.e. HIV/HCV testing, referral and opioid misuse/overdose prevention) which could help address the intersecting epidemics of opioid misuse, IDU, and HIV/HCV.³

Successfully linking newly diagnosed (including incident) HCV-infected ED patients for HCV care at specialty clinic has been widely recognized as the one of the most critical steps for eliminating HCV in the community; challenges remain however, as linkage rate from other ED are in the low 30s.^{11,12} A multidisciplinary and multi-dimensional approach not only for HCV care but also opioid substitution therapy, might significantly improve linkage-to-care rate.^{11,13}

Regarding limitations, this is a single institution study with a small number of seroconversions. In addition, our estimates of incidence are based only on tests within our health system. Finally, as this was a longitudinal chart review study of disease occurrence in patients in the medical care setting, our study could be impacted by the medical surveillance bias when comparing HCV incidence in the general population. Patients included for this study might more likely be those who were perceived to be at increased risk by clinicians, or who presented with HCV-related symptoms, increasing the likelihood that they would have been tested for HCV prior to implementation of our ED-based testing program in 2015. Since this is a retrospective chart review study, ED clinicians were unaware of our study when they ordered an HCV test for patients. This type of potential bias would not have impacted our findings of the higher risk subgroups of patients in whom higher HCV incidence was observed. In spite of these limitations, our study provides the first evidence of alarmingly high HCV incidence in ED patients, and should be informative to public health policymakers crucial for devising strategies to augment current HCV testing recommendations.

In summary, in this urban ED, the high HCV incidence in the ED population is comparable to that seen amongst the CDC defined high-risk groups. The relatively higher incidence observed in subgroups, that are each disproportionately affected by the HCV/HIV/opioid epidemics, highlights the potential role that urban EDs could serve as sentinel sites, both for diagnosing HCV and providing a portal of entry to care. We propose that ED-based bundled interventions for diagnosing HCV and HIV, coupled with identification of persons at risk for opioid use/abuse, could be an important component of the public health strategy for addressing these epidemics which represent ongoing threats to the health of the US population.

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HCV Incidences and Incidence Ratios by Socio-Demographic Characteristics of 299 Patients at an Urban Emergency Department, 2003 – 2016.

Table 1

Characteristics	Category	Number	Incident HCV	Person-Years	HCV Incidence (per 1,000 PY)	Incidence Ratio (95% CI)
Overall		299	6	1706.0	3.5	
Age (Years)	18 – 34	120	1	645.9	1.5	1.0
	35 – 44	49	2	286.9	7.0	4.5 (0.3, 132.8)
	45 – 54	66	2	383.2	5.2	3.4 (0.3, 99.4)
Gender	55	64	1	390.0	2.6	1.7 (0.0, 64.6)
	Female	181	3	1095.3	2.7	1.0
	Male	118	3	610.7	4.9	1.8 (0.3, 10.4)
Race *	African American	235	2	1476.9	1.4	1.0
	White	46	4	229.2	17.5	12.9 (2.3, 100.6)
	Other	18	0	55.5	0.0	–
CDC Birth Cohort (1945 – 1965)	Yes	74	2	445.1	4.5	1.0
	Born before	20	0	113.4	0.0	–
	Born after	205	4	1147.5	3.5	0.8 (0.1, 6.1)
Birth Cohort	Prior to 1945	20	0	113.4	0.0	–
	1945 – 1965	74	2	445.1	4.5	1.0
	1966 – 1975	55	2	331.2	6.0	1.3 (0.1, 12.9)
	1976 – 1985	75	2	416.8	4.8	1.1 (0.1, 10.3)
	1986 – 1998	75	0	399.5	0.0	–
Insurance Payor	Commercial	167	3	1005.3	3.0	1.0
	Public	108	2	583.8	3.4	1.1 (0.1, 7.7)
	Self-Pay or Other	4	0	28.0	0.0	–
IDU *	Missing	20	1	88.9	11.2	3.8 (0.1, 35.4)
	No	292	4	1658.3	2.4	1.0
	Yes	7	2	47.7	41.9	17.4 (2.2, 98.0)
HIV Status	Negative	243	4	1369.6	2.9	1.0
	Positive	34	0	239.3	0.0	–
	Unknown	22	2	97.1	20.6	7.1 (0.9, 39.8)
Known/Aware HIV Status *	Yes	277	4	1608.9	2.5	1.0

Characteristics	Category	Number	Incident HCV	Person-Years	HCV Incidence (per 1,000 PY)	Incidence Ratio (95% CI)
	No	22	2	97.1	20.6	8.3 (1.1, 46.7)

Relevant categories were collapsed in order to eliminate no incident HCV case in the particular category for the purpose of estimation of incidence ratio.

* mid-p exact test, $p<0.05$