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Declining Hepatitis C Virus (HCV) incidence over 20 years among HIV positive and HIV negative injection drug users (IDUs) in Baltimore, MD (1988-2008)

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REVISED ABSTRACT

BACKGROUND: National statistics suggest declining HIV incidence among IDUs over the past two decades. Whether there have been comparable trends in other blood-borne infections (e.g. HCV) is unclear but has implications for resource allocation, prevention interventions and vaccine studies. We characterize HCV prevalence and incidence in a cohort of IDUs over 20 years, where we have previously demonstrated declining HIV incidence (4.4 per 100 p-y in 1988-89 to 0.20 per 100 p-y in 2005-08).

METHODS: ALIVE is an ongoing cohort of IDUs in Baltimore, MD. We characterized trends in HCV prevalence among 1698 IDUs recruited in four periods: 1988-89, 1994-95, 1997 and 2005-08. Incidence per 100 person-years (py) was calculated over the first two years of follow-up for those in each recruitment cohort who were HCV antibody negative at entry (n=373). Trends were compared across the four groups using Poisson regression.

RESULTS: At recruitment, median age was 39 years, 77% were female, 78% black and 20% HIV positive. HCV prevalence declined from 85% in 1988-89 to 78% in 1994-95 and 70% in 1998, but increased to 78% in 2005-08 (p<0.01). Similarly, HCV incidence declined from 22.0 per 100py in 1988-89 to 17.2 per 100py in 1994-95, 17.9 in 1998 and 7.8 per 100py in 2005-08 (p=0.07). After adjusting for age, years of injection drug use, other demographics and drug-related risk behaviors, the prevalence in 2005-08 was comparable to 1998 suggesting that the apparent increase was due to differences between the cohorts. In multivariate analysis accounting for demographic differences, the 1994-95 and 2005-08 cohort experienced declines relative to the 1988-89 cohort but these were not statistically significant. A small proportion of these declines appeared attributable to changes in drug-related risk behavior over time. Decreases were observed in both HIV positive and negative IDUs; however there was a more dramatic decrease in prevalence among HIV positives that continued even after 1998 (prevalence ratio for 2005-08 vs. 1999, 0.92).

CONCLUSIONS: These data suggest that commensurate with HIV infection, HCV prevalence and incidence have declined among IDUs with the most substantial change coming before 1998. However, a 78% prevalence and an incidence more than 40-fold higher than HIV in 2005-08 reflects continued high levels of transmission and a large future burden of HCV-associated liver disease among IDUs with and without HIV.

BACKGROUND / OBJECTIVE

- HIV incidence has declined among IDUs over the past decade but high risk behaviors among IDUs persist
- Hepatitis C virus is nearly 10 times more infectious than HIV
- Population-level HCV incidence may potentially serve as a surrogate for drug-related risk behavior in the community
- If prevention efforts have truly been successful in this community, declines in HIV incidence should be accompanied by declines in HCV incidence
- We have demonstrated declining HIV incidence in a community-based cohort of IDUs in Baltimore, MD from 1988-2007

- ***The objective of this analysis was to characterize trends in HCV prevalence and incidence among IDUs over four recruitment periods spanning 20 years***

METHODS

Study Population

- The AIDS Linked to the IntraVenous Experience (ALIVE) is a community-based cohort of IDUs in Baltimore, MD
- There have been four recruitment periods between 1988-2008: 1988-89 (n=2946), 1994-95 (n=391), 1998 (n=244) and 2005-08 (n=875)
- Participants in all periods had to be ≥ 18 years of age and have a history of drug injection (prior 11 years for 1988-89, prior 3 years for 1994-95,prior 1 year for 1998 and 2005-08.)

HCV Prevalence

- We included all persons with a viable baseline specimen with the exception of the 1988-89 cohort. Due to the large size, we took a random sample of 250 persons of the 1988-89 cohort
- Poisson regression with robust variance estimation was used to determine prevalence ratios (PR)
- Analyses included in interaction term between age and cohort

HCV Incidence

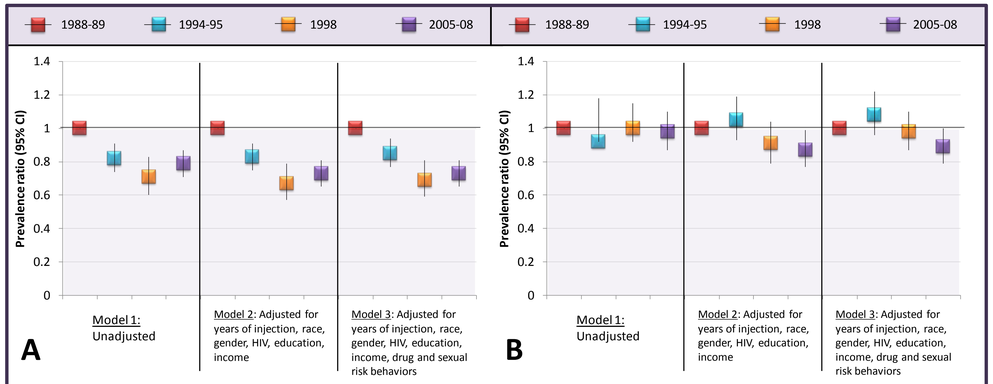
- We included all individuals who were HCV antibody negative at baseline and had a follow-up visit within one year of baseline
- Incidence per 100 person-years was calculated for each recruitment cohort to reflect only time until 1st follow-up visit if it occurred within 1 year of baseline
- Poisson regression was used to calculate incidence rate ratios (IRR)

TABLE 1. Characteristics by recruitment cohort

Characteristic	1988-89 (n=246)	1994-95 (n=379)	1998 (n=232)	2005-08 (n=874)
Median age (interquartile range)	34 (30 – 38)	37 (32 – 42)	40 (31 – 40)	43 (36 – 48)
Duration of injection drug use	13 (7 – 19)	15 (8 – 23)	18 (10 – 26)	19 (10 – 27)
Male gender	201 (82)	253 (22)	150 (13)	562 (48)
African-American	216 (88)	360 (26)	219(16)	573 (42)
HIV-infected	56 (23)	42 (11)	71 (31)	201 (23)
≥ High school education	114 (47)	177 (24)	95 (13)	367 (49)
No formal income	10 (4)	35 (9)	67 (31)	206 (24)
Injection drug use at baseline None Heroin Cocaine Both	 27 (11) 19 (8) 37 (15) 161 (66)	 11 (3) 38 (12) 20 (6) 250 (75)	 0 (0) 37 (16) 4 (2) 187 (82)	 84 (10) 158 (18) 20 (2) 581 (68)
Ever shared needles	236 (96)	312 (83)	165 (72)	755 (87)
Ever attended a shooting gallery	114 (46)	222 (59)	140 (61)	759 (87)
Median sexual partners in 10 yrs	10 (4 – 25)	7 (3 – 20)	3 (2 – 10)	6 (3 -18)

RESULTS

FIGURE 1. HCV prevalence by age at entry and recruitment cohort



Presented are prevalence ratios (unadjusted and adjusted) of HCV infection. Results are stratified by age and calendar time because there was a statistically significant interaction between age and calendar time (p<0.01). Panel A reflects age <39 and Panel B reflects age ≥39. Reference group for all models is the 1988-89 cohort. P values for all prevalence ratios in Panel A are statistically significant. Only the p value for the 2005-08 cohort in Model 2 of Panel A is statistically significant.

FIGURE 2. Incidence rates of HCV infection by recruitment cohort

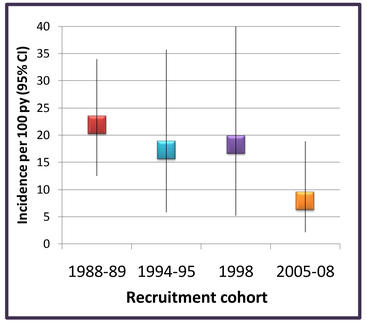


TABLE 2. Incidence rate ratios of HCV infection by covariates

	Incidence rate ratio (95% confidence interval)			
	1988-89	1994-95	1998	2005-08
Model 1: unadjusted	REF	0.79 (0.28 – 2.19)	0.82 (0.27 – 2.47)	0.36 (0.12 – 1.09)
Model 2:adjusted for age, time since 1st injection	REF	0.80 (0.27 – 2.33)	0.98 (0.31 – 3.06)	0.55 (0.14 – 2.14)
Model 3: adjusted for age, time since 1st injection, gender, race	REF	0.81 (0.26 – 2.51)	1.01 (0.33 – 3.04)	0.48 (0.13 – 1.70)
Model 4: adjusted for age, time since 1st injection, gender, race, HIV	REF	0.82 (0.27 – 2.53)	1.01 (0.33 – 3.04)	0.48 (0.14 – 1.68)
Model 5: adjusted for age, time since 1st injection, gender, race, HIV, education, income	REF	0.70 (0.21 – 2.38)	0.95 (0.26 – 3.45)	0.38 (0.09 – 1.62)
Model 6: adjusted for age, time since 1st injection, gender, race, HIV, education, income, drug-related risk behaviors	REF	0.98 (0.28 – 3.37)	0.99 (0.27 – 3.63)	0.43 (0.09 – 2.18)
Model 7: adjusted for age, time since 1st injection, gender, race, HIV, education, income, drug and sex-related risk behaviors	REF	1.00 (0.29 – 3.42)	0.90 (0.26 – 3.20)	0.36 (0.07 – 1.87)

CONCLUSION

- Commensurate with HIV infection, HCV prevalence and incidence have declined among IDUs, but changes have not been as dramatic as they have been for HIV
- Changes in HCV prevalence were only apparent over time in individuals younger than 39 years of age and were most dramatic from 1988-89 to 1994
- HCV prevalence remained relatively stable among persons ≥39 years of age with slight suggestion of a decline after 1998.
- Declines in HCV incidence were more modest with the most substantial decline occurring in 2005-08. A small proportion appeared attributable to changes in drug-related risk behavior (Model 6)
- However, a 78% prevalence and an incidence more than 40-fold higher than HIV in 2005-08 reflects continued high levels of transmission and a large future burden of HCV-associated liver disease among IDUs with and without HIV.

Supported by the National Institute on Drug Abuse (DA12568 and DA04334