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The hepatitis C virus cascade of care in the New York City (NYC) Jail System

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I have no conflicts of interest to declare.

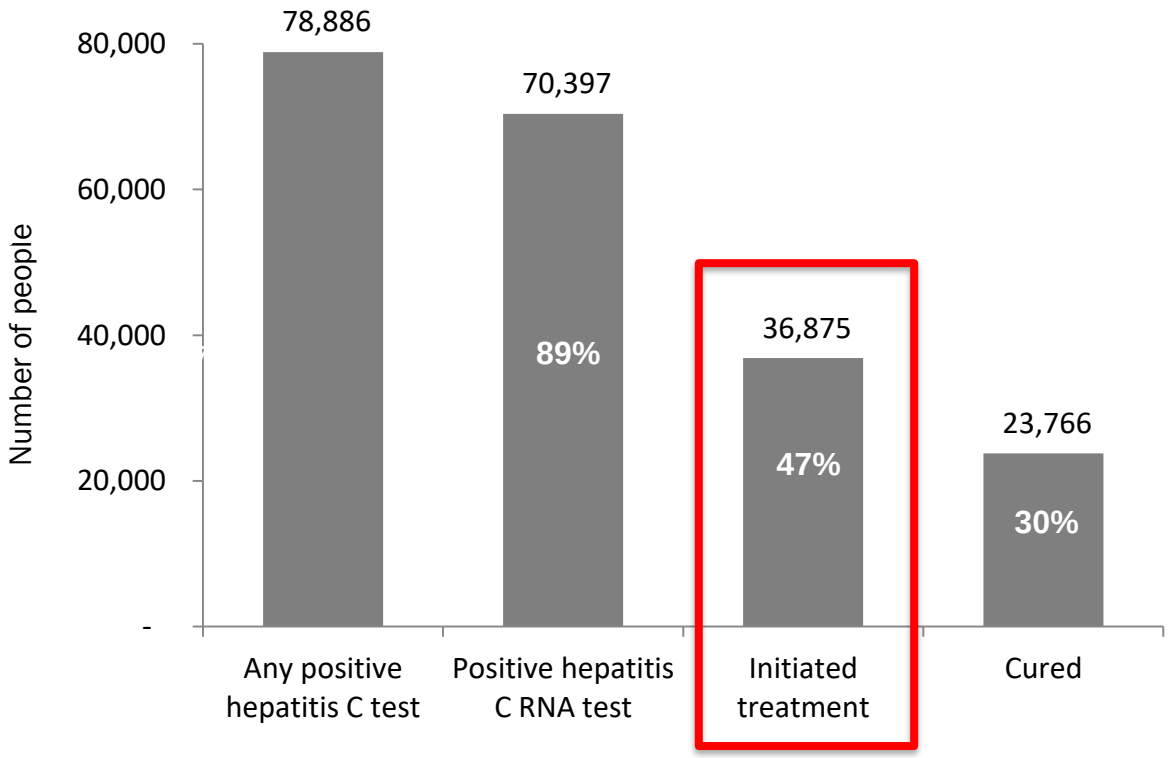
Outline

I. Background
II. Methods
III. Results
IV. Discussion

I. Background

Hepatitis C (HCV) cascade of care has improved during DAA era, but gaps remain

- Surveillance-based cascade of care for NYC residents 2014-2017
- Estimated 116,000 with chronic HCV (1.4% prevalence) in NYC (2017 data)
- Challenges remain in connecting patients to HCV treatment and training more clinicians to prescribe



Source: DOHMH, New York City Hepatitis A, B & C Annual Report, 2017; Moore M et al, 2018.

New York City jail system

2nd largest jail system in US

Fiscal year 2018:

- Average daily population 8,896 (94% male)
- Total admissions 49,455
- Average age 35.8 years
- Racial/ethnic breakdown:

  Non-Hispanic Black (53%)

  Hispanic (33%)

  Non-Hispanic White (8%)

Length of stay statistics:

- 32% stay for ≤ 4 days
- 21% stay for ≥3 months

US Definitions:

Prison = long-term correctional facility, convicted, sentenced ≥1 year

Jail = facility detaining those awaiting trial or serving sentence <1 year

Source: NYC Department of Correction

www1.nyc.gov/site/doc/about/doc-statistics.page

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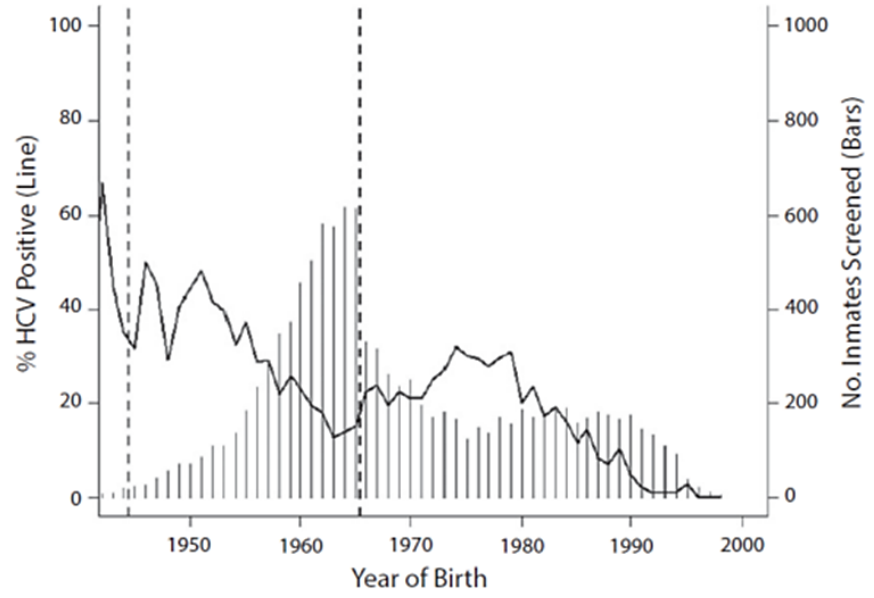
Risk factor & birth cohort HCV screening and seropositivity patterns
Correctional Health Services (CHS)
NYC jail system, June 2013 – June 2014

Screening Rates	
Overall Screening	19% (10,858/56,590)
Birth Cohort (b.1945-1965)	64% (5487/8560)
Born after 1965	11% (5303/47,775)
Seroprevalence among those screened	
Overall	20.6%
Born before 1945	34.9%
Born 1945-1965	22.5%
Born after 1965	18.5%

Hepatitis C Screening of the "Birth Cohort" (Born 1945–1965) and Younger Inmates of New York City Jails

Matthew J. Akiyama, MD, MSc, Fatos Kaba, MA, Zachary Rosner, MD, Howard Alper, PhD, Robert S. Holzman, MD, and Ross MacDonald, MD



Note. Dotted lines enclose the years 1945 to 1965.

FIGURE 1—HCV Seropositivity and Number of Inmates Screened, by Year of Birth: New York City Jail System, June 13, 2013–June 13, 2014

Source: Akiyama MJ et al, 2016.

Study Objective

To describe the HCV cascade of care for individuals admitted to NYC jail system during 2014-2017 when direct-acting antiviral (DAA) treatment was available.

II. Methods

Methods

Study design: Retrospective observational cohort

Unit of analysis: Individual patient

Inclusion: All patients admitted to NYC jail system January 2014 – December 2017

Exclusion:

- Patients who did not receive a medical intake (N=12,121)
- Patients cured with interferon therapy previously in jail (N=18)
- Patients who entered jail on DAA therapy from the community (N=88)

Data sources

- Demographic data from jail-based electronic health and pharmacy records
- Diagnostic workup and treatment initiation was included through April 30, 2018
- Virologic outcomes data from NYC Department of Health and Mental Hygiene (DOHMH) HCV surveillance registry
  - Includes all positive HCV antibody, positive and negative HCV viral load, HCV genotype results for NYC residents, including labs sent from NYC jails
  - Viral load data was captured for this study through July 17, 2019

Outcome definitions

1. Being screened for HCV.
2. Screening positive for HCV.
3. Having a confirmatory HCV RNA test done.
4. Being seen by an HCV treater in jail.
5. Receiving DAA therapy: started treatment from January 2014 through April 2018.
6. Sustained virologic response at 12 weeks (SVR12): HCV RNA undetectable, checked 64 days or later after the treatment end date.

Subgroups

1. Long stay cohort: had at least one jail stay that was ≥120 days during study time frame.
2. Frequent stay cohort: had >10 separate jail stays during study time frame.
3. HIV-infected cohort: defined by any history of positive HIV Ab/Ag testing, HIV viral load testing by CHS, or self-report on admission to NYC jail system.

Source: Reddy KR et al, 2017; Welzel TM et al, 2017.

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Source: Reddy KR et al, 2017; Welzel TM et al, 2017.

Statistical analysis

- Outcomes of (1) having confirmatory HCV RNA test done and (2) being seen by an HCV treater were analyzed by logistic regression to test for associations with variables hypothesized to be significant
- Independent variables hypothesized *a priori* to be significant:
  - Age
  - Sex
  - Race/ethnicity
  - HIV status
  - Length and frequency of stays
  - Serious mental illness (SMI)‡
  - Opioid use disorder (OUD)Ω

‡ NYC jail system defines SMI to include (a) schizophrenia spectrum and other psychotic disorders, (b) bipolar and related disorders, (c) depressive disorders, or (d) post-traumatic stress disorder (PTSD), as defined by the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5). These exclude diagnoses resulting from a substance use or medical condition.

Ω Suspected or confirmed OUD was defined based on DSM-4/5 criteria or positive urine toxicology screening on medical intake or self-reported use of the substance.

III. Results

Cohort characteristics

	Total N=121,375	Long Stay N=28,749	Frequent Stay N=1041	HIV-infected N=4252
Age, median (IQR)[α]	33 (25-44)	33 (25-45)	40 (32-49)	47 (35-53)
	N (column %)	N (column %)	N (column %)	N (column %)
Sex[‡]*				
Male	107,771 (88.8)	26,851 (93.4)	954 (91.6)	3530 (83.0)
Female	13,481 (11.1)	1869 (6.5)	85 (8.2)	715 (16.8)
HIV*				
Yes	4252 (3.5)	1074 (3.7)	80 (7.7)	N/A
No	117,123 (96.5)	27,675 (96.3)	961 (92.3)	
Serious mental illness (SMI)*				
Yes	10,654 (8.8)	4112 (14.3)	270 (25.9)	665 (15.6)
No	110,720 (91.2)	24,637 (85.7)	771 (74.1)	3586 (84.3)
Ever Homeless*				
Yes	20,236 (16.7)	7597 (26.4)	687 (66.0)	908 (21.4)
No	101,139 (83.3)	21,152 (73.6)	354 (34.0)	3344 (78.6)
Opioid Use Disorder*				
Yes	20,947 (17.3)	6628 (23.1)	573 (55.0)	1435 (33.7)
No	100,428 (82.7)	22,121 (76.9)	468 (45.0)	2817 (66.3)
Length of stay in days, median (IQR)[β]*	27 (4-144)	277 (210-425)	311 (174-494)	42 (6-174)
Number of incarcerations, median (IQR)[μ]*	1 (1-2)	2 (1-4)	12 (10-14)	2 (1-3)

[β] Median of each individual's cumulative length of stay during the cohort time frame (January 1, 2014 to December 31, 2017)

[μ] Median of each individual's cumulative number of incarcerations during the cohort time frame (January 1, 2014 to December 31, 2017)

[α]Age calculated at admission date of last incarceration

[‡]123 with missing data

*Chi-square testing with significant difference between subgroups and rest of overall cohort, with significance at $p<0.05$

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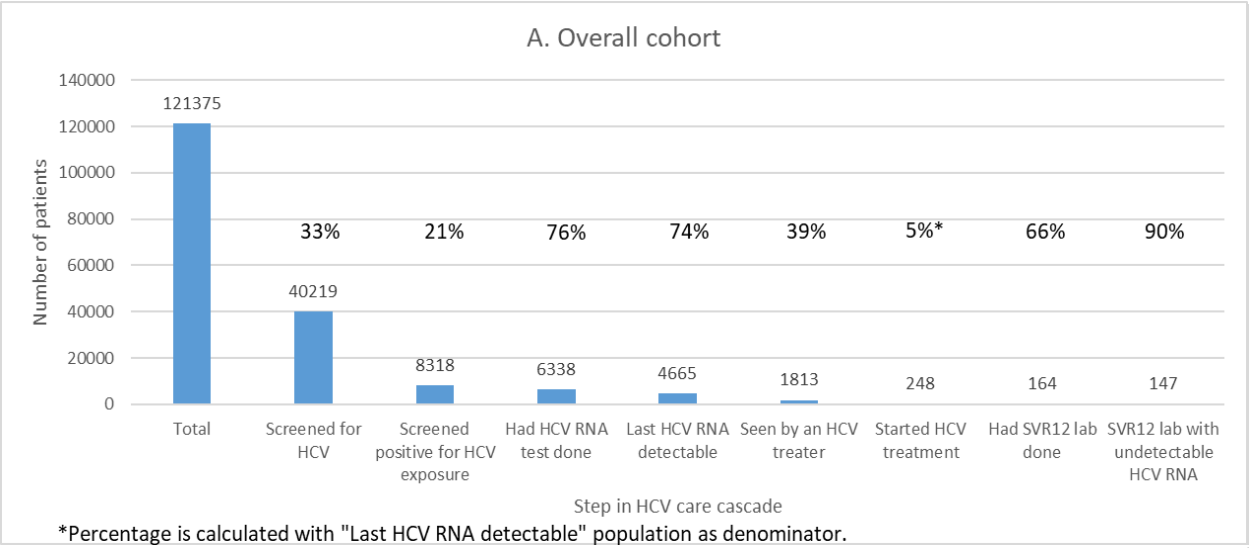
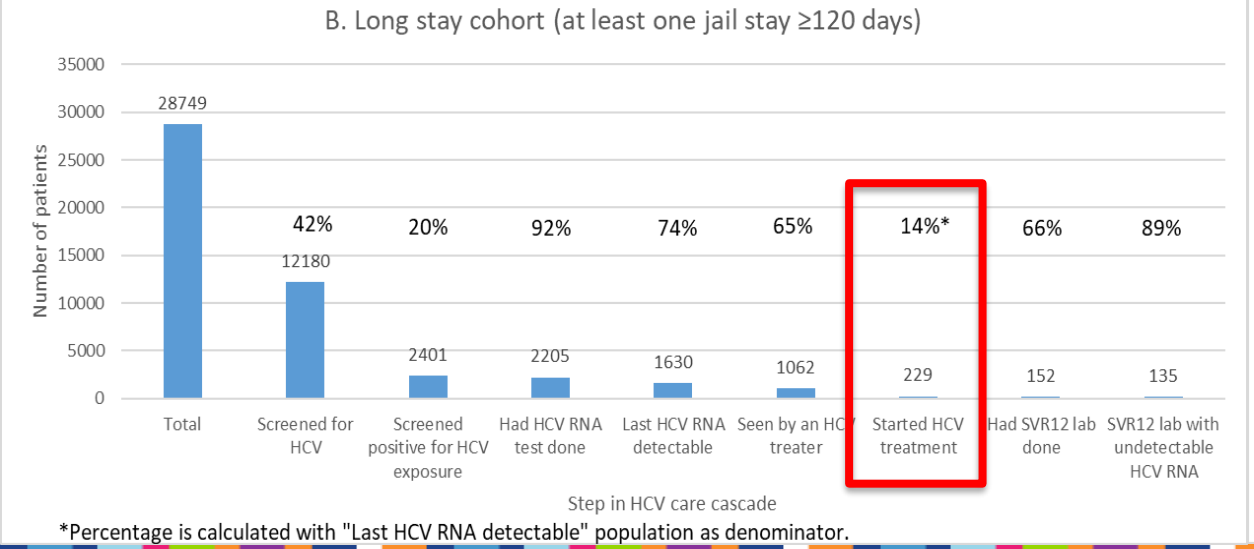
Cascades of care – patients incarcerated during January 1, 2014 – December 31, 2017

Note: percentages are calculated with previous step as denominator, unless otherwise noted.



*Percentage is calculated with "Last HCV RNA detectable" population as denominator.



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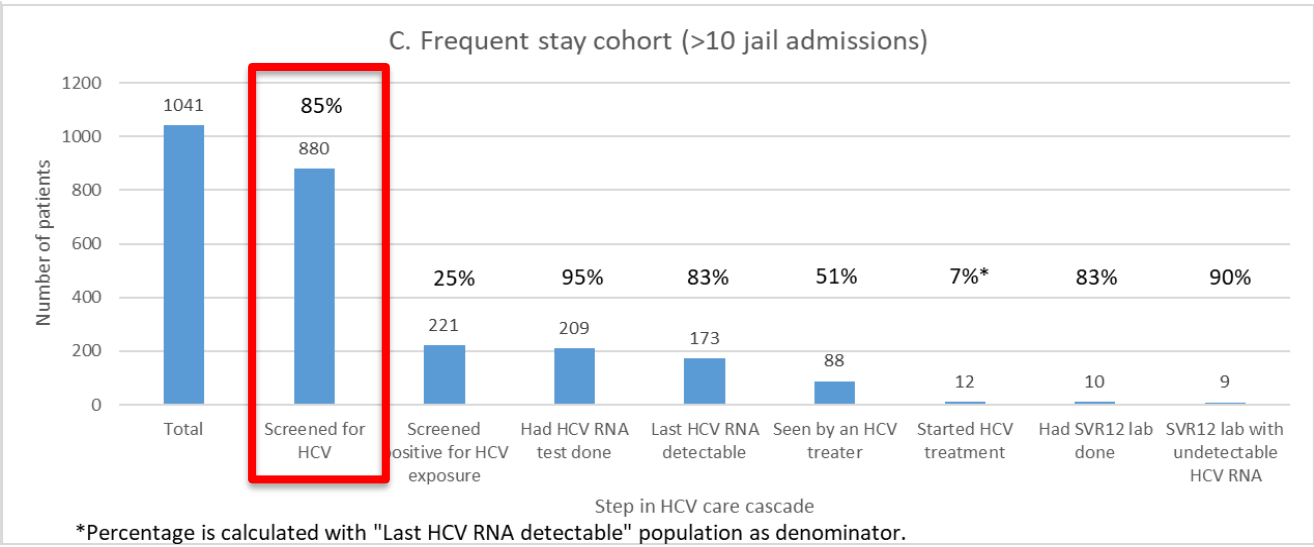

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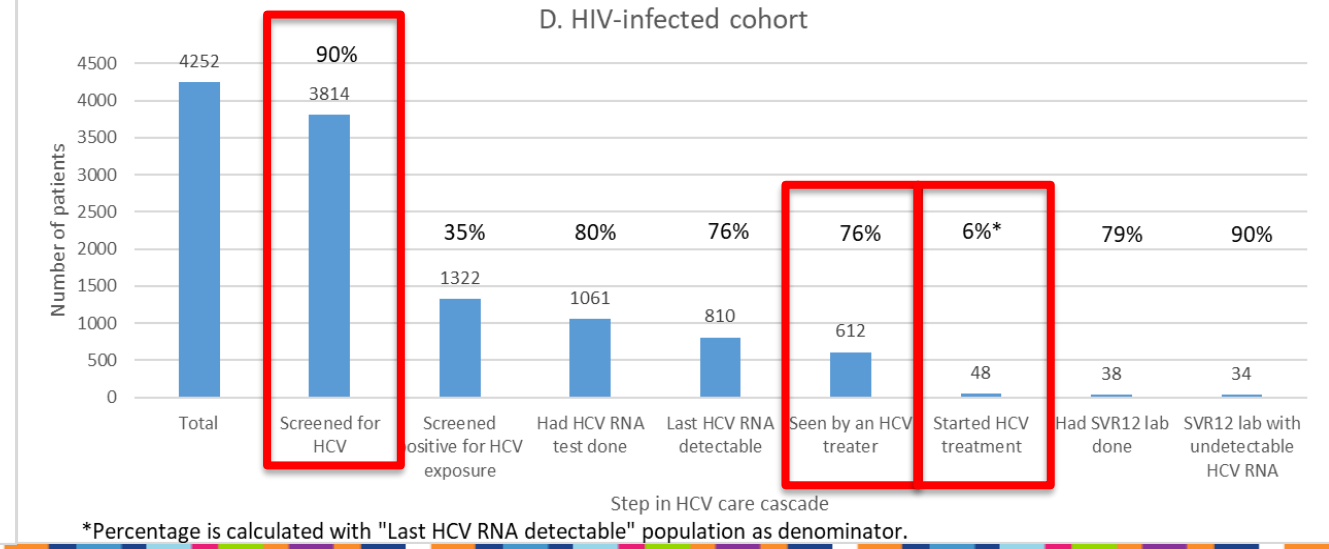

*Percentage is calculated with "Last HCV RNA detectable" population as denominator.

Cascade outcomes by key subgroups

	Total N=121,375	Screened for HCV N=40,219 (33%)	Screened positive for HCV exposure N=8318 (21%)	HCV RNA test done N=6338 (76%)	Last HCV RNA detectable N=4665 (74%)	Seen by HCV treater N=1813 (39%)	Treated N=248 (5%[α])
	N (column %)	N (row %)	N (row %)	N (row %)	N (row %)	N (row %)	N (row %)[α]
Birth cohort (year)							
Before 1945	270 (0.2)	148 (54.8)	38 (25.6)	23 (60.5)	18 (78.3)	5 (27.8)	0 (0.0)
1945-1965	18,769 (15.5)	13,435 (71.6)	3743 (27.9)	2800 (74.8)	2023 (72.3)	813 (40.2)	106 (5.2)
After 1965	103,316 (84.3%)	26,633 (26.0)	4537 (17.0)	3515 (77.5)	2624 (74.7)	995 (37.9)	142 (5.4)
HIV							
Yes	4252 (3.5)	3814 (89.7)	1322 (34.7)	1061 (80.3)	810 (76.3)	612 (75.6)	48 (5.9)
No	117,123 (96.5)	36,406 (31.1)	6996 (19.2)	5277 (75.4)	3855 (73.1)	1201 (31.2)	200 (5.2)
Opioid use disorder							
Yes	20,947 (17.3)	15,365 (73.4)	6131 (39.9)	4871 (79.4)	3603 (74.0)	1372 (38.1)	203 (5.6)
No	100,428 (82.7)	24,855 (24.7)	2187 (8.8)	1467 (67.1)	1062 (72.4)	441 (41.5)	45 (4.2)
Length of stay in days, median (IQR)[β]	27 (4-144)	62 (11-216)		95 (24-241)		225 (105-358)	384 (250-557)
Number of incarcerations, median (IQR)[μ]	1 (1-2)	2 (1-3)		2 (1-4)		3 (1-4)	3 (1-5)

[β] Median of each individual's cumulative length of stay during the cohort time frame (January 1, 2014 to December 31, 2017)
[μ] Median of each individual's cumulative number of incarcerations during the cohort time frame (January 1, 2014 to December 31, 2017)
[α]Denominator is "last HCV RNA detectable"

Factors associated with main outcomes of interest

Patient characteristics	Had HCV RNA test sent (among those who screened positive for HCV)			Being seen by an HCV treater while in jail (among those with detectable HCV RNA)		
	N (%)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)[μ]	N (%)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)[π]
Sex						
Female	1005 (79.8)	1.3 (1.1, 1.5)	1.4 (1.2, 1.7)	271 (39.9)	1.1 (0.9, 1.2)	1.5 (1.2, 1.8)
Male	5328 (75.6)	--	--	1542 (38.7)	--	--
HIV						
Infected	1061 (80.3)	1.3 (1.1, 1.5)	1.5 (1.3, 1.7)	612 (75.6)	6.8 (5.7, 8.1)	10.9 (9.0, 13.2)
Uninfected	5277 (75.4)	--	--	1201 (31.2)	--	--
Long stay[α]						
Yes	2205 (91.8)	4.9 (4.2, 5.7)	4.5 (3.9, 5.3)	1062 (65.2)	5.7 (5.0, 6.5)	8.1 (7.0, 9.5)
No	4133 (69.8)	--	--	751 (24.7)	--	--
Frequent stay[∞]						
Yes	209 (94.6)	4.9 (3.9, 6.3)	4.0 (3.1, 5.1)	88 (50.9)	1.4 (1.2, 1.6)	1.3 (1.1, 1.6)
No	6129 (75.7)	--	--	1725 (38.4)	--	--

OR = odds ratio

[μ] Final multivariable model included sex, HIV status, long stay status, frequent stay status, serious mental illness status, and opioid use disorder status

[π] Final multivariable model included sex, HIV status, long stay status, and frequent stay status

[α] all patients with ≥1 jail stay that was ≥120 days during the cohort time frame (January 1, 2014 to December 31, 2017)

[∞] all patients with >10 incarcerations during the cohort time frame (January 1, 2014 to December 31, 2017)

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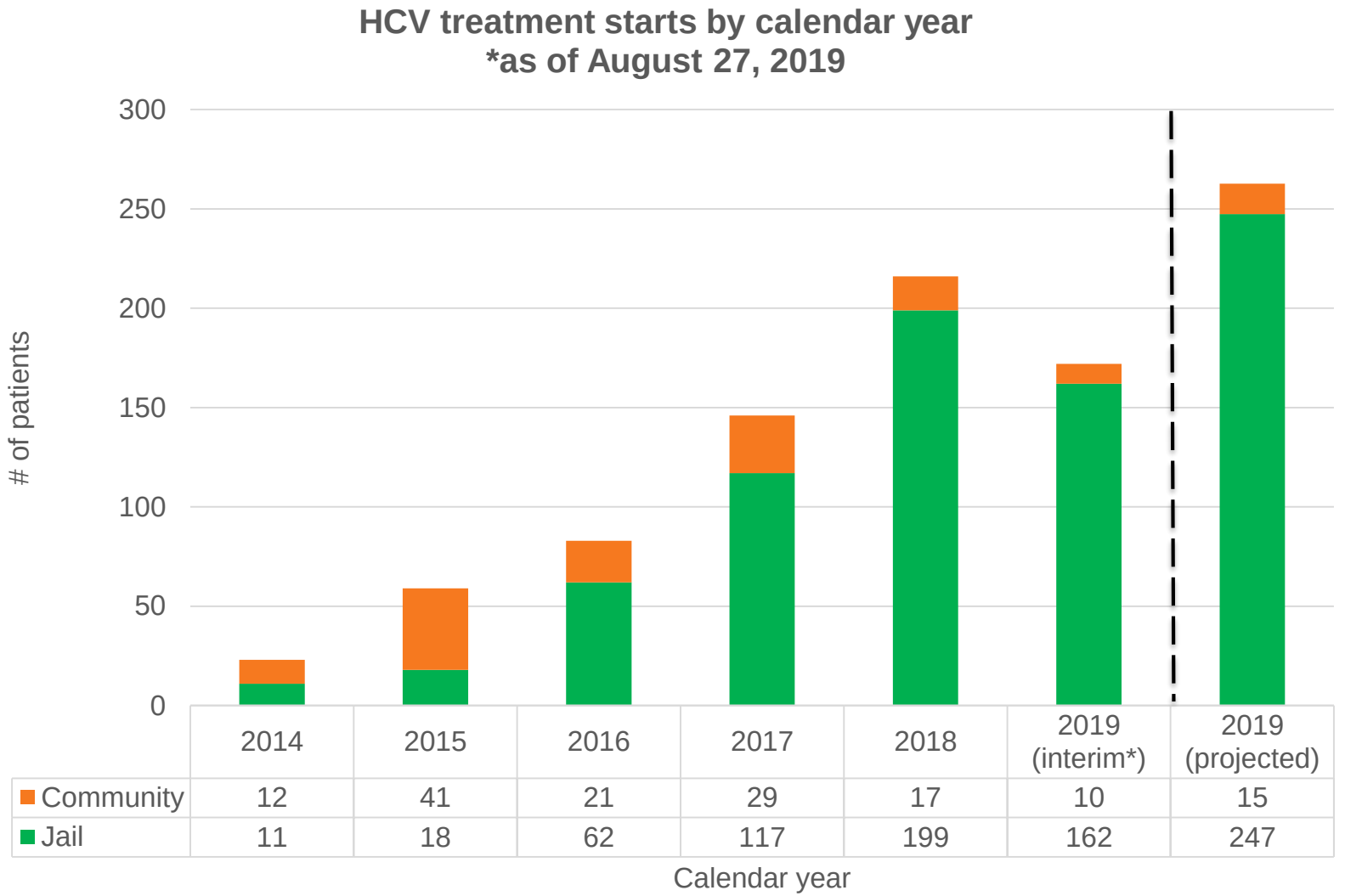

Note: 2019 projection assumes continued treatment initiation at current rate for the remainder of the year.

IV. Discussion

- Subgroups with heavier exposure to jail (long stay and frequent stay cohort) have higher burden of mental health and substance use disorder than the overall jail population
- HCV screening rate high in risk groups: 1945-1965 birth cohort, HIV-positive, and opioid use disorder
- We achieved high rates of confirmatory HCV RNA testing
- Treatment rates were generally low, but scaling up annually

Source: Jain MK et al, 2019.

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Acknowledgements

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