

A Digital Case-Finding Algorithm for Diagnosed but Untreated Hep C: A Tool for Increasing Linkage to Treatment and Cure

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Conflict of Interest/Funding

No conflicts of interest to report.

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NYC is making progress toward WHO impact targets but has a long way to go.

WHO indicator	WHO 2030 target	Proposed NYC indicator	NYC baseline data	Latest available NYC data	Percentage change from baseline
New cases of chronic hepatitis B infections	90% reduction	Newly reported cases of chronic hepatitis B ⁵	8,344 (2016)	5,964 (2019)	28.5% reduction
New cases of chronic hepatitis C infections		Newly reported cases of chronic hepatitis C ⁵	6,438 (2016)	4,427 (2019)	31.2% reduction
Hepatitis B deaths	65% reduction	Percentage of people with hepatitis B who died prematurely ⁵	53% (2016)	46% (2017)	13.2% reduction
Hepatitis C deaths		Percentage of people with hepatitis C who died prematurely ⁵	53% (2016)	48% (2017)	9.4% reduction

**2030 Target:
65% reduction
in pre-mature
deaths**

**2019:
9.4% reduction
in pre-mature
deaths**

Only 50% of NYC residents with a positive test for HCV RNA first reported in 2015 had been treated by 2019

HCV is not a solved problem:

Many diagnosed cases have not been treated

Goals:

1. To develop computer algorithms to identify diagnosed-but-untreated HCV⁺ patients at Mount Sinai
2. To engage patients in HCV treatment and reduce HCV infections in the Mount Sinai Healthcare System, focusing on patients at average- and elevated risk of liver disease progression.

Algorithm Development

Identify data elements and determine their Electronic Medical Record (EMR) codes

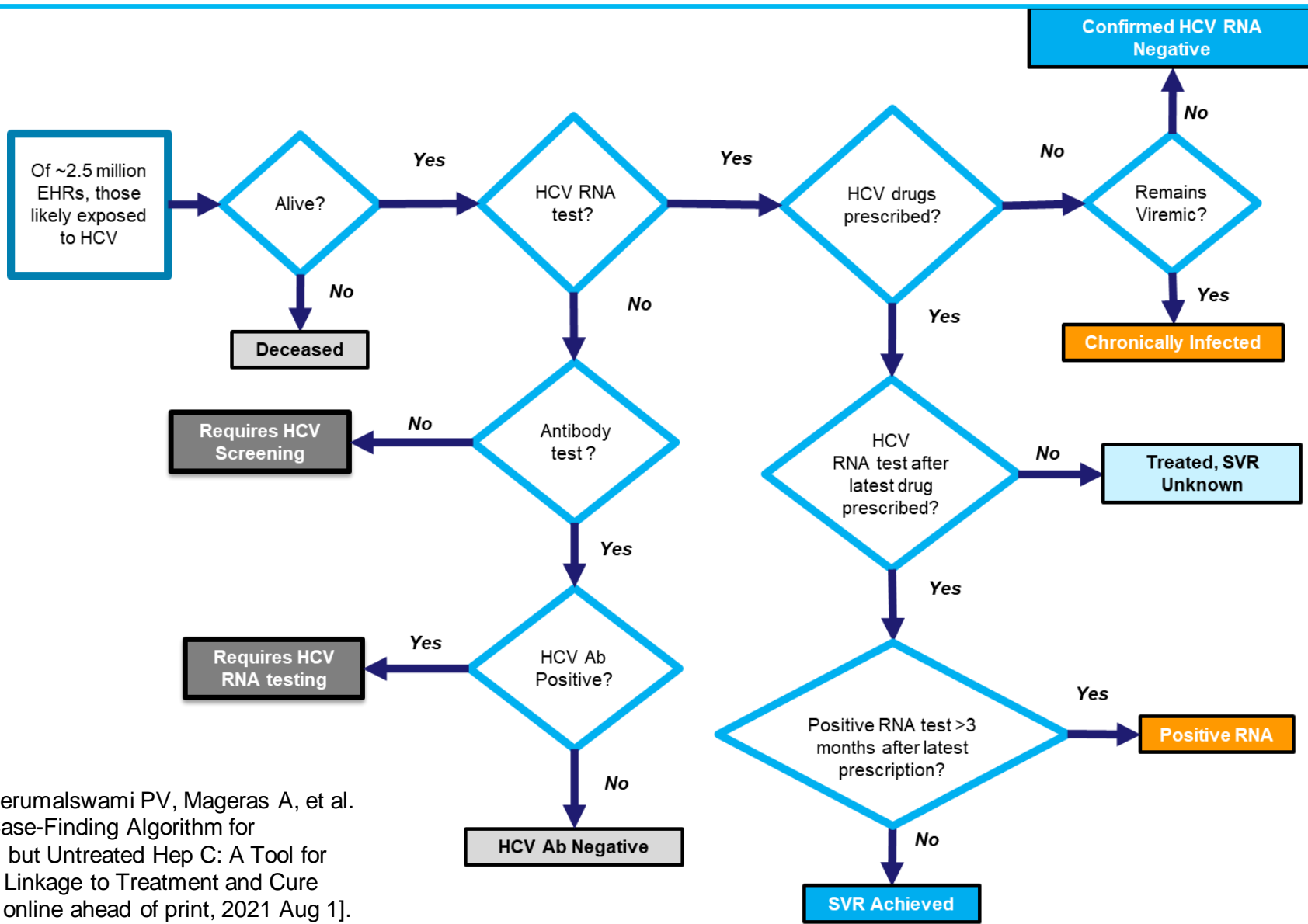
International classification of diseases (ICD) 9/10 codes: B17.10, B17.11, B18.2, B19.10, B19.20, B19.21, K73.2, K74.60, K74.69, R76.8, Z86.19

HCV RNA tests	
25779	HEPATITIS C QUANTITATION
5280	HEPATITIS C VIRUS RNA QUANT
7049	HCV RNA QN PCR
7050	HCV RNA QN PCR
19356	COBAS TAQMAN HCV
13013	HEPATITIS C VIRUS RNA QUANT RT-PCR
18331	HCV RNA IU/ML
18332	HCV RNA QNPCR
3360	HCV RNA QUANTITATIVE
3408	HEPATITIS C VIRUS SUBTYPE PCR W/REFLEX GENOTYPE
3358	HCV RNA, QUANT
3361	HCV RNA, QN, TMA
6953	HCV RNA, TMA
6998	HCV RNA IU/ML
6999	HCV RNA, QN, PCR
5286	HEPATITIS C VIRUS RNA QUANT, GENOTYPE
16741	HEPATITIS C QUANTITATION
30038	HCV RNA QUANTITATIVE

HCV Antibody Tests	
8817	HEP C AB(874)
10102	HCV AB,
9653	HEPATITIS W/PROFILE C PANEL
16463	HEP C VIRUS AB
24426	HCV AB
8441	HEPATITIS C VIRUS AB
14548	HEP C AB
3407	HEPATITIS C VIRUS AB
5014	HEPATITIS C VIRUS AB(NS)
18361	HEP. C AB
13912	HEPATITIS C ANTIBODY BY CIA INTERP

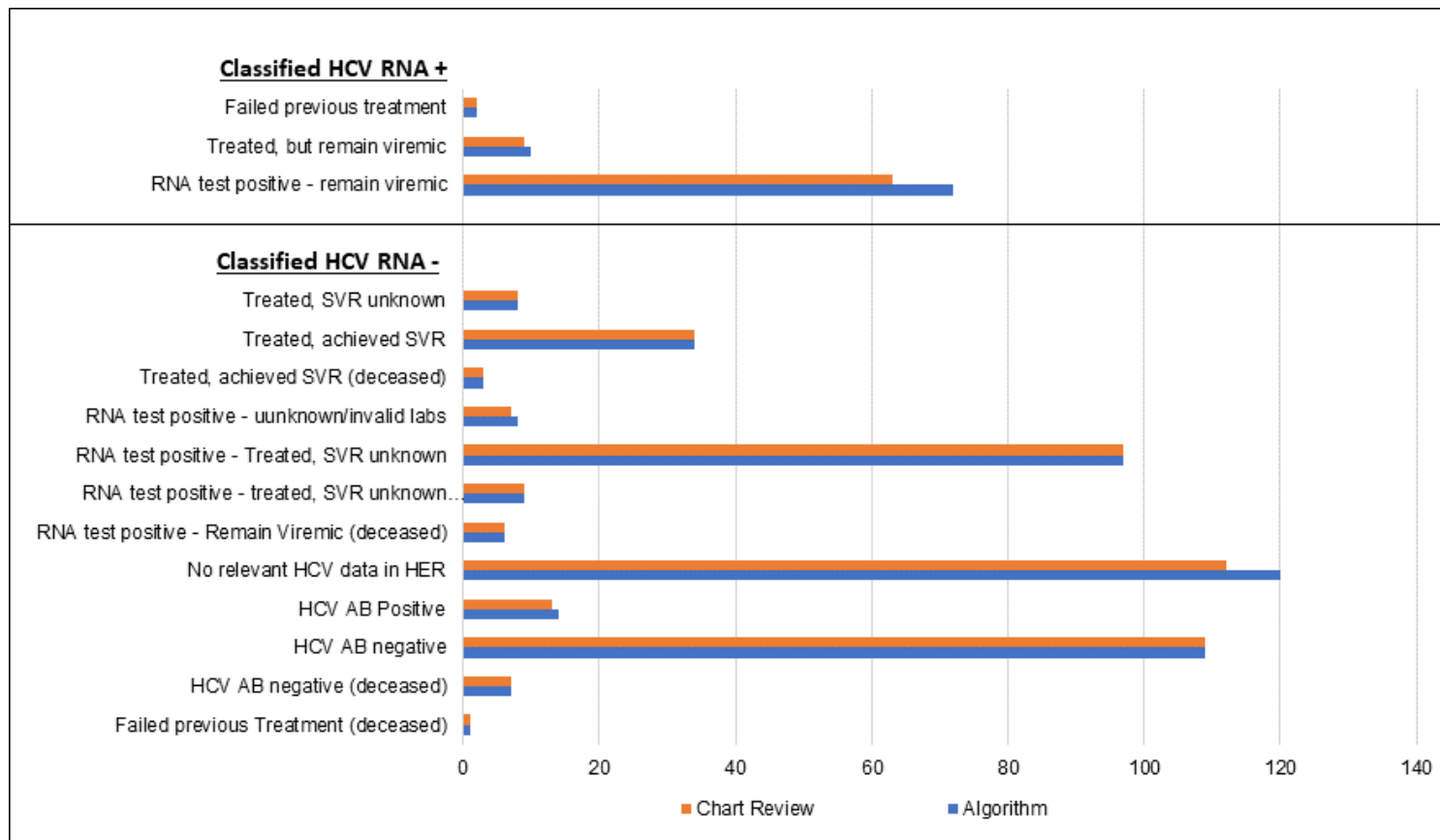
HCV Medications	
DACLATASVIR (DAKLINZA)	
ELBASVIR-GRAZOPREVIR (ZEPATIER)	
OMBITASVIR-PARITAPREVIR-RITONAVIR (TECHNIVIE)	
RIBAVIRIN (COPEGUS, REBETOL, RIBASPHERE, RIBAPAK)	
OMBITASVIR-PARITAPREVIR-RITONAVIR AND DASABUVIR (VIEKIRA PAK)	
SOFOSBUVIR-VELPATASVIR-VOXILAPREVIR (VOSEVI)	
SIMEPREVIR (OLYSIO)	
GLECAPREVIR-PIBRENTASVIR (MAVYRET)	
LEDIPASVIR-SOFOSBUVIR (HARVONI)	
SOFOSBUVIR (SOVALDI)	
SOFOSBUVIR-VELPATASVIR (EPCLUSA)	
INTERFERON ALPHA-2B	
INTERFERON ALPHA-1 (INFERGEN)	
PEGYLATED INTERFERON ALPHA-2A	
PEGYLATED INTERFERON ALPA-2B	

Algorithm Outputs



Wyatt B, Perumalswami PV, Mageras A, et al. A Digital Case-Finding Algorithm for Diagnosed but Untreated Hep C: A Tool for Increasing Linkage to Treatment and Cure [published online ahead of print, 2021 Aug 1]. Hepatology. 2021;10.1002/hep.32086. doi:10.1002/hep.32086

Algorithm Performance Evaluation: Compare the algorithm to manual chart review

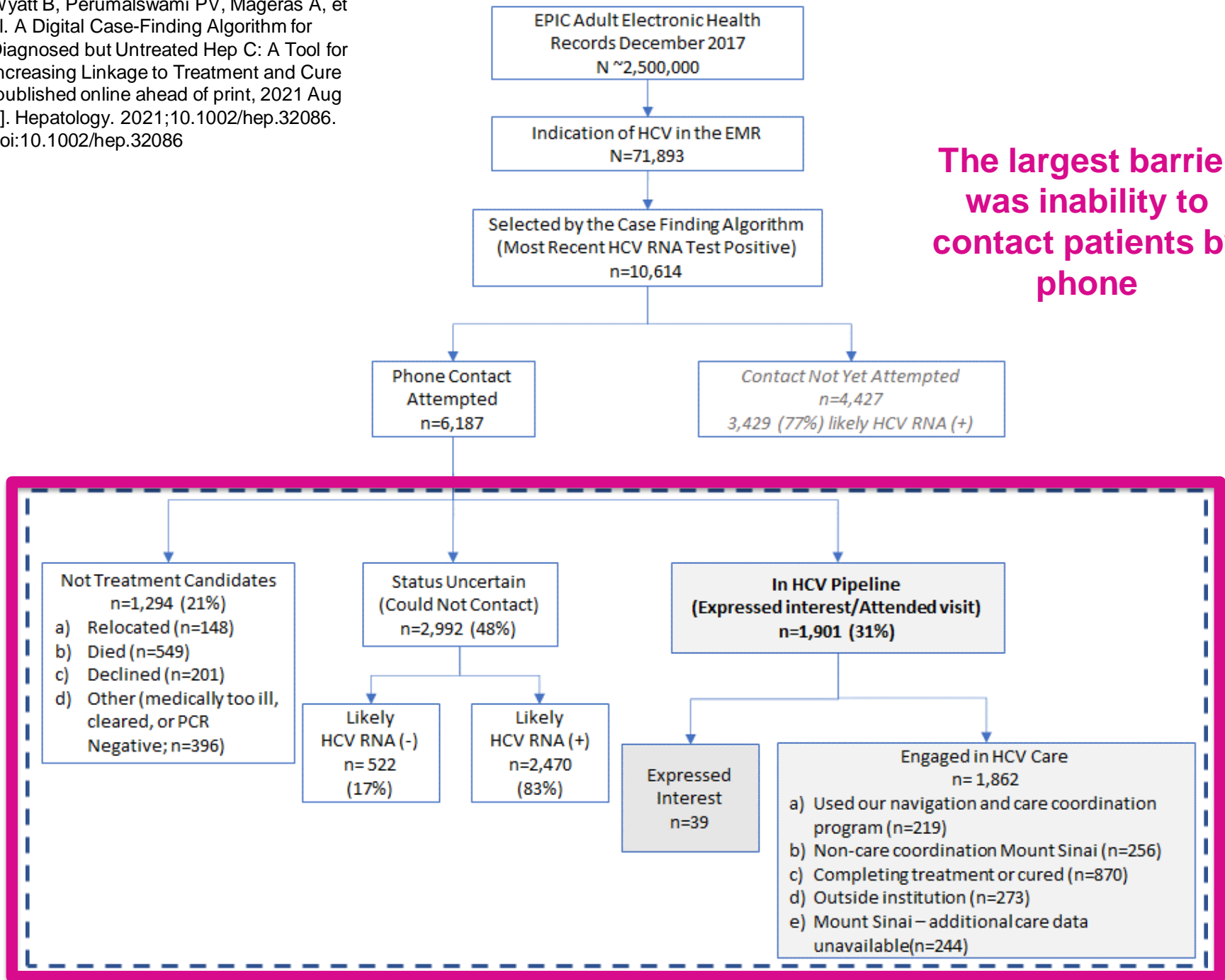


	Computer	Manual	Predictive Value
HCV RNA positive	84	74	PPV = 88%
HCV RNA negative	416	405	NPV = 97%

Summary

Strengths and Weaknesses of the Automated Case-Finding Approach

- The algorithm scored ~ 0.4% of EHRs as HCV RNA positive, reducing the number of charts needing manual review from 2.5 million to ~ 11,000, a great enrichment
- The algorithm picked up ~ 88% of the EHRs that had affirmative HCV RNA positive data
- Miscalls were typically associated with unstructured data reported in idiosyncratic syntax, sometimes in the media section
- Allowed for additional modifications to prioritize patients based on disease severity (Fibrosis score, ALT measurements, HIV, Diabetes)
- It may be possible to develop a risk index (age, social history, elevated ALT) to identify likely HCV treatment candidates who do not have HCV RNA test results



The largest barrier was inability to contact patients by phone

Care coordination was beneficial

Analysis of 475 patients who were deemed eligible for HCV treatment as of 12/2017			
	Enrolled in our care coordination program (n=219)	Not enrolled in our care coordination program (n=256)	P-Value*
FIB-4 at baseline Median (IQR)	2.5 (1.5, 4.7)	2.1 (1.3, 3.6)	0.76
Time from HCV evaluation to treatment initiation median (IQR) days	52 (30.8, 100)	71 (40.5, 147.8)	0.58
Number (percentage) initiating treatment	177 (81%)	148 (58%)	<0.001
Number (percentage) completing treatment	157 (72%)	137 (54%)	<0.001
Number (percentage) achieving SVR 4 or later	146 (66%)	118 (46%)	<0.001
*Two sample T-test for continuous variables and chi-square for categorical variable Abbreviations: Interquartile range (IQR)			

There is a significant difference in the percentage of patients who start treatment, complete and achieve SVR

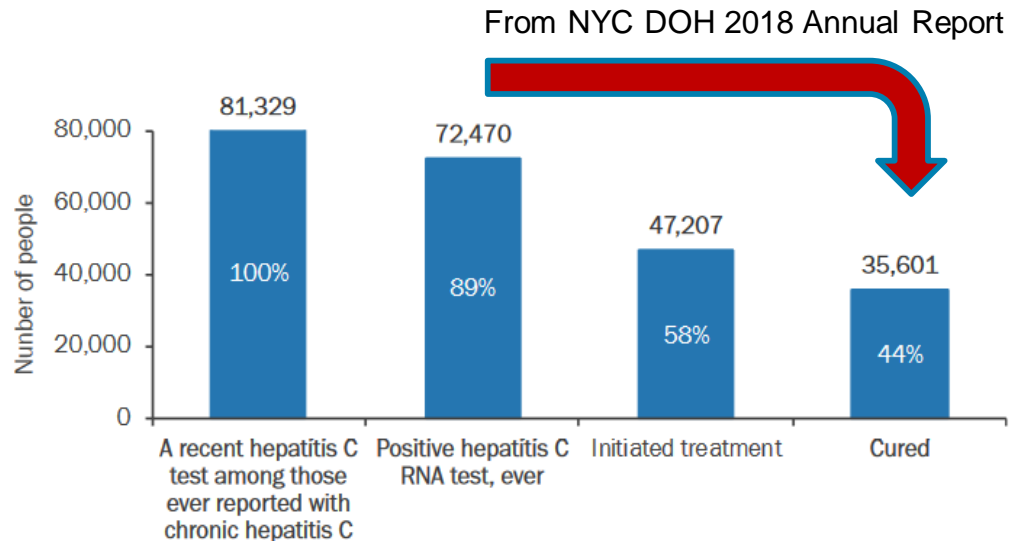
Barriers to Starting and Completing Treatment

Barriers to starting treatment at Mount Sinai among 149 candidates who did not start treatment during the follow-up period			
	Enrolled in our care coordination program (n=42)	Not enrolled in our care coordination program (n=107)	Total (n=149)
Competing medical priorities	7	49	56
Cleared HCV spontaneously	1	2	3
Died	6	11	17
Declined treatment or were lost to follow up	15	26	41
Transferred to care elsewhere	3	12	15
Delays due to missed appointments, comorbidities, or COVID-19	10	7	17

Barriers to completing treatment at Mount Sinai among 32 patients who started but did not complete treatment			
	Enrolled in our care coordination program (n=20)	Not enrolled in our care coordination program (n=12)	Total (n=32)
Competing medical priorities	0	2	2
Died	2	1	3
Became incarcerated	1	0	1
Lost to follow up	11	6	17
Transferred to care elsewhere	0	1	1
Stopped treatment, but achieved an SVR	6	2	8

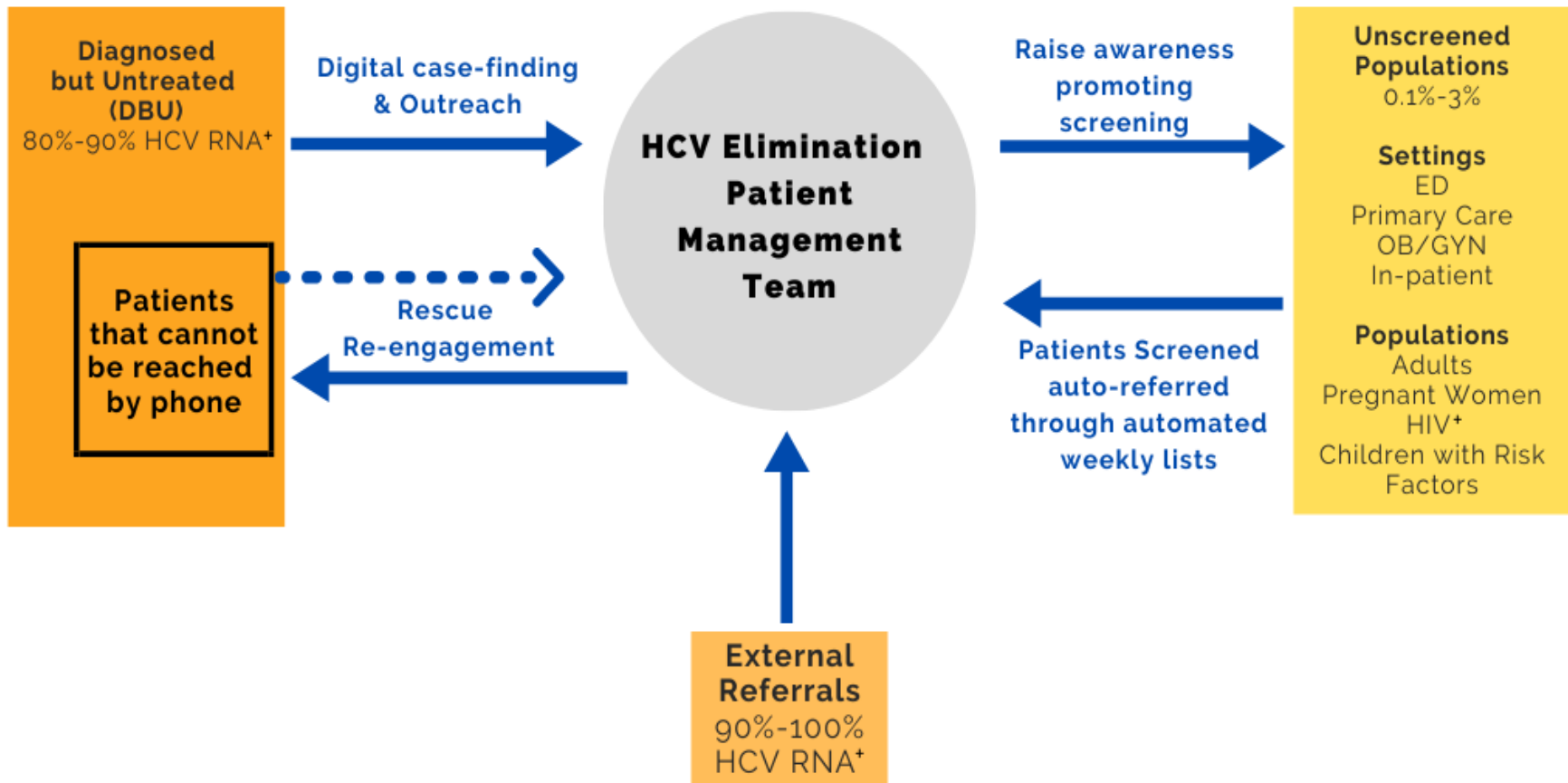
Our work is not done...

- In NYC only about 50% of known HCV RNA-positive residents are cured
- The DOH estimates that 1.4% of NYC residents are HCV RNA-positive, about 40% of them remain undiagnosed.
- New CDC HCV Screening Guidelines, April 10, 2020 - Recommended HCV screening for nearly all adults (not just baby boomers and other high-risk individuals) however Covid stole its thunder



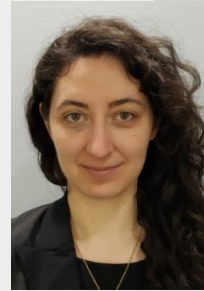
Eliminating HCV will require new approaches...

Comprehensive HCV Elimination Across a Healthcare System (Mount Sinai Health Care System Model)



The HCV Elimination Team

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