Moving More People with a Hepatitis C Diagnosis to Treatment: Alerts in CHORUS, a Clinical Decision Support System

Douglas T. Dieterich[1], Rachel Palmieri Weber[2], Ricky K. Hsu[3,4], Carl Millner[5], Brooke Levis[2], Jennifer S. Fusco[2], Laurence Brunet[2], Annie Son[6], Bruce Kreter[6], Gregory P. Fusco[2]

[1] Icahn School of Medicine at Mount Sinai, New York, NY; [2] Epividian, Inc., Raleigh, NC; [3] NYU Langone Health Center, New York, NY; [4] AIDS Healthcare Foundation, New York, NY; [5] AIDS Healthcare Foundation, Los Angeles, CA; [6] Gilead Sciences, Inc., Foster City, CA

Background

o HCV is one of the most common bloodborne pathogens in the US and the rate of incident HCV infections has increased in recent years

o Despite the availability of effective treatment with direct-acting antivirals, too many people with HCV infection progress to liver cirrhosis and failure

Objective

To assess whether providing alerts through CHORUS, a clinical decision support system, increases the prescription of treatment for diagnosed, untreated individuals with HCV

Methods

Study Population

o OPERA® observational cohort: Prospectively captured, routine clinical data from EHRs in the US

o CHORUS™: A web-based CDSS that translates, transforms, and organizes EHR data into useful reports for healthcare providers

o Inclusion criteria: 18 years of age or older with active, untreated HCV infection

Before & After Study Design

o No alerts were disseminated in the **before** period (inclusion: 16JAN2022-16AUG2022; follow-up through 17OCT2022)

o Alerts identifying individuals with diagnosed, untreated HCV were disseminated to clinics in the **after** period (inclusion: 16JAN2023-16AUG2023; follow-up through 17OCT2023)

Alerts

o Included an individual's:
- Date of HCV diagnosis
- Date of last detectable HCV viral load or genotype
- Prescriptions for prior HCV treatment

Analyses

o Among individuals who completed a visit with a healthcare provider, the proportions of individuals prescribed HCV treatment over follow-up were described

o Incidence rates and 95% CIs of prescriptions for HCV treatment over follow-up were estimated via univariate Poisson regression

Abbreviations

ADAP, AIDS Drug Assistance Program; CDSS, clinical decision support system; CI, confidence interval; DAA, direct-acting antivirals; EHR, electronic health records; HBV, hepatitis B virus; HCV, hepatitis C virus; HIV, human immunodeficiency virus; IQR, interquartile range; IR, incidence rate; mL, milliliter; n, number; py, person-years; μL, microliter; Tx, treatment; US, United States; VL, viral load

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Results

Figure 1. Individuals with (dark) and without (light) ≥1 visit over follow-up

BEFORE: 404 (77%) | 119 (23%) — 16JAN2022-17OCT2022
AFTER: 296 (55%) | 244 (45%) — 16JAN2023-17OCT2023
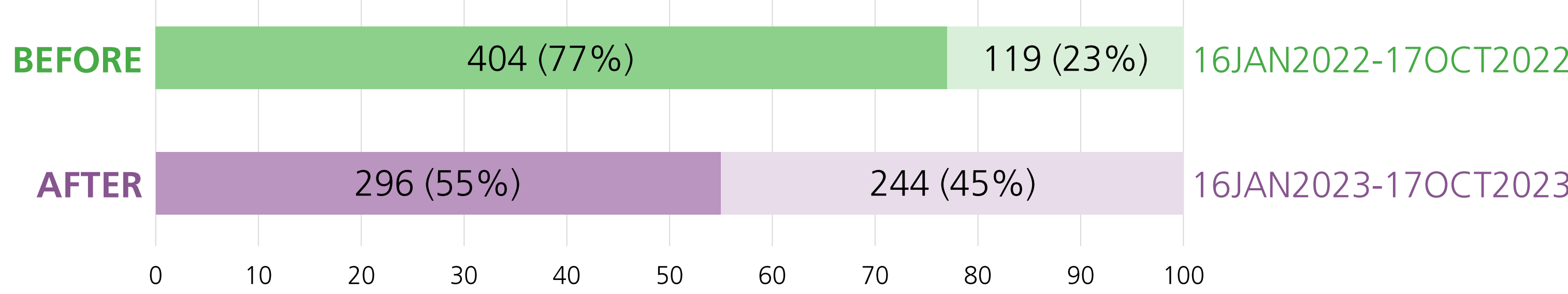
Table 1. Baseline demographic characteristics

	BEFORE N = 404	AFTER N = 296
Age, median years (IQR)	48 (37, 57)	47 (37, 58)
Female sex, n (%)	69 (17)	60 (20)
Black race, n (%)	172 (43)	130 (44)
Hispanic ethnicity, n (%)	88 (22)	73 (25)
Care received in Southern US, n (%)	245 (61)	186 (63)
Men who have sex with men, n (%)	262 (65)	173 (58)
People who inject drugs	94 (23)	64 (22)
Payer[a], n (%)		
Medicaid	145 (36)	127 (43)
Medicare	50 (12)	77 (26)
Commercial insurance	165 (41)	164 (55)
Cash	26 (6)	11 (4)
ADAP/Ryan White	142 (35)	110 (37)
Other	29 (7)	89 (30)

[a] Categories are not mutually exclusive

Table 2. Baseline clinical characteristics

	BEFORE N = 404	AFTER N = 296
HCV infection		
Months since last HCV antibody test, median (IQR)	13 (5, 35)	12 (4, 28)
Months since last HCV VL test, median (IQR)	9 (3, 31)	6 (2, 17)
Individuals with prior HCV genotype test, n (%)	170 (42)	146 (49)
HIV co-infection, n (%)	388 (96)	285 (96)
Last HIV VL measurement (copies/mL), median (IQR)	20 (19, 180)	20 (19, 110)
Last CD4 cell count measurement (cells/μL), median (IQR)	544 (312, 735)	528 (338, 764)
Other clinical characteristics		
HBV co-infection, n (%)	40 (10)	30 (10)
Any comorbid condition[a], n (%)	321 (79)	241 (81)
Number of visits in the last 12 months, median (IQR)	4 (2, 7)	4 (2, 6)

[a] At least one condition in any of the following categories (ever): cardiovascular disease, invasive cancer, endocrine disorder, mental health condition, bone disorder, renal disease, hypertension, rheumatoid arthritis, or substance use

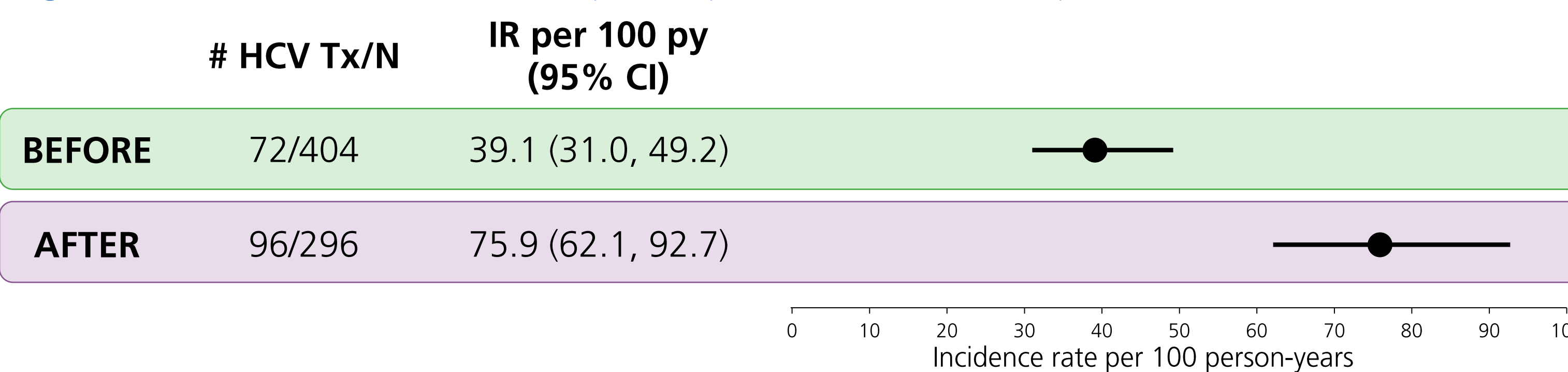### Figure 4. Incidence rates of HCV prescriptions over follow-up

	# HCV Tx/N	IR per 100 py (95% CI)
BEFORE	72/404	39.1 (31.0, 49.2)
AFTER	96/296	75.9 (62.1, 92.7)

Incidence rate per 100 person-years

Figure 2. Events over follow-up among the visit population: BEFORE period

Visit Population N = 404
- No HCV Viral Load n = 245 (61%)
  - HCV Treatment n = 32 (13%)
  - Death n = 0
  - End of Study n = 213 (87%)
- HCV Viral Load n = 159 (39%)
  - Confirmed HCV+ n = 111 (70%)
    - HCV Treatment n = 40 (36%)
    - Death n = 0
    - End of Study n = 71 (64%)
  - Spontaneous Clearance n = 48 (30%)
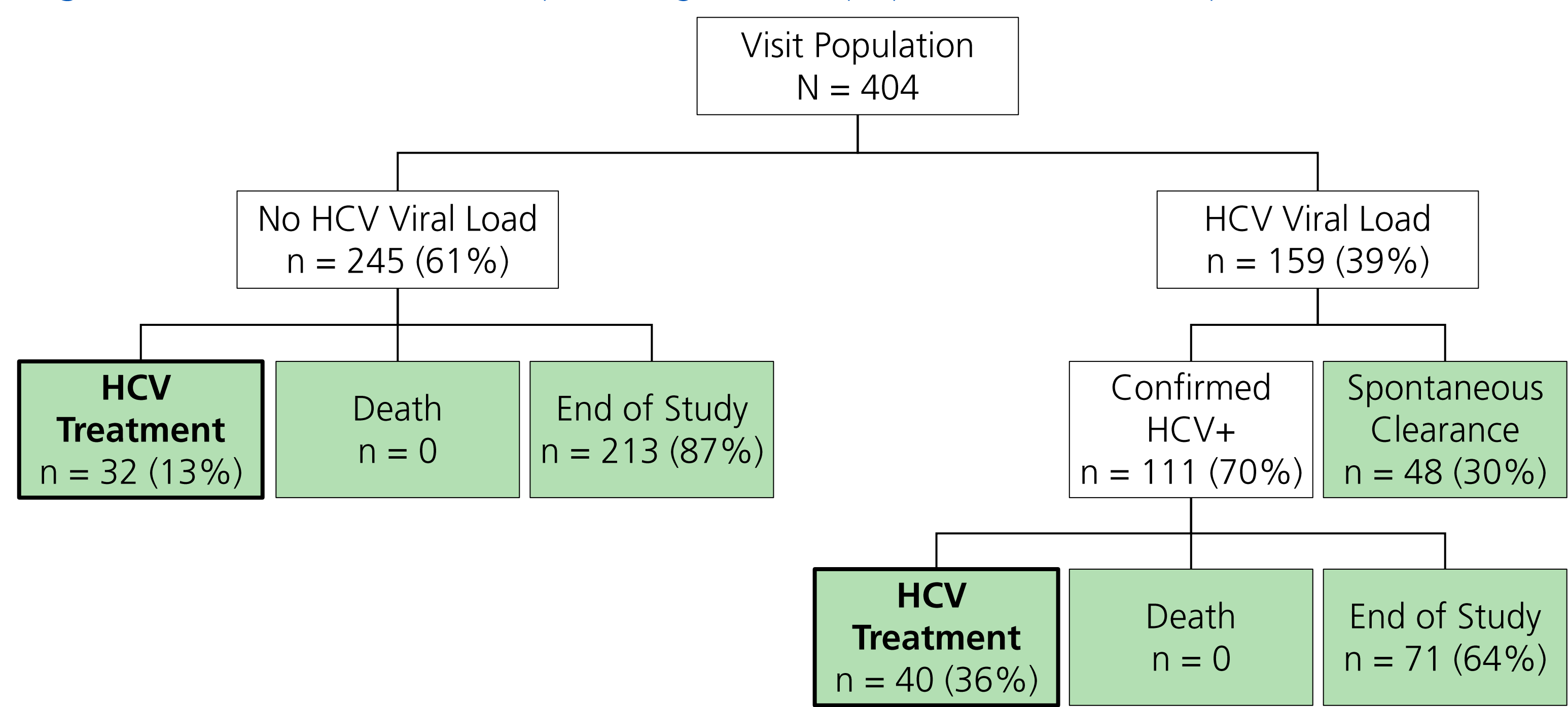
Figure 3. Events over follow-up among the visit population: AFTER period

Visit Population N = 926
- No HCV Viral Load n = 159 (54%)
  - HCV Treatment n = 33 (21%)
  - Death n ≤5[a]
  - End of Study n = 125 (79%)
- HCV Viral Load n = 137 (46%)
  - Confirmed HCV+ n = 118 (86%)
    - HCV Treatment n = 63 (53%)
    - Death n = 0
    - End of Study n = 55 (47%)
  - Spontaneous Clearance n = 19 (14%)
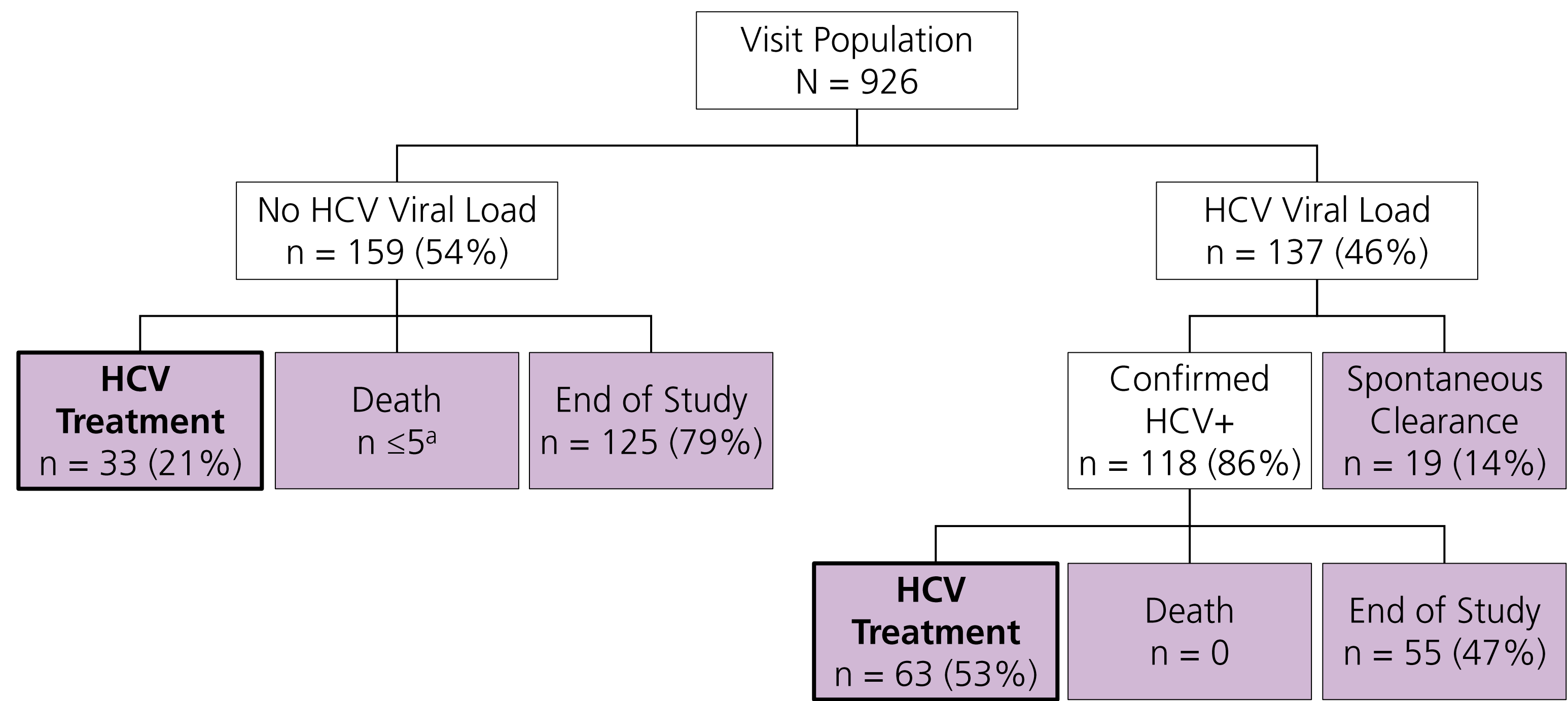
[a] HIPAA regulations require the masking of cells with 1 to 5 individuals

Table 3. Description of HCV treatment

	BEFORE N = 404	AFTER N = 296
Received prescription for HCV treatment, n (%)	72 (18)	96 (32)
Specific DAA combination therapy		
Mavyret (glecaprevir/pibrentasvir), n (%)	35 (49)	47 (49)
Epclusa (sofosbuvir/velpatasvir), n (%)	27 (38)[a]	39 (41)
Harvoni (ledipasvir/sofosbuvir), n (%)	8 (11)	8 (8)
Vosevi (sofosbuvir/velspatasvir/voxilaprevir), n (%)	≤5[b]	≤5[b]
Zepatier (elbasvir/grazoprevir), n (%)	≤5[b]	0
Weeks from visit to prescription, median (IQR)	4 (1, 17)	7 (<1, 19)

[a] ≤5 individuals also received a prescription for ribavirin
[b] HIPAA regulations require the masking of cells with 1 to 5 individuals

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Discussion

o There were 523 and 540 individuals with diagnosed, untreated HCV infection in the **before** and **after** periods, respectively (**Figure 1**)
  - 404 (77%) and 296 (55%), had ≥1 visit at a clinic over follow-up

o Baseline characteristics were comparable between individuals in **before** & **after** periods (**Tables 1 & 2**)

o A greater proportion of individuals in the **after** period (32%) than the **before** period (18%) received a prescription for HCV treatment over follow-up (**Table 3**)
  - Among 168 individuals prescribed HCV treatment:
    - All prescriptions were for DAA combination therapy
    - Most (88%) received Mavyret or Epclusa

o Referrals for HCV management outside of the study sites, which are primary- and HIV-care focused, were not easily identified in the EHR

o Confirmatory HCV viral load testing over follow-up did not occur among all individuals (**Figures 2 & 3**)
  - A greater proportion of individuals in the **after** period (46%) than the **before** period (39%) received ≥1 HCV viral load test over follow-up
  - Spontaneous clearance was identified in a greater proportion of individuals in the **before** period (30%) than in the **after** period (14%); the reason for this difference between periods is unclear
  - Among 229 individuals with confirmed (still) active HCV infection, a greater proportion of individuals in the **after** period (53%) received a prescription for HCV treatment than those in the **before** period (36%)

o From the first visit over follow-up, the rate of HCV prescription was statistically significantly higher in the **after** period than in the **before** period (**Figure 4**)

Key Findings

o Though the incidence rate of HCV treatment nearly doubled when alerts identified individuals with untreated HCV infection, the proportion of individuals receiving treatment remains suboptimal

o Continued reminders in the CDSS over a longer period and a better understanding of referrals for HCV management outside of primary-care-focused clinics may be the next steps toward successful elimination of HCV infection and transmission