HIV Infection and Long COVID: A RECOVER Program, Electronic Health Record Based Cohort

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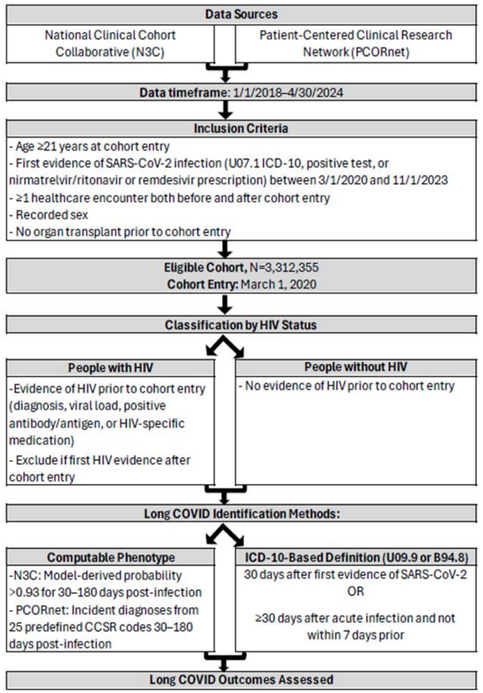
BACKGROUND

- People with HIV (PWH) may be at increased risk for long COVID after acute SARS-CoV-2 infection though more investigation is needed to clarify actual risk versus reporting bias.
- Conditions that are risk factors for long COVID tend to be more prevalent among some PWH including lower socioeconomic status, behavioral health co-morbidities, severe SARS-CoV-2, and metabolic co-morbidities.
- We characterize the variation in the incidence of long COVID by HIV serostatus using symptom-based and diagnostic code assignments of long COVID.

METHODS

- Cohort identified using data from the Patient-Centered Clinical Research Network (PCORnet) and the National Clinical Cohort Collaborative (N3C). See flowchart in Figure.

Figure 1. Flowchart of Inclusion/Exclusion Criteria and Methods



- Multivariable logistic regression was performed to determine the association of HIV with long COVID.
- PCORnet and N3C constructed separate models for computable phenotype (CP)-based and ICD-10-CM long-COVID outcomes.

Using a computed phenotype to define long COVID, we found a ***modest but significantly increased odds of long COVID development in people with HIV*** in two large, distinct cohorts. No significant association was found when long COVID was defined using ICD-10 codes. Diagnosing long COVID in populations with baseline chronic conditions, including HIV, may be challenging due, in part, to overlapping symptomatology.

RESULTS

Table 1. Long COVID Cohort Characteristics for PCORnet and N3C

	PCORnet		N3C	
n	People without HIV 1,357,932	People with HIV 11,964	People without HIV 3,288,424	People with HIV 23,931
Age (years, SD)	52 (18)	50 (13)	51 (18)	48 (14)
Age Group				
≤ 50 years	642,051 (47%)	5,646 (47%)	1,657,976 (50%)	13,346 (56%)
51-65 years	378,063 (28%)	4,948 (41%)	890,176 (27%)	8,286 (35%)
> 65 years	337,818 (25%)	1,370 (11%)	740,272 (23%)	2,299 (9.6%)
Sex at birth				
Male	519,029 (38%)	7,922 (66%)	1,295,949 (39%)	15,106 (63%)
Female	838,903 (62%)	4,042 (34%)	1,992,475 (61%)	8,825 (37%)
Race/Ethnicity				
Non-Hispanic White	757,601 (56%)	3,311 (28%)	2,346,164 (71%)	10,286 (43%)
Hispanic	136,257 (10%)	2,289 (19%)	267,808 (8.1%)	3,396 (14%)
Non-Hispanic Black	180,355 (13%)	4,325 (36%)	416,187 (13%)	8,013 (34%)
Non-Hispanic Other	47,379 (3.5%)	507 (4.2%)	46,627 (1.4%)	336 (1.4%)
Non-Hispanic Asian	29,310 (2.2%)	169 (1.4%)	79,545 (2.4%)	665 (2.8%)
Missing/Unknown	207,030 (15%)	1,363 (11%)	112,918 (3.4%)	1,075 (4.5%)
Pre-Pandemic Healthcare Utilization (Avg Days per year)	13 (18)	20 (26)	21 (32)	37 (48)
COVID Severity				
Not Hospitalized	1,202,005 (89%)	9,909 (83%)	2,949,218 (90%)	20,343 (85%)
Hospitalized	114,916 (8.5%)	1,443 (12%)	192,583 (5.9%)	2,064 (8.6%)
Hospitalized w/IMV	20,243 (1.5%)	315 (2.6%)	26,939 (0.8%)	324 (1.4%)
Incidental Hospitalization	20,768 (1.5%)	297 (2.5%)	119,684 (3.6%)	1,200 (5%)
CP Long COVID Diagnosis Eligible	1,357,932 (100%)	11,964 (100%)	3,241,417 (99%)	22,943 (96%)
Long COVID Diagnosis (CP)	257,794 (19%)	2,539 (21%)	261,189 (8.1%)	2,779 (12%)
Long COVID Diagnosis (ICD-10)	22,516 (1.7%)	209 (1.7%)	46,112 (1.4%)	412 (1.7%)

IMV: invasive mechanical ventilation; CP: computed phenotype.

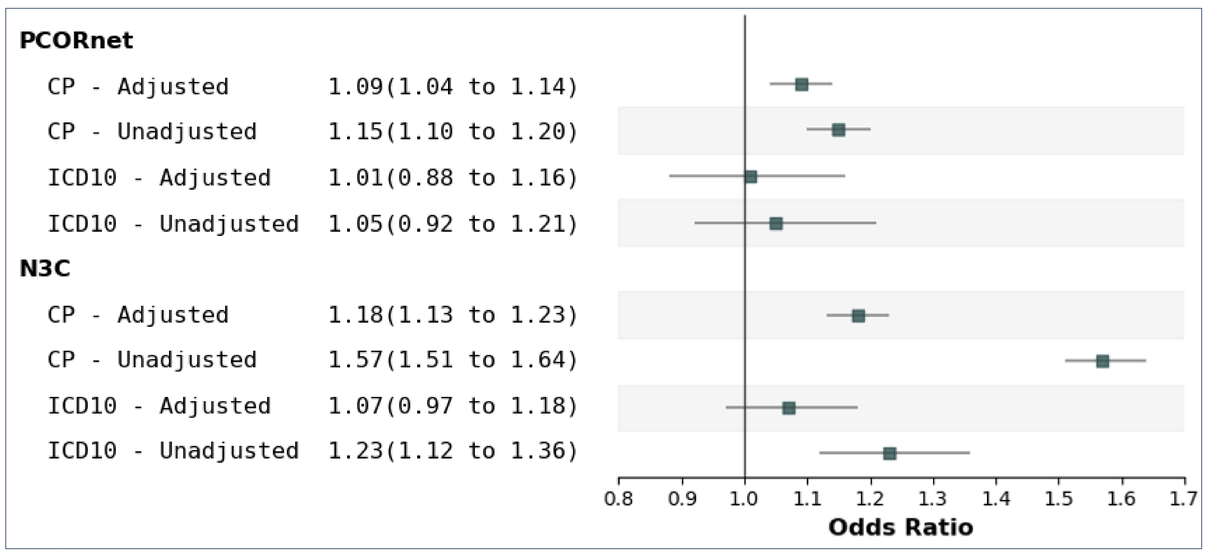
Table 2. Adjusted Covariates by computed phenotype and ICD10 Definition of Long COVID

	Computed phenotype		ICD10 Codes	
	PCORnet Odds Ratio (CI)	N3C Odds Ratio (CI)	PCORnet Odds Ratio (CI)	N3C Odds Ratio (CI)
HIV Status				
People without HIV	—	—	—	—
People with HIV	1.09 (1.04-1.14)	1.18 (1.13-1.23)	1.01 (0.88-1.16)	1.07 (0.97-1.18)
Age Group				
51-65 years	—	—	—	—
≤ 50 years	0.9 (0.89-0.91)	0.76 (0.75-0.77)	0.79 (0.77-0.82)	0.78 (0.76-0.80)
> 65 years	1.08 (1.07-1.09)	0.86 (0.85-0.87)	0.76 (0.74-0.79)	0.71 (0.69-0.73)
Race/Ethnicity				
Non-Hispanic White	—	—	—	—
Hispanic	1 (0.99-1.01)	0.99 (0.97-1.00)	0.74 (0.7-0.77)	0.94 (0.91-0.97)
Non-Hispanic Black	1.05 (1.04-1.07)	1.07 (1.06-1.08)	0.7 (0.67-0.72)	0.84 (0.82-0.86)
Non-Hispanic Other	1.03 (1.01-1.05)	0.66 (0.63-0.69)	0.93 (0.86-0.99)	0.56 (0.50-0.62)
Non-Hispanic Asian	0.97 (0.94-1)	0.87 (0.85-0.90)	0.83 (0.75-0.92)	0.91 (0.85-0.97)
Missing/Unknown	0.32 (0.31-0.32)	0.96 (0.93-0.98)	0.41 (0.38-0.43)	0.83 (0.78-0.87)
Sex at birth				
Male	—	—	—	—
Female	1.17 (1.16-1.18)	1.40 (1.38-1.41)	1.36 (1.32-1.4)	1.41 (1.38-1.44)
COVID Severity				
Not Hospitalized	—	—	—	—
Hospitalized	1.58 (1.56-1.6)	2.43 (2.40-2.47)	1.84 (1.77-1.91)	2.59 (2.51-2.66)
Hospitalized W/IMV	1.34 (1.3-1.39)	2.68 (2.60-2.76)	3.05 (2.86-3.26)	3.72 (3.51-3.94)
Incidental Hospitalization	0.71 (0.67-0.75)	2.10 (2.06-2.13)	0.58 (0.48-0.69)	2.18 (2.10-2.26)
COVID Variant				
Omicron BA.1.1 - BA.2	—	—	—	—
Ancestral	1.03 (1.02-1.05)	0.85 (0.84-0.86)	1.09 (1.05-1.14)	0.85 (0.82-0.87)
Alpha	1.08 (1.07-1.1)	1.01 (1.00-1.03)	1.41 (1.35-1.48)	1.17 (1.14-1.21)
Delta	1.02 (1.01-1.04)	1.00 (0.99-1.01)	1.6 (1.53-1.67)	1.46 (1.42-1.50)
Omicron BA.2.12.1 - BA.5	1 (0.99-1.02)	1.14 (1.13-1.16)	0.67 (0.64-0.71)	0.79 (0.77-0.82)
Omicron BQ.1.1 - XBB.1.5	0.89 (0.88-0.91)	1.12 (1.11-1.14)	0.49 (0.46-0.52)	0.74 (0.71-0.76)

IMV: invasive mechanical ventilation;

- Among nearly 1.4 million people in PCORnet and 3.3 million N3C with and without HIV, PWH were younger, more likely to be male or identify as Black or Hispanic and had higher pre-pandemic healthcare utilization (Table 1).
- People identifying as female had increased odds of long COVID development using both definitions

Figure 2. Primary associations between pre-COVID HIV and Long COVID status, stratified by cohort and Long COVID definition.



Box is odds ratio (OR), Line is 95% confidence interval (CI), CP; computed phenotype, ICD 10; diagnosis code U09.9 or B94.8 for long COVID

STRENGTHS AND LIMITATIONS

- Strengths: Concordance between PCORnet and N3C cohorts.
- Limitations: Unable to include vaccination status or repeat infections; only known COVID included; unable to stratify by HIV-1 viral load.

CONCLUSIONS

- Long COVID may be under-recognized and under-diagnosed in people with HIV.
- Diagnosing long COVID in populations with baseline chronic conditions, including HIV, may be challenging due, in part, to overlapping symptomatology.

IMPLICATIONS

- PWH may face compounding disparities and stigma with long COVID, especially among minority populations.
- User-friendly methods for clinical diagnosis of long COVID are needed to improve recognition and access to care for this condition.

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