Title
COVID-19 Susceptibility and Outcomes Among People Living With HIV in San Francisco

Journal
JAIDS Journal of Acquired Immune Deficiency Syndromes, 86(1)

ISSN
1525-4135

Authors
Sachdev, Darpun
Mara, Elise
Hsu, Ling
et al.

Publication Date
2021

DOI
10.1097/qai.0000000000002531

Peer reviewed

COVID-19 Susceptibility and Outcomes Among People Living With HIV in San Francisco

Darpun Sachdev, MD,[a] Elise Mara, MPH,[b] Ling Hsu, MPH,[b] Susan Scheer, PhD, MPH,[b] George Rutherford, MD,[c] Wayne Enanoria, PhD, MPH,[c] and Monica Gandhi, MD, MPH[d]

Introduction: Studies to examine whether HIV predisposes to a higher incidence of COVID-19 or more severe disease are accumulating. Initial studies from New York City suggested more severe disease among people living with HIV (PLWH), but this was during a time when hospitals were over-capacity and health systems stretched. This report presents the incidence and outcomes among PLWH with COVID-19 in San Francisco over the first 6 months of the pandemic.

Methods: Community transmission of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) was first reported in San Francisco on March 5, 2020. This report examines the match of the San Francisco Department of Public Health COVID-19 testing database and the San Francisco Department of Public Health HIV Surveillance case registry from March 24, 2020, to September 3, 2020.

Results: Among 4252 COVID-19 tests performed among PLWH, 4.5% (N = 193) were positive for COVID-19, compared with a 3.5% (N = 9626) positivity rate among the 272,555 people without HIV tested for COVID-19 ($P < 0.001$). The mean age of those infected with HIV/COVID-19 was 48 years (20–76), 38.9% White, 38.3% Latinx, 11.9% Black, and 91.2% were men. Only 54.6% of coinfected PLWH were housed, with the remainder marginally housed. The rate of severe illness with COVID-19 was not increased among PLWH.

Discussion: In San Francisco, susceptibility to COVID-19 was increased among PLWH over the first 6 months of the pandemic, although clinical outcomes were similar to those without HIV. Homelessness and higher rates of congregate living situations among PLWH likely accounted for this disparity. Special efforts to house patients with marginal housing during the COVID-19 pandemic are needed.

Key Words: HIV, COVID-19, susceptibility, people living with HIV (PLWH), homelessness, housing stability

(*J Acquir Immune Defic Syndr* 2021;86:19–21)

Received for publication July 21, 2020; accepted September 25, 2020.

From the [a]San Francisco Department of Public Health, Population Health Division, Disease Prevention and Control Branch, San Francisco, CA; [b]San Francisco Department of Public Health, Population Health Division, Applied Research, Community Health Epidemiology and Surveillance Branch, San Francisco, CA; [c]Division of Epidemiology and Biostatistics, Department of Medicine, University of California San Francisco, San Francisco, CA; and [d]Division of HIV, Infectious Diseases, and Global Medicine, Department of Medicine, University of California San Francisco, San Francisco, CA.

Funding source for this report: NIAID/NIH R01AI158013 (M.G.: P.I.)
The authors have no conflicts of interest to declare.

INTRODUCTION

Data are accumulating regarding the impact of HIV infection on either susceptibility to COVID-19 infection or disease severity. There are reasons to think that people living with HIV (PLWH) may be more susceptible to Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) in urban centers in congregate living situations where social distancing is more difficult to achieve. In San Francisco, PLWH have higher rates of unstable housing at 8.0% compared with 1.0% among the general San Francisco population,[1] with subsequently higher rates of living in single residency occupancy hotels, shelters, or tent encampments. There are also reasons to consider why PLWH could have more severe manifestations of COVID-19 than those without HIV. There is a higher rate of comorbidities among PLWH than those without HIV that predispose to severe COVID-19, including pulmonary disease,[2] cardiovascular disease,[3] and smoking.[4] Moreover, nearly half of the PLWH in the United States (and 67% of PLWH in the city of San Francisco)[1] are over 50 years old.

On the other hand, there is speculation that tenofovir-based antiretroviral therapy (ART) could protect PLWH from COVID-19 infection or severe disease. Because the phosphorylated forms of both tenofovir disoproxil fumarate (TDF) and tenofovir alafenamide (TAF) have in vitro activity against the SARS-CoV-2 RNA-dependent RNA polymerase,[5] analogous to remdesivir, tenofovir could modulate SARS-CoV-2 susceptibility or disease. A recent cohort study of PLWH diagnosed with COVID-19 in Spain demonstrated less severe disease among patients on TDF-based regimens,[6] although channeling bias could not be ruled out (with healthier patients put on TDF), especially because the same association was not seen with TAF-based ART. A randomized controlled trial to ascertain whether TDF/emtricitabine protects health care workers from contracting SARS-CoV-2 in Spain is ongoing.[7]

Initial case series describing HIV/COVID-19 coinfections to date were small, with reports from New York City[8] and Italy[9] showing more severe outcomes of COVID-19 among PLWH. The largest studies to date on HIV/COVID-19 coinfection are from the Veterans Aging Cohort Study (VACS),[10] the above-mentioned cohort study from Spain,[6] and a larger cohort from Western Cape Town, South Africa.[11] In the VACS, outcomes were compared between PLWH and COVID-19 (n = 253), PLWH and no COVID-19 (n = 2346), HIV-uninfected persons with COVID-19 (n = 504), and HIV-uninfected persons without COVID-19 (n = 4473).[10] HIV did not increase susceptibility to SARS-CoV-2 infection, nor

incidence of severe COVID-19 disease, although PLWH were more likely to be tested for COVID-19 than those without HIV.[7] In South Africa, PLWH who contracted SARS-CoV-2 (n = 3978) died at 2.39 times the rate of patients without HIV without COVID-19, although HIV was a minor risk factor for severe COVID-19 compared with typical comorbidities associated with severe COVID-19 (age, diabetes, and cardiopulmonary disease), even in this setting of high HIV prevalence.[11] And, finally, in a recent cohort study from Spain, COVID-19 occurred at a higher incidence among PLWH (n = 236) but was not associated with more severe disease.[6] This study examines the incidence of COVID-19 infection and outcomes among PLWH across San Francisco over the 6 months after community transmission was reported in the city.

METHODS

Community transmission of SARS-CoV-2 was first reported in San Francisco on March 5, 2020, followed shortly thereafter by initial shelter in place recommendations and shelter in place mandates on March 16, 2020.[8] On March 24, 2020, the Health Officer of the City and County of San Francisco ordered all clinical laboratories testing for SARS-CoV-2 infection to electronically report all positive and nonpositive test results for COVID-19 to the local health department. Here, we present data, using descriptive statistics, from a match of the San Francisco Department of Public Health COVID-19 testing and case database and the San Francisco Department of Public Health HIV Surveillance case registry performed on September 3, 2020 (6 months after the first case).

RESULTS

Among 4252 COVID-19 tests performed among PLWH from March 24, 2020, to September 3, 2020, 4.5% (N = 193) were positive for COVID-19. This compares with a 3.5% (N = 9626) positivity rate among the 272,555 people without HIV who were tested for COVID-19 by that date. The proportion of PLWH who tested positive was significantly higher than people without HIV (2 tailed z-test 3.52, $P = 0.00004$).

Among all persons coinfected with HIV and COVID-19, the mean age was 48 years (interquartile range, 37–57), 38.9% White, 38.3% Latinx, 11.9% Black, 6.7% Asian, 91.2% were men, 6.2% women, and 2.6% transgender women (Table 1). Thirty (15.5%) of these PLWH who tested positive for COVID-19 were part of an outbreak investigation in congregate living situations, such as a homeless shelter.[12] Of the PLWH with COVID-19, 68.9% were diagnosed with HIV before 2010, and 44% were virally suppressed at their most recent laboratory test. At the last CD4 count result, 121 (62.7%) had a CD4 count >500 cells/mm,^{3} 60 (31.1%) had a CD4 count of 200–500, and 12 (6.2%) had a CD4 count <200.

Of the 193 persons coinfected with COVID-19 and HIV, 183 (94.8%) were interviewed by a case investigator at the time of their COVID-19 diagnosis (Table 1). Of these, only 100 (54.6%) were housed, and the others likely experienced marginal housing: 6 (3.3%) lived in a long-term care facility or residential care facility, 5 (2.7%) stayed in a shelter, 13 (7.1%) lived in a single room occupancy hotel, 6 were experiencing street homelessness, and 52 (28.4%)

TABLE 1. Demographics and Outcomes of Participants

Demographics (n = 193)	n (%)
Current gender	
Male	176 (91.2)
Female	12 (6.2)
Transgender female	5 (2.6)
Age, yrs	
13–24	4 (2.1)
25–39	57 (29.5)
40–49	39 (20.2)
50–59	60 (31.1)
>60	33 (17.1)
Race/ethnicity	
White	75 (38.9)
African American	23 (11.9)
Latinx	74 (38.3)
Asian	13 (6.7)
Others	8 (4.2)
HIV risk	
MSM	138 (71.5)
PWID	8 (4.2)
MSM-PWID	34 (17.6)
Heterosexual	10 (5.2)
Others/unknown	3 (1.6)
Year of HIV diagnosis	
1985–2010	133 (68.9)
2011–2015	26 (13.5)
2016–2020	34 (17.6)
Virologic suppression (viral load, VL)	
Suppressed at last VL	85 (44.0)
Not suppressed at last VL	108 (56.0)
Part of outbreak	
No	163 (84.5)
Yes	30 (15.5)
Current smoker	
No	166 (90.7)
Yes	17 (9.3)
Outcomes of Patients Interviewed (n = 183)	**n (%)**
Contact of known case	
No	139 (76)
Yes	44 (24)
Hospitalized	
No	169 (92.4)
Yes	14 (7.6)
ICU admission	
No	181 (98.9)
Yes	2 (1.1)
Deceased	
No	183 (100)

ICU, Intensive care unit; MSM, men-who-have-sex-with-men; PWID, persons who inject drugs.

stated they were not housed but did not further specify. Of the 183 interviewed, 24% reported known contact with someone diagnosed with COVID-19, and 42.6% reported an additional risk factor for COVID-19 disease severity (7.1% cardiovascular disease, 4.9% diabetes, 1.6% liver, and 4.4% lung disease, Table 2). In addition, 9.3% were current smokers, and 10.9% were former smokers. Only 60.7% reported COVID-19 symptoms at interview; the most frequently reported were cough (38.8%), fever (33.9%), rhinorrhea (25.7%), myalgias (28.4%), headache (26.8%), chills (21.9%), shortness of breath (15.3%), sore throat (15.3%), and loss of taste/smell (19.1%). Only 7.7% required hospitalization, and only 2 patients required admission to the intensive care unit. None of the HIV/COVID-19 coinfected patients died.

DISCUSSION

These data from a high HIV incidence city in the United States add to the growing literature around HIV and COVID-19 coinfection and are consistent with larger studies published to date from the United States and Europe suggesting that HIV does not seem to predispose to more severe COVID-19 outcomes.[6,10] Small studies in the New York City have suggested worse outcomes among PLWH, but not consistently, and data reporting was from a time when the hospitals were exceeding capacity. Our report, similar to the one conducted in Spain,[6] does suggest an increased incidence of SARS-CoV-2 infection among HIV compared with people without HIV in San Francisco from the date community transmission was reported (March 5, 2020) to September 3, 2020 (4.5% vs. 3.5%, P 0.00004). This may be due to the fact that a number of HIV/COVID-19 coinfected patients in our study were in congregate living situations such as single residency occupancy hotels, homeless shelters, and long-term care facilities. Shared bathrooms and crowded spaces make social distancing challenging.

Indeed, with 45.4% of the HIV/COVID-19 coinfected people in this study experiencing marginal housing, housing status is the most likely contributor to the increased susceptibility to SARS-CoV-2 among PLWH in San Francisco. A large outbreak in a homeless shelter in San Francisco occurred near the beginning of the study period.[12] New HIV infections are also higher and virologic suppression rates lower among PLWH with unstable housing compared with those who are housed in San Francisco,[1] consistent with the disparities seen with COVID-19 susceptibility.

Our data indicate that specific policies to reduce risk of COVID-19 transmission among PLWH are indicated,[6] including limiting exposures in high-risk congregate settings. San Francisco has taken steps to house people with unstable housing preferentially during the COVID-19 pandemic, but more efforts are needed countywide to house those who are homeless as a public health measure. Medical care of homeless individuals with and without HIV is paramount during a pandemic. Housing assistance, continuation of ART,[9] and continuity of care are required as we try to protect people living with HIV from SARS-CoV-2 infection worldwide.

TABLE 2. Comorbidities of Patients

Patients Interviewed (n = 183)	n (%)
Any comorbidity	
No	105 (57.4)
Yes	78 (42.6)
Lung disease	
No	175 (95.6)
Yes	8 (4.4)
Diabetes	
No	174 (95.1)
Yes	9 (4.9)
Cardiovascular disease	
No	170 (92.9)
Yes	13 (7.1)
Chronic renal disease	
No	181 (98.9)
Yes	2 (1.1)
Liver disease	
No	180 (98.4)
Yes	3 (1.6)
Other comorbidities	
No	144 (78.7)
Yes	39 (21.3)

REFERENCES

1. San Francisco Department of Public Health. *HIV Epidemiology Annual Report 2019*. Available at: https://www.sfdph.org/dph/files/reports/RptsHIVAIDS/AnnualReport2019_Indigo_20200914_Web_fixed.pdf. Accessed September 20, 2020.
2. Fitzpatrick ME, Kunisaki KM, Morris A. Pulmonary disease in HIV-infected adults in the era of antiretroviral therapy. *AIDS*. 2018;32:277–292.
3. Triant VA. Cardiovascular disease and HIV infection. *Curr HIV/AIDS Rep*. 2013;10:199–206.
4. Mdodo R, Frazier EL, Dube SR, et al. Cigarette smoking prevalence among adults with HIV compared with the general adult population in the United States: cross-sectional surveys. *Ann Intern Med*. 2015;162:335–344.
5. Elfiky AA. Ribavirin, remdesivir, sofosbuvir, galidesivir, and tenofovir against SARS-CoV-2 RNA dependent RNA polymerase (RdRp): a molecular docking study. *Life Sci*. 2020;253:117592.
6. Del Amo J, Polo R, Moreno S, et al. Incidence and severity of COVID-19 in HIV-positive persons receiving antiretroviral therapy: a cohort study. *Ann Intern Med*. 2020;173:536–541.
7. PNS. Randomized clinical trial for the prevention of SARS-CoV-2 infection (COVID-19) in healthcare personnel (EPICOS). Available at: https://clinicaltrials.gov/ct2/show/study/NCT04334928. Accessed April 1, 2020.
8. San Francisco Department of Public Health. Order of the health officer no. C19-07. Directing all individuals living in the county to shelter at their place of residence. Available at: https://www.sfdph.org/dph/alerts/files/HealthOrderC19-07-%20Shelter-in-Place.pdf. Accessed March 16, 2020.
9. UNAIDS. *Modelling the Extreme—COVID-19 and AIDS-Related Deaths*. 2020. Available at: https://www.unaids.org/en/resources/presscentre/featurestories/2020/may/20200525_modelling-the-extreme. Accessed September 20, 2020.
10. Park LS, Rentsch CT, Sigel K, et al. COVID-19 in the largest US HIV cohort. AIDS 2020: 23rd International AIDS Conference San Francisco/Oakland Virtual; July 6–10, 2020. Abstract LBPEC23.
11. Boulle A, Davies M, Hussey H, et al. Risk factors for COVID-19 death in a population cohort study from the Western Cape Province, South Africa. *Clin Infect Dis*. 2020:ciaa1198. doi: 10.1093/cid/ciaa1198. [epub ahead of print].
12. Fagan K. *None of Homeless Who Tested Positive at Big SF Shelter Showed Serious Coronavirus Symptoms*. San Francisco, CA: Chronicle; 2020. Available at: https://www.sfchronicle.com/bayarea/article/None-of-homeless-who-tested-positive-at-big-SF-15206152.php. Accessed April 16, 2020.