Disproportionate burden of coronavirus disease 2019 among racial minorities and those in congregate settings among a large cohort of people with HIV

Eric A. Meyerowitz[a], Arthur Y. Kim[a,b], Kevin L. Ard[a,b], Nesli Basgoz[a,b], Jacqueline T. Chu[a,b,c], Rocio M. Hurtado[a,b,d], Catherine K. Lee[a], Wei He[c], Theresa Minukas[a], Sandra Nelson[a,b], Bisola O. Ojikutu[a,b], Greg Robbins[a,b], Sarimer Sanchez[a], Virginia A. Triant[a,b,c,e], Kimon Zachary[a,b] and Rajesh T. Gandhi[a,b]

Background: Many people living with HIV (PLWH) have comorbidities which are risk factors for severe coronavirus disease 2019 (COVID-19) or have exposures that may lead to acquisition of severe acute respiratory distress syndrome coronavirus 2. There are few studies, however, on the demographics, comorbidities, clinical presentation, or outcomes of COVID-19 in people with HIV.

Objective: To evaluate risk factors, clinical manifestations, and outcomes in a large cohort of PLWH with COVID-19.

Methods: We systematically identified all PLWH who were diagnosed with COVID-19 at a large hospital from 3 March to 26 April 2020 during an outbreak in Massachusetts. We analyzed each of the cases to extract information including demographics, medical comorbidities, clinical presentation, and illness course after COVID-19 diagnosis.

Results: We describe a cohort of 36 PLWH with confirmed COVID-19 and another 11 patients with probable COVID-19. Almost 85% of PLWH with confirmed COVID-19 had a comorbidity associated with severe disease, including obesity, cardiovascular disease, or hypertension. Approximately 77% of PLWH with COVID-19 were non-Hispanic Black or Latinx whereas only 40% of the PLWH in our clinic were Black or Latinx. Nearly half of PLWH with COVID-19 had exposure to congregate settings. In addition to people with confirmed COVID-19, we identified another 11 individuals with probable COVID-19, almost all of whom had negative PCR testing.

Conclusion: In the largest cohort to date of PLWH and confirmed COVID-19, almost all had a comorbidity associated with severe disease, highlighting the importance of

[a]Division of Infectious Diseases, Department of Medicine, Massachusetts General Hospital, [b]Harvard Medical School, [c]Division of General Internal Medicine, Massachusetts General Hospital, [d]Global Health Committee, and [e]Mongan Institute, Massachusetts General Hospital, Boston, Massachusetts, USA.

Correspondence to Rajesh T. Gandhi, MD, Division of Infectious Diseases, Department of Medicine, Massachusetts General Hospital, 55 Fruit St., Boston, MA 02114, USA.

Tel: +1 617 726 3906; fax: +1 617 726 7653; e-mail: RGANDHI@mgh.harvard.edu
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non-HIV risk factors in this population. The racial disparities and frequent link to congregate settings in PLWH and COVID-19 need to be explored urgently.

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Introduction

Coronavirus disease 2019 (COVID-19), caused by infection with severe acute respiratory distress syndrome coronavirus 2 (SARS-CoV-2), has spread around the world, but little is known about how this disease affects people living with HIV (PLWH). The few reports to date on this subject have analyzed small numbers of PLWH and conclusions have been limited [1–3].

In the general population, major risk factors for severe COVID-19 include advanced age, hypertension, diabetes, obesity, and cardiovascular disease [4–7]. More than 40% of PLWH in the United States are now more than 50 years old and many have overlapping comorbidities associated with severe COVID-19 [8]. In addition, as people with HIV age, they may be living in congregate settings, including skilled nursing facilities, where rapid spread of SARS-CoV-2 infection has occurred [9,10]. There are no reports to date on the risk for COVID-19 among PLWH in congregate settings. Finally, there is little information available regarding the clinical manifestations and outcomes of COVID-19 in people with HIV.

Given the uncertainties regarding COVID-19 in people with HIV, we evaluated the demographics, risk factors, clinical presentation, and diagnosis of COVID-19 in this population. Here we report the characteristics and outcomes of the largest cohort to date of PLWH with confirmed COVID-19 ($n = 36$, Table 1) and a second cohort with probable COVID-19 ($n = 11$, Table 2).

Methods

Using an electronic registry, all PLWH with COVID-19 cared for at our hospital from 3 March to 26 April 2020 were systematically identified. COVID-19 risk or diagnosis was captured by a flag in the electronic medical record. HIV diagnosis was identified based on International Classification of Diseases codes 042/B20, HIV RNA drawn or HIV Ag/Ab reactive; all HIV diagnoses were then confirmed by manual review. Suspected cases were PLWH cared for in our clinic who presented with typical symptoms including fever, chills, myalgias, and cough, without an alternative diagnosis during the study time period. The study was deemed exempt by our Institutional Review Board.

Data collected from manual chart reviews included presenting symptoms, duration of symptoms at time of presentation, race/ethnicity, comorbidities, and BMI. Each patient's current antiretroviral regimen and most recent $CD4^+$ cell count were collected. Their type of work and place of residence were also recorded. Particular types of employment such as in grocery stores, convenience stores, or healthcare were considered 'front-line work.' Congregate settings included group homes, assisted living facilities, and skilled nursing facilities. COVID-19 illness severity was graded for each patient. Mild or moderate COVID-19 was defined as not requiring supplemental oxygen (either in an outpatient or inpatient setting). Severe COVID-19 was defined as hospitalized patients who required supplemental oxygen or had a peripheral capillary oxygen saturation of 94% or less on ambient air but did not require care in the ICU. Patients with critical disease required ICU-level care, often with mechanical ventilation.

Results

We identified 36 people with HIV who had confirmed cases of COVID-19 based on a positive nasopharyngeal swab PCR (tested a mean of 5.7 days after symptom onset, range 1–17). Another 11 PLWH had probable COVID-19 based on typical symptoms and lack of an alternative diagnosis during a period of low circulation of other respiratory viruses. Of the probable cases, 10 were PCR negative (tested a mean of 7.1 days after symptom onset, range 2–16) and one was not tested (he was diagnosed early in the outbreak when testing was not widely available).

Among those with confirmed COVID-19, almost two-thirds (21/36) required hospitalization, including eight with severe and seven with critical illness. Two patients (5.6%) died and four remain hospitalized, including two people in intensive care. At presentation, 21 (58.3%) reported fever, 20 (55.6%) reported cough, and 14 (38.9%) reported shortness of breath. Thirty-three (91.7%) reported at least one of these symptoms. Seven

Table 1. Confirmed coronavirus disease 2019 cases among a cohort of people living with HIV.

Age/Sex	BMI	Comorbidities	Most recent CD4$^+$ cell count and CD4$^+$%	Symptoms	ART	Congregate setting or front-line worker	COVID severity	Outcome
With high-risk comorbidity or exposure								
42/M	38	HTN	1044/45.3%	Nonproductive cough, fever, sore throat, myalgias, fatigue, and dyspnea	DRV/r + TAF/FTC	No	Mild	Admitted for 24 h and discharged home
58/M	33	DM, HTN, NASH, HLD	968/25.1%	Fever, cough, muscle aches, diarrhea	TAF/FTC/RPV + DTG	No	Mild	Managed as outpatient
72/M	22	ESRD, stroke	234/21%	Fever	DTG + 3TC	Lives in congregate setting	Mild	Admitted for <48 h largely for dialysis as mild symptoms
52/F	32	None (obesity)	799/33.1%	Fever and productive cough	NVP + TAF/FTC	Works in congregate setting	Severe	Admitted for 6 days
49/F	22	ESRD, stroke	660/51.1%	Cough, low-grade fever, anosmia, myalgias, sore throat, and fatigue	DTG + TAF/FTC	Multiple family members diagnosed before she was	Mild	Managed as outpatient
55/M	24	CKD, DM	914/40.4%	Headache, shortness of breath	BIC/TAF/FTC	Front-line worker	Severe	Admitted for 6 days
48/M	28	HLD	411/20.1%	Fever, cough, shortness of breath	BIC/TAF/FTC	Front-line worker	Severe	Admitted for 7 days
58/M	29	HLD	252/18.1%	Cough, shortness of breath	DRV + EVG/c/TAF/FTC	Works in congregate setting	Mild	Admitted for 3 days
81/M	23	HTN, DM, CHF	244/25.6%	Cough, shortness of breath, fever	EFV + ABC + RAL	Two family members work in congregate settings	Severe	Admitted for 7 days
50/M	28	HLD	775/32.7%	Cough, fever	BIC/TAF/FTC	Front-line worker	Mild	Managed as outpatient
49/F	27	NAFLD	1282/35.8%	Body aches, loss of smell, shortness of breath	BIC/TAF/FTC	Works in congregate setting	Mild	Managed as outpatient
60/M	25	CKD, stroke	139/8.1%	Mental status change, hypotension	RAL + TAF/FTC	Lives in congregate setting	Mild	Admitted for 11 days initially in setting of hypotension, being treated for CoNS endocarditis
58/F	24	COPD, DM, smoker	611/33.2%	Fever, shortness of breath, hypoxemia	DTG + ABC/3TC	Lives in congregate setting	Critical	Remains admitted to ICU on ventilator. Required vasopressors intermittently
57/F	36	HTN	1009/54.4%	Cough, myalgias	BIC/TAF/FTC	Lives in congregate setting	Mild	Managed as an outpatient, with one visit to ED
59/F	40	CHF, CKD, CAD, DM, HLD, HTN, prior stroke	1174/28.4%	Fever, shortness of breath	DTG + ABC/3TC + DRV/r + ETR	Lives in congregate setting	Critical	Prior DNI order, transferred to ED and died
64/M	25	DM	660/30.5%	Anosmia	DTG + TAF/FTC	No	Mild	Managed as an outpatient
63/M	22	HTN, prior stroke, CKD	426/27.1%	Vomiting, fever, altered mental status	DTG + TAF/FTC	Lives in congregate setting	Critical	Intubated in ED and admitted to ICU; died
46/M	40	DM	652/32.0%	Sinus congestion, mild shortness of breath	BIC/TAF/FTC	Front-line worker	Mild	Managed as an outpatient
61/F	30	HTN	926/34.7%	Dry cough, fever, progressive sore throat, dyspnea, GI discomfort, and loose stools	TAF/FTC/RPV	Works in congregate setting	Severe	Admitted for 4 days with shortness of breath, improved with supportive care
54/F	28	CKD, HTN	481/22.3%	Fever, cough, shortness of breath, nausea	TAF/FTC/RPV	No	Mild	Admitted for 5 days
56/F	31	Asthma	1024/42.3%	Cough, sore throat	TAF/FTC/RPV	Works as visiting nurse	Mild	Managed as an outpatient
59/M	26	COPD, HLD, lymphoma (in remission)	604/26.4%	Sore throat, low-grade fever	BIC/TAF/FTC	Works as home health aide	Mild	Managed as an outpatient
45/M	32	None (obesity)	346/26.1%	Cough, fever, chills	BIC/TAF/FTC	Wife is front-line worker	Mild	Managed as an outpatient
62/F	33	HTN, HLD, prediabetes	684/28.6%	Headache, cough	BIC/TAF/FTC	Works in a congregate setting	Mild	Managed as an outpatient

Table 1 (*continued*)

Age/Sex	BMI	Comorbidities	Most recent CD4$^+$ cell count and CD4$^+$%	Symptoms	ART	Congregate setting or front-line worker	COVID severity	Outcome
57/M	20	CHF, CKD, smoker	247/35.9%	Fatigue, generalized weakness, shortness of breath	BIC/TAF/FTC	Lives in congregate setting	Severe	Admitted for 5 days
67/F	22	CHF, DM, dementia	378/19.7%	Altered mental status	TAF/FTC/RPV + RAL	Lives in congregate setting	Critical	Remains in ICU, now extubated, after 2-week intubation, course complicated by Staph aureus bacteremia
54/M	26	HTN, HLD	1042/41%	Fever, chills, headache, myalgias, night sweats	BIC/TAF/FTC	No	Critical	Admitted for 7 days, in ICU for several days but never intubated
50/F	42	None (obesity)	622/36.5%	Fever, shortness of breath, cough, myalgias	DTG + TAF/FTC	No	Severe	Admitted for 9 days
48/F	35	HTN	1441/41.5%	Mild cough	BIC/TAF/FTC	Works in a congregate setting	Mild	Managed as an outpatient
65/F	29	COPD, smoker	942/47.3%	Cough, fever, shortness of breath, diarrhea, myalgias	BIC/TAF/FTC	Lives in a congregate setting	Critical	Discharged after a 37-day admission that included 3 weeks of mechanical ventilation
No high-risk comorbidity or exposure identified								
29/M	20	None	314/31.9%	Muscle aches, cough, runny nose/ nasal congestion	BIC/TAF/FTC	No	Mild	Managed as outpatient
40/M	27	None	843/37.2%	Fever, cough, anosmia, fatigue	DTG + TAF/FTC	Front-line worker	Mild	Managed as an outpatient
24/M	21	None	16/1.2%	Headache, shortness of breath	None	No	Critical	Remains admitted to Neuro ICU for >10 days
45/M	24	None	1485/43%	Cough, fever, diarrhea, dyspnea headache, myalgias	DTG + TAF/FTC	Front-line worker	Severe	Admitted for 9 days
49/M	24	None	383/15%	Fever, generalized weakness, poor appetite	DRV/c + DTG	Front-line worker	Mild	Admitted for 3 days
38/F	25	Essential thrombocythemia, Hodgkin lymphoma (in remission)	870/32.0%	Fever, cough, change in taste, myalgias, fatigue, sore throat	TDF/FTC/RPV	Front-line worker	Mild	Managed as an outpatient with one visit to ED

3TC, lamivudine; ABC, abacavir; ART, antiretroviral therapy; BIC, bictegravir; CAD, coronary artery disease; CHF, congestive heart failure; CKD, chronic kidney disease; CoNS, coagulase negative *Staphylococci*; COPD, chronic obstructive pulmonary disease; COVID-19, coronavirus disease 2019; DM, diabetes mellitus; DNI, do not intubate; DRV/c, darunavir/cobicistat; DRV/r, darunavir/ritonavir; DTG, dolutegravir; ED, emergency department; EFV, efavirenz; EVG/c, elvitegravir/cobicistat; ESRD, end stage renal disease; ETR, etravirine; EVG, elvitegravir; F, female; FTC, emtricitabine; GI, gastrointestinal; HLD, hyperlipidemia; HTN hypertension; M, male; NAFLD, nonalcoholic fatty liver disease; NASH, nonalcoholic steatohepatitis; NVP, nevirapine; RAL, raltegravir; RPV, rilpivirine; TAF, tenofovir alafenamide.

Table 2. Probable coronavirus disease 2019 cases among a cohort of people living with HIV.

Age/Sex	BMI	Comorbidities	Most recent $CD4^+$ cell count and $CD4^+$%	Symptoms	ART	Congregate setting or front-line worker	COVID severity	Outcome
With high-risk comorbidity or exposure								
54/M	24	DM, HTN, HLD	871/39.6%	Cough, shortness of breath, fatigue, myalgias, chills	BIC/TAF/FTC	No	Mild	Managed as an outpatient
55/F	33	HTN, DM, RA, HLD	96/11.5%	Body aches, chest heaviness, loss of taste, chills, nausea	BIC/TAF/FTC	No	Mild	Managed as an outpatient
49/F	19	GPA, APLA	406/26.3%	Cough, fever, chills, polyuria, dysuria, and vaginal lesions	BIC/TAF/FTC + DRV/c	No	Mild	Admitted for 3 days, discharged and treated for cellulitis
49/F	30	HLD	852/40.4%	Shortness of breath, palpitations, dizziness	BIC/TAF/FTC	No	Critical	Admitted bradycardic, hypotensive with high-degree AV block, intubated for 10 days. Course complicated by VT, pressor need, RRT need, Biopsy showed lymphocytic myocarditis. Treated with steroids with rapid improvement
55/F	30	DM, HTN	792/31.6%	Sore throat, cough, rhinorrhea, fever	DTG + TAF/FTC	Works in congregate setting	Mild	Managed as an outpatient
55/F	26	HTN, HLD, h/o splenectomy	621/23.8%	Feverish, chest pain	DTG + TAF/FTC	Family member diagnosed with COVID before	Mild	Admitted for 48 h for antibiotics given fever in setting of splenectomy
43/M	19	Smoker	498/33.8%	Fever, runny nose/nasal congestion, chills, loss of appetite	DTG + TAF/FTC	No	Mild	Managed as an outpatient
49/M	31	HTN	676/28.3%	Chills and hemoptysis in background of months of shortness of breath	RAL + ABC/3TC	Works in congregate setting	Severe	Remains admitted for >6 days and being treated for bilateral PE with pulmonary infarct and superimposed pneumonia
48/M	23	Smoker	890/32.3%	Cough, shortness of breath, sore throat	BIC/TAF/FTC	No	Mild	Managed as an outpatient
32/M	33	None (obesity)	1141/38.9%	Cough, fever	BIC/TAF/FTC	No	Mild	Managed as an outpatient
No high-risk comorbidity or exposure identified								
30/M	N/A	None	481/28.1%	Fever, diarrhea, sore throat, night sweats, myalgias	BIC/TAF/FTC	No	Mild	Managed as an outpatient

3TC, lamivudine; ABC, abacavir; APLA, antiphospholipid antibody syndrome; ART, antiretroviral therapy; AV, atrioventricular; BIC, bictegravir; COVID-19, coronavirus disease 2019; Critical, requiring ICU admission for respiratory failure requiring intubation or ECMO, vasopressors, or multisystem organ failure; DM, diabetes mellitus; DRV/c, darunavir/cobicistat; DTG, dolutegravir; F, female; FTC, emtricitabine; GPA, granulomatosis with polyangiitis; HLD, hyperlipidemia; h/o, history of; HTN hypertension; M, male; Mild, not requiring admission or supplemental O_2 or requiring admission but no supplemental oxygen; NAFLD, nonalcoholic fatty liver disease; NASH, nonalcoholic steatohepatitis; NVP, nevirapine; PE, pulmonary embolism; RA, rheumatoid arthritis; RAL, raltegravir; RRT, renal replacement therapy; Severe, SpO_2 of 94% or less on RA or $PaO_2/FiO_2 < 300$ mmHg or requiring supplemental oxygen but not mechanical ventilation; TAF, tenofovir alafenamide; VT, ventricular tachycardia.

(19.4%) reported gastrointestinal symptoms including anorexia, nausea, vomiting or diarrhea, and five (13.8%) reported anosmia or dysgeusia.

The average age of the cohort was 53.4 years (range 24–81 years), with a higher age for those who required hospital admission compared with those who were managed as outpatients (55.9 versus 50 years, respectively). Thirty (83.3%) had comorbidities associated with severe COVID-19. The most common comorbidities were obesity defined as BMI more than 30 (12/36; 33.3%), hypertension (11/36; 30.6%), diabetes (8/36; 22.2%), hyperlipidemia (8/36; 22.2%), and chronic kidney disease (8/36; 22.2%). Of those who were hospitalized, 18/21 (85.7%) had a comorbidity associated with severe COVID-19; of those who were managed as outpatients, 12/15 (80%) had a comorbidity.

Regarding the demographics of the patients in this cohort, 16 (44.4%) were non-Hispanic Black and 12 (33.3%) were Hispanic/Latinx. For comparison, our clinic population includes just over 1300 PLWH, of whom around 50% are White, 30% Black, and 10% Hispanic/Latinx. Nearly half of the patients or their family members (16/36 or 44.4%) lived or worked in a congregate setting (group home, assisted living, or skilled nursing facility). Eleven others either worked in 'front-line' jobs including home healthcare and retail/grocery stores or had household members working in these positions.

Two patients had a $CD4^+$ cell count less than 200 cells/μl, and one patient, who was simultaneously diagnosed with COVID-19, HIV/AIDS, and cryptococcal meningitis, was not on antiretroviral therapy (ART). Of those

on ART, 29/35 were on an integrase strand transfer inhibitor, nine were on a nonnucleoside reverse transcriptase inhibitor, and four were on protease inhibitors. Thirty were on a tenofovir-containing regimen.

In the cohort of patients with probable COVID-19, 4/11 required hospital admission, including one with severe disease and one with critical illness who required mechanical ventilation in the setting of biopsy proven lymphocytic myocarditis. Nine (81.8%) had mild/moderate disease. There were no deaths in this group, and none remain in the hospital. All presented with typical symptoms including fever, cough, myalgias, anosmia, etc. The average age was 47.2 years (range 32–55 years). Ten (90.9%) had a comorbidity associated with severe COVID-19. Six (54.5%) were non-Hispanic Black, two (18.2%) were Hispanic/Latinx, and three (27.3%) were White. Two worked in congregate settings and one had a family member diagnosed with COVID-19 before she developed symptoms. One had a $CD4^+$ cell count less than 200 cells/μl and all were on ART.

Discussion

In this study, we describe the largest cohort to date ($n = 36$) of PLWH with confirmed COVID-19. Most patients presented during their first week of symptoms, though some presented later. Although most patients had mild or moderate disease, 58.3% required hospitalization, and 5.6% died. The vast majority (91.7%) presented with typical symptoms of COVID-19. The average age of the cohort was 53.4 years with a higher age for those requiring admission (55.9 years) compared with those managed as outpatients (50 years), consistent with what has been reported in large series of people without HIV [6,11]. Risk factors for severe COVID-19 in PLWH also appear to be similar to those in people without HIV: of note, nearly 85% of those in our cohort had a well recognized risk factor or comorbidity, highlighting the importance of non-HIV risk factors in this population.

That almost 80% of people in this cohort compared with 40% of our HIV clinic population were Black or Hispanic/Latinx highlights the urgency of understanding and mitigating racial disparities in COVID-19. Racial disparities in incidence and outcomes for COVID-19 are being increasingly recognized [7,12,13]. Racial disparities in prevalence and outcomes for PLWH are also well described [14,15]. Some of the same structural forces that are associated with higher rates of HIV – such as poverty or unstable housing – also contribute to likelihood of SARS-CoV-2 infection. These 'twin' pandemics highlight the impact of social forces on disparate infectious diseases. And, because risk factors for COVID-19 and HIV may overlap, people with COVID-19 should be tested for HIV if not previously assessed.

The significant proportion (44% of people in our cohort) with exposure to long-term care facilities suggests clinicians should be attentive to the possibility of COVID-19 among PLWH in congregate settings. This may be particularly important as more PLWH move into congregate settings as the population ages. Given the multiple outbreaks described in skilled nursing facilities as well as in correctional facilities and other congregate settings, public health officials, and policy makers must work quickly to protect these highly vulnerable populations [9,16,17]. That some in our cohort had household members with exposure to congregate settings or front-line work underscores the importance of asking about these potential exposures for patients and all members of their household.

Finally, the identification of individuals with a compatible syndrome but negative PCR testing, emphasizes the importance of not discounting the possibility of COVID-19 in PLWH with negative PCR tests. Widespread access to testing, including PCR and serologic assays, will inform optimal diagnostic approaches, for PLWH and the general population.

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Conflicts of interest

A.Y.K. has served on the scientific advisory board of Biomarin. N.B. serves on the Board of Directors of Allergan LLC. J.T.C. owns individual stocks for Johnson & Johnson and Pfizer. G.R. receives research support paid to the institution from Gilead, Citius Pharm, Emergent Biosolutions, Pfizer, and Leonard Meron Bioscience. R.T.G. has served on a scientific advisory board for Merck and Gilead. The other authors report no conflicts of interest.

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