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

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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
Keywords: congregate setting, coronavirus disease 2019, HIV, pandemic, racial disparities, severe acute respiratory distress syndrome coronavirus 2

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 |
|---------|-----|---------------|-------------------------------------|----------|-----|----------------------------------------|----------------|---------|
| 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  | 234/21.4%                          | 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  | OKD, 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 | Front-line worker | Mild | Managed as outpatient |
| 60/M    | 25  | OKD, 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, hypotension | 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, OKD | 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, G1 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  | OKD, 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) | 604/24.6%                          | 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:

| Age/Sex | BMI | Comorbidities | Most recent CD4⁺ cell count and CD4⁺% | Symptoms | ART | Congregate setting or front-line worker | COVID severity | Outcome |
|---------|-----|---------------|--------------------------------------|----------|-----|----------------------------------------|---------------|---------|
| 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 | 161/1.2% | Headache, shortness of breath | None | None | Critical | Remains admitted to Neuro ICU for >10 days |
| 45/M    | 24  | None | 1485/43% | Cough, fever, diarrhea, dysgeusia, 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/DRG | Front-line worker | Mild | Admitted for 3 days |
| 38/F    | 25  | Essential thrombocytopenia, 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.
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

### 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 frontline worker | COVID severity | Outcome |
|---------|-----|---------------|-------------------------------------|----------|-----|--------------------------------------|--------------|---------|
| 54/M    | 24  | DM, HTN, HLD  | 871/39.6%                          | Fever, 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     | 406/26.1%                         | 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 bradycardia, 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%                      | Fever, 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 |
| 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 O₂ 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, SpO₂ of 94% or less on room air or PaO₂/FiO₂ < 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.
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 frontline 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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