COVID-19 Infection Outcomes and Testing Outreach Efforts Among People Living With HIV in Milwaukee, Wisconsin

Trevor Birkey, MD; Joanna Woodbury, APSW; Sol Del Mar Aldrete, MD

ABSTRACT

Introduction: Since the beginning of the COVID-19 pandemic, the incidence and severity of COVID-19 co-infection in people living with HIV (PLWH) has been an area of investigative research. Clinic databases of PLWH provide opportunities to investigate outcomes of COVID-19 co-infection and efficacy of outreach efforts, which are integral to patient care during health crises.

Methods: All PLWH over 18 years of age who receive care at the Froedtert & Medical College of Wisconsin Adult Infectious Disease Clinic and who had a COVID-19 test performed during May 2020 through March 2021 were included for analysis. All patients received an individualized phone call with COVID-19 testing education and information. Automated data collection and manual chart review were used to acquire information on demographics, outreach efforts, COVID-19 testing results, and COVID-19 clinical course.

Results: Four hundred sixty-two COVID-19 tests completed on 793 PLWH were included, with 40 (8.7%) positive tests and 422 (91.3%) negative tests on a predominantly young, male, and virally suppressed cohort. Most patients had mild to moderate COVID-19 infection (20/27, 74.07%), with 1 patient requiring hospitalization and zero deaths. Three hundred fourteen (39.59%) patients accepted outreach for COVID-19 testing; 171 were tested in our health system, with 72 of those tests occurring within 2 weeks. Outreach efforts demonstrated a statistically significant increase in COVID-19 testing ($P < 0.001$).

Conclusions: In this largely young, male, virally suppressed cohort of PLWH, most COVID-19 co-infections were associated with mild to moderate disease severity, with 1 hospitalization and zero deaths. Individualized patient outreach efforts were associated with a significant increase in COVID-19 testing, most of which occurred after a single phone call. This outreach process could have utility in other public health arenas, though may be limited by larger patient populations.

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INTRODUCTION

In late 2019, the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) emerged in Wuhan, China, and has since spread worldwide, infecting millions of people. As of May 3, 2023, 765 million Coronavirus disease (COVID-19) cases and 6.9 million COVID-19-related deaths have been reported worldwide.[1] COVID-19, the disease caused by SARS-CoV-2, has clinical manifestations ranging from asymptomatic infection to respiratory failure and death.[2] Several studies have demonstrated that biologic characteristics, including older age, obesity, hypertension, diabetes, and chronic kidney disease, are associated with a higher risk of severe disease and death from COVID-19.[3] Also well published is the disproportionate impact COVID-19 has on underserved populations due to differences in race, socioeconomic status, health care accessibility, educational opportunities, housing situations, and prevalence of chronic medical conditions.[4-6]

Similarly, a disproportionate burden of HIV infection exists in this population. The impact of co-infection with COVID-19 in people living with HIV (PLWH) has been an area of research. Generally, PLWH are perceived to be at high risk of developing severe COVID-19 infection due to their characteristic chronic inflammatory state and varying degrees of immune dysfunction.[7] To date, reports on outcomes of COVID-19 infection in this population have been mixed. Most studies have demonstrated no significant differences in disease severity or

mortality in PLWH when compared to the general population.[8-16] However, a smaller number of studies have identified either significant or trends toward significant increases in disease severity and/or mortality rates in this population.[17-21] Electronic medical record registries of PLWH offer opportunities for outreach into communities that may be disproportionately affected by COVID-19. While there are publications that explore the detrimental effect of the COVID-19 pandemic on HIV testing and treatment of PLWH, along with suggestions of ways to improve outreach (including via self-testing HIV kits, increased social media presence, and increased televisits), little information exists about outreach to them with regard to COVID-19 testing.[22-25] We outline one center's experience with outreach efforts to PLWH during the COVID-19 pandemic and add to the current body of work regarding outcomes of COVID-19 infection in this population.

METHODS

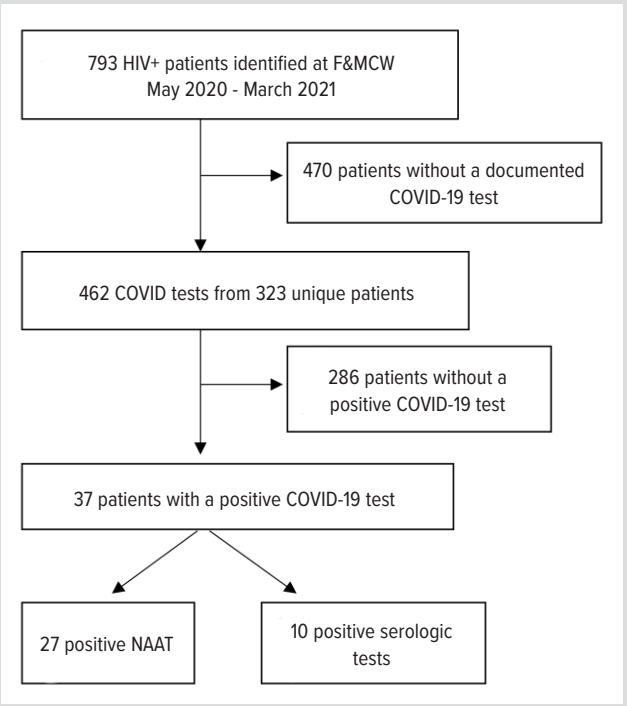
Patient Selection

Cases of co-infection were identified through use of an Epic (Epic Systems Corporation, Verona, Wisconsin) registry. Seven hundred ninety-three patients with HIV infection over the age of 18 who receive care through the Froedtert and the Medical College of Wisconsin (F&MCW) Adult Infectious Disease Clinic were included in the study. Co-infection was defined as those with HIV infection who were diagnosed with COVID-19 infection either by a positive nucleic acid amplification test (NAAT) for SARS-CoV-2 or a positive serology test between May 2020 to March 2021.

Data Extraction

Following patient identification, further data were gathered via use of the CAREWare database. Information regarding patient age at time of diagnosis, sex at birth, current antiretroviral therapy (ART), race, last viral load, COVID-19 test result, and type of COVID-19 test completed were extracted automatically. A suppressed viral load was defined as greater than 200 copies/mL, which is the standard threshold used in guidelines. The most recent viral load prior to the date of a COVID-19 test was used for analysis. Because CD4 counts were not reliably available with proximity to COVID-19 testing—likely given heterogeneity in provider preference following prolonged viral suppression—these values were not included in our analysis. Manual chart review was then performed to identify medical comorbidities, clinical presentation of infection, and outcomes, including severity of infection, need for hospitalization, and death. Obesity was defined as body mass index greater than 30 kg/m^2. Centers for Disease Control and Prevention guidelines were utilized for the definition of severity, with categories of mild to moderate (mild symptoms up to mild pneumonia), severe (dyspnea, hypoxia, or more than 50% lung involvement on imaging), and critical (respiratory failure, shock, or multiorgan system dysfunction), as well as asymptomatic infection. Care Everywhere software Epic Systems, Verona, Wisconsin) was used to review hospitalizations occurring at outside institutions.

Figure. Selection of Patient Inclusion



Abbreviation: F&MCW, Froedtert and the Medical College of Wisconsin
Thirty-seven patients with positive testing were included in analysis; 286 patients with negative testing were included in the control group.

Outreach Efforts

Ryan White emergency funding was applied for and utilized for outreach efforts to PLWH who were active Ryan White recipients receiving their medical care through the F&MCW infectious disease clinic. All 793 patients identified via the institution's Epic registry received an individualized telephone call from a clinic social worker. COVID-19 outreach data were logged and included the date of outreach and number of attempts. If the patient engaged and accepted the service, a template was used to document the conversation, including information regarding patient requests and prior COVID-19 testing results. The completed template was then routed to a staff HIV nurse for COVID-19 test education and scheduling.

Data Analysis

Four main types of analyses were conducted. First, chi-square tests and 2-sample *t* tests were used to assess differences in demographic characteristics and comorbidities between individuals who tested positive and negative for COVID-19. Second, frequencies and percentages of symptoms and severity were calculated for individuals with a positive NAAT test. Third, a pre-post analysis was conducted to assess COVID-19 testing before and after the outreach intervention. The sample for this analysis

included only individuals who received the outreach intervention. McNemar's test was used to test for significance between pre- and post-outreach intervention. Finally, the entire study sample was utilized to compare testing across the number of outreach attempts. Chi-square tests were used to test for significance across the no outreach, post-outreach 1 call, and post-outreach 2 or more calls groups. STATA SE 2013 (StatCorp LP College Station, Texas) was used to accomplish this analysis. Variables used were compiled from electronic medical records. Age was utilized as a continuous variable. Sex at birth was coded as male and female. Current ART was classified as yes or no. Race/ethnicity was categorized as Non-Hispanic White, Non-Hispanic Black, Hispanic, and Non-Hispanic Other. Last viral load was dichotomized into less than 200 copies/mL and greater than or equal to 200 copies/mL. Comorbidities such as obesity, hypertension, type 2 diabetes, chronic kidney disease, and chronic obstructive pulmonary disease were coded as binary variables.

Ethical Approval

This study was approved by the Institutional Review Board of the Medical College of Wisconsin.

Table 1. Demographic Characteristics of People Living With HIV Tested for COVID-19

	Total (n = 323)	COVID positive (n = 37)	COVID negative (n = 286)	*P* value
Age, years, average (SD)	48.98 (13.86)	42.08 (13.15)	49.87 (13.72)	0.001
Sex at birth, n (%)				
Male	258 (79.88%)	31 (83.78%)	227 (79.37%)	0.53
Female	65 (20.12%)	6 (16.22%)	59 (20.63%)	
Race, n (%)				
Non-Hispanic Black	155 (47.99%)	22 (59.46%)	133 (46.50%)	
Non-Hispanic White	132 (40.87%)	12 (32.43%)	120 (41.96%)	
Hispanic	26 (8.05%)	1 (2.70%)	25 (8.74%)	0.23
Non-Hispanic Other	10 (3.10%)	2 (5.41%)	8 (2.80%)	
Current antiretroviral therapy, n (%)				
Yes	302 (93.50%)	34 (91.89%)	268 (93.71%)	0.72
No	21 (6.50%)	3 (8.11%)	18 (6.29%)	
Last viral load, n (%)				
< 200	274 (84.82%)	32 (86.49%)	242 (84.62%)	0.80
≥ 200	48 (14.86%)	5 (13.51%)	43 (15.03%)	
Obesity, n (%)				
No	213 (65.94%)	23 (62.16%)	190 (66.43%)	0.61
Yes	110 (34.06%)	14 (37.84%)	96 (33.57%)	
Hypertension, n (%)				
No	221 (68.42%)	28 (75.68%)	193 (67.48%)	0.31
Yes	102 (31.58%)	9 (24.32%)	93 (32.52%)	
Type 2 diabetes, n (%)				
No	278 (86.07%)	33 (89.19%)	245 (85.66%)	0.80
Yes	45 (13.93%)	4 (10.81%)	41 (14.34%)	
Chronic kidney disease, n (%)				
No	290 (89.78%)	33 (89.19%)	257 (89.86%)	0.78
Yes	33 (10.22%)	4 (10.81%)	29 (10.14%)	
Chronic obstructive pulmonary disease, n (%)				
No	310 (95.98%)	36 (97.30%)	274 (95.80%)	> 0.99
Yes	13 (4.02%)	1 (2.70%)	12 (4.20%)	

RESULTS

Patient Selection

Selection of included patients is outlined in the Figure. Through use of the CAREWare dataset, a total of 793 PLWH who received care at F&MCW were identified. Between May 2020 and March 2021, 360 NAAT and 102 serologic tests were performed for a total of 462 COVID-19 tests. Of these, there were 40 (8.65%) positive tests and 422 (91.34%) negative tests. Of the positive tests, 2 patients had both a positive NAAT and serology, while 1 patient had 2 positive NAATs (performed 4 weeks apart), leaving 37 unique patients who tested positive and were included for analysis. Of the 37 positive cases, 27 (72.97%) were identified by NAAT and 10 (27.02%) by serology. Of the 422 negative tests – after adjusting for multiple tests performed on the same individual – 286 unique patients were identified for the control group.

Demographics

Demographic information for the patient cohort is summarized in Table 1. Patients were divided into 2 groups according to the presence or absence of a positive COVID-19 test. Between the two groups, the COVID-postive group was significantly younger that the COVID-negative group (42.08 vs 49.87 years, $P = 0.001$). Most of the total cohort was male (79.88%), were on ART at time of testing (93.5%), and were virally suppressed (85.09%). The most represented races were Non-Hispanic Black (47.99%) and Non-Hispanic White (40.87%). The most common comorbidities were obesity (34.06%) and hypertension (31.58%). There was no statistically significant difference between the groups with regard to sex at birth, race, current ART, last viral load (copies/mL), or medical comorbidity (obesity, hypertension, type 2 diabetes, chronic kidney disease, or chronic obstructive pulmonary disease).

Outcomes and Presentations of COVID-19-Positive Patients

Data regarding presenting symptom(s), severity, and need for hospitalization are summarized in Table 2. Only patients with a positive NAAT test (n = 27) were included in this analysis, as those who tested positive via serologic test generally did not have symp-

Table 2. Outcomes and Presentations of COVID-19-Postive Patients Diagnosed Via Nucleic Antigen Amplification Test, N = 27

	n (%)
Symptoms	
Cough	13 (48.15)
Fatigue	7 (25.93)
Subjective fever	5 (18.52)
Myalgias	5 (18.52)
Congestion	5 (18.52)
Sore throat	4 (14.81)
Diarrhea	4 (14.81)
Anosmia	4 (14.81)
Chills	3 (11.11)
Headache	3 (11.11)
Nausea	3 (11.11)
Shortness of breath	3 (11.11)
Weakness	2 (7.41)
Anorexia	2 (7.41)
Abdominal pain	1 (3.70)
Back pain	1 (3.70)
Rhinorrhea	1 (3.70)
Severity	
Asymptomatic	3 (11.11)
Mild to moderate	20 (74.07)
Severe	4 (14.81)
Critical	0 (0.00)
Hospitalization	
Yes	1 (3.70)
No	26 (96.30)

Figure 2. Flow Diagram of Test Completion and Outreach Efforts

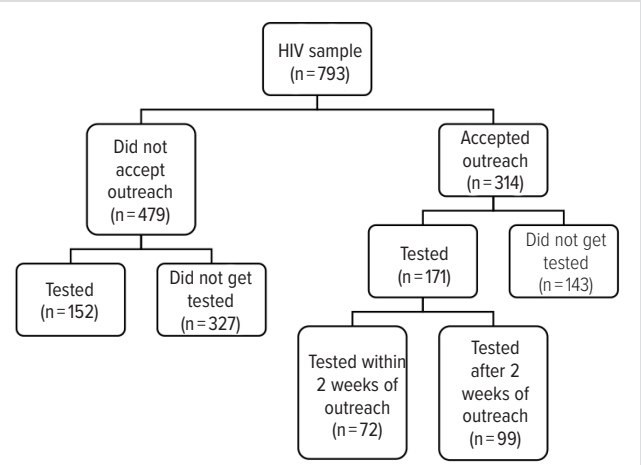


Table 3. COVID-19 Test Completion in Those Who Accepted Outreach Intervention

	Before Outreach (n = 314)	After Outreach (n = 314)	*P* value
COVID-19 tested			
Yes	20 (6.37%)	151 (48.09%)	< 0.001
No	294 (93.63%)	163 (51.91%)	

toms charted due to unknown timing of infection. Most patients (n = 20, 74.07%) had symptoms that correlated with mild to moderate infection, the most common of which included cough (48.15%), fatigue (25.93%), subjective fever (18.52%), myalgias (18.52%), and congestion (18.52%). The remaining symptomatic patients met criteria for severe infection due to dyspnea and/or hypoxia (n = 4, 14.81%). Three patients were asymptomatic, and all were tested following concern for exposure. There were no critical infections. Only 1 patient required hospitalization, and there were no documented deaths.

Outreach Efforts

The number of outreach attempts and subsequent testing is outlined in Figure 2. Of the 793 PLWH identified, 314 (39.59%) accepted outreach and 479 did not (60.40%). Of those who accepted outreach, 171 (54.45%) were tested; 72 of those tests (42.10%) were performed within 2 weeks of outreach, and 20 (6.37%) were tested prior to outreach. Of those who did not accept outreach, 152 (31.73%) patients were tested during the study period. Information summarizing the effect of outreach efforts is included in Tables 3 and 4. Following outreach, 151 tests were performed within the monitoring period, which represented a statistically significant change in the amount of testing. One hundred forty-seven (97.35%) of these tests were performed after 1 call, and 4 were after 2 or more calls (2.65%). In total, regardless of outreach, 323 patients (40.73%) underwent COVID-19 testing out of the 793 identified PLWH.

DISCUSSION

Overall, patients sampled from the F&MCW adult infectious disease clinic were found to be a largely young, male cohort who were virally suppressed on ART. Most patients presented with symptoms correlating to mild to moderate COVID-19 infection, with 1 hospitalization and zero deaths. When compared to other publications investigating PLWH during this time period, the demographics of our study population were similar overall.[8-15] The main difference was an overrepresentation of Non-Hispanic White patients in our cohort, though multiple studies did not report race, and exact numbers varied considerably by location. Additionally, our sample size of 27 PLWH and COVID-19 co-infection was smaller when compared to other studies – most with population sizes between 30 and 80. Patients in our cohort who tested positive were statistically younger, which may be representative of differences in social distancing and may have contributed to milder infections overall.

Hypotheses that PLWH may be at higher risk for severe COVID-19 infection and death have been postulated since early in the pandemic due to immune dysregulation and varying degrees of immunodeficiency, with some existing studies demonstrating this effect in New York, South Africa, and the United Kingdom.[17-20] One review article discussed that several

independent risk factors in PLWH may contribute to a higher risk of mortality overall, including older age, male gender, Black racial background, presence of medical comorbidities, intravenous drug use, and low CD4 cell counts.[21] During our survey of existing publications, most data suggested there was not a significant increase in disease severity or mortality in PLWH with COVID-19 co-infection when compared to the general population – especially when virally suppressed.[8-16] Our data demonstrate a lack of severe co-infection and mortality in this cohort and perhaps is related to immune recovery while virally suppressed on ART. When compared to these publications, our data appear to have lower rates of both hospitalizations and deaths. This may be representative of a lower sample size or that our study timeframe did not include some of the earliest cases of COVID-19 in our population.

Table 4. Outreach Efforts and COVID-19 Testing

(n = 793)	Total (n = 499)	No Outreach/ Pre-Outreach (n = 283)	Post-Outreach 1 call (=11)	Post-Outreach 2+ calls	*P* value
COVID-19 Tested, no. (%)					
Yes	323 (40.73%)	172 (34.47%)	147 (51.94%)	4 (36.36%)	<0.001
No	470 (59.27%)	327 (65.53%)	136 (48.06%)	7 (63.64%)	

Through grant funding, all PLWH who received HIV care at F&MCW received COVID-19 testing outreach with a telephone call from a social worker, which, if accepted, was documented in the patient chart. If testing was declined, the reason was not documented consistently in the chart. Common documented reasons for declining testing included a lack of symptoms, recent testing, or a general lack of interest. Overall, compared to testing that had been performed prior to any outreach, outreach efforts by our team had a statistically significant impact on the number of PLWH who completed testing. The discovery of an effecctive and successful manner of outreach is valuable. Outreach for other public health issues, including vaccination, may be able to follow a similar design. Additionally, given that PLWH represent a highly marginalized population, any outreach efforts that better connect these patients to health care are important. In our population, outreach efforts were possible due to an existing database of PLWH that was small enough to make individualized phone calls feasible; thus, this may not be realistic to expand to larger patient populations.

To our knowledge, there are limited studies examining the results of outreach efforts to PLWH during the COVID-19 pandemic. One such study is a virtual outreach program led by students at Brigham and Women's Hospital in Boston, Massachusetts.[26] This outreach was aimed at identifying areas of social need, such as food and financial insecurity, health education regarding COVID-19, and engagement of individuals struggling with social isolation. Outreach events were thought to have positive effects on students, providers, and patients alike. Overall, this study suggests that direct engagement of PLWH through outreach efforts has more potential benefits than simply those related to physical health and highlights the significant psychosocial impact of the COVID-19 pandemic.

There are multiple limitations to this study. With regards to the COVID-19 data in PLWH, it is possible that patients in the F&MCW database tested positive or were hospitalized at outside institutions. We attempted to mitigate this by using the Care Everywhere software to query various institutions across the city and state but could not capture all regional hospitals or COVID-19 testing sites. The small sample size raises questions about the power of the study, though based on similar studies, the overall demographics appear to be consistent with the notable difference of overrepresenting the Non-Hispanic White population. Our results may not be generalizable to centers that have a patient population with lower rates of viral suppression, with most of our patients being on ART and virally suppressed at the time of COVID-19 testing. Regarding outreach efforts, it is difficult to discern whether COVID-19 testing during our study period was specifically due to the outreach event. However, any patient who accepted the outreach was given information about where and how to test, so there was likely value in the outreach, even if testing occurred several months later.

CONCLUSIONS

In this largely young, virally suppressed cohort of PLWH, COVID-19 co-infection was associated with mostly mild to moderate disease severity, which corresponds with most existing studies. Outreach efforts by the infectious disease department via individualized phone calls to PLWH were shown to have a statistically significant increase in the number of patients who were tested for COVID-19. This type of outreach may have value for further public health efforts, though would likely have limitations expanding to other populations given the one-to-one nature of communication.

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