



Social and Behavioral Impacts of COVID-19 on People Living with HIV: Review of the First Year of Research

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Abstract

Purpose of the Review The SARS-CoV-2 (COVID-19) pandemic brought unprecedented social change with the most severe impacts on the most vulnerable populations, including people living with HIV (PLWH). This review examined findings from empirical studies of social and behavioral impacts of COVID-19 on PLWH in the first year of the pandemic.

Recent Findings Impacts of COVID-19 on PLWH fit within an HIV syndemics framework, with overlapping COVID-19 and HIV comorbid conditions concerning mental health and structural inequality. Early impacts of COVID-19 on social isolation, emotional distress, stigma, and substance use varied across studies with few consistent patterns. Structural inequalities, particularly impacts on food security and housing stability, were observed more consistently and globally.

Summary COVID-19 intersects with HIV infection along with multiple interlocking comorbidities that are best characterized and understood within a syndemics framework.

Keywords HIV-COVID-19 co-infection · Social impacts · Behavioral impacts · People living with HIV

Introduction

In the first quarter of 2020, the SARS-CoV-2 pandemic disrupted nearly every facet of human interaction worldwide, including efforts to conduct ongoing research. Recognizing the widespread impacts of SARS-CoV-2, the cause of COVID-19, virologists and public health researchers working on HIV infection quickly turned their attention to the structure, pathogenesis, and prevention of this new pathogen. For social and behavioral scientists working on HIV infection, the challenges posed by a novel life-threatening communicable disease were apparent and familiar [1, 2]. For many researchers, ongoing studies that were focused on the health and behavior of people living with HIV (PLWH) were seen as opportunities to study the impacts of COVID-19 on PLWH. Here, we review the social and behavioral

research concerning the impacts of COVID-19 on PLWH that reported data collected in the first year of the SARS-CoV-2 pandemic.

COVID-19 complicates the clinical course of HIV infection and vice versa. Early observers reported that PLWH experienced more severe clinical outcomes from COVID-19 compared to people not living with HIV [3]. In a review of 22 studies with 20,982,498 patients across Africa, Asia, Europe, and North America, Ssentongo et al. [4] found that PLWH were significantly more likely to develop COVID-19 and had greater COVID-19 mortality than their HIV-negative counterparts. Greater severity and death rates from COVID-19 among PLWH have been confirmed [5, 6]. Factors such as immune suppression, chronic inflammation, and other underlying conditions associated with HIV infection likely account for greater COVID-19 severity in PLWH [3, 4]. Studies show that when HIV is fully suppressed, the clinical course of COVID-19 may be no different for people with HIV than it is for people who are HIV negative, with comorbid conditions complicating the protective benefits of viral suppression [7]. There is also evidence that antiretroviral therapies (ART) may offer some clinical benefit in COVID-19, although the evidence for these protective effects of ART are inconclusive [4, 8–10]. The potential for more severe COVID-19 clinical outcomes among PLWH

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brought a sense of urgency to understanding the social and behavioral impacts of COVID-19 on PLWH.

A substantial literature on the social and behavioral implications of COVID-19 for PLWH emerged within the first year of the SARS-CoV-2 pandemic. Unlike the first years of the HIV pandemic which were met with relative indifference, the early weeks of COVID-19 were met with entire countries and industries mobilized to contain and prevent the spread of infection. In a review of rapidly conducted studies, commentaries, and editorials concerning the social impacts HIV-affected populations, Winwood et al. [11] examined research published through January 31, 2021. Taking a broad approach, the review identified several emerging trends in the early studies of COVID-19-HIV co-infection, including expansion of telehealth and impacts on mental health, food insecurity, social isolation, finances and sexual behavior. The clustering of multiple impacts around COVID-19 and their implications for PLWH indicated that COVID-19 could be considered a contributing condition and complication in the broader context of factors that influence HIV infection.

COVID-19 and HIV Syndemics

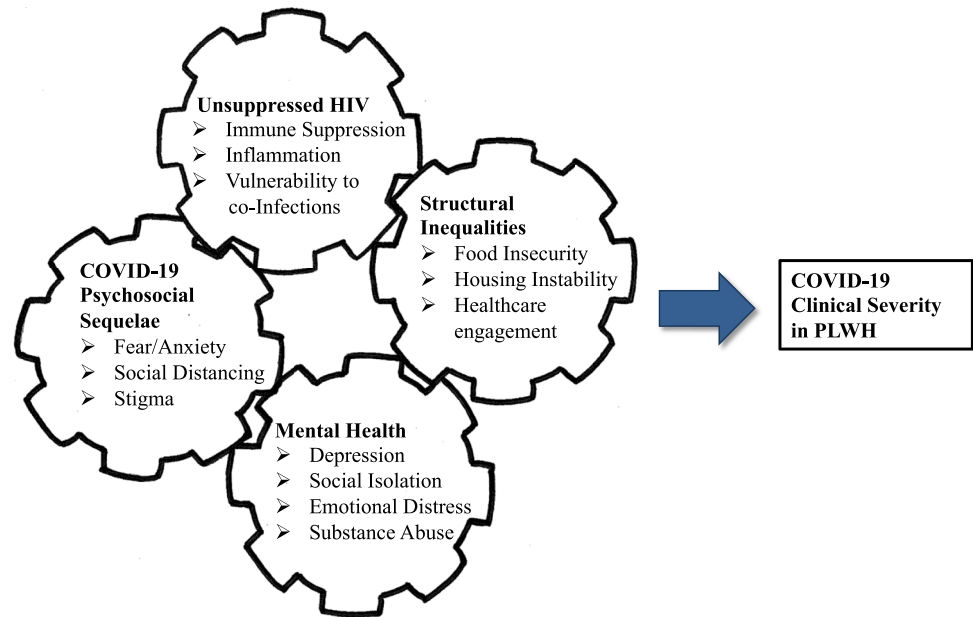
The COVID-19 and HIV pandemics intersect in the context of multiple overlapping comorbidities at the individual and structural levels. For example, type-2 diabetes and metabolic syndrome significantly contribute to the severity of COVID-19, as well as contributing to the morbidity and mortality of HIV infection [12–14]. Several other health conditions that increase the risk for severe COVID-19 are prevalent in PLWH, including hypertension, obesity, and chronic pulmonary disease [15]. Furthermore, ART is associated with metabolic disruptions that can complicate the clinical course of type-2 diabetes and metabolic syndrome [16]. Stress, depression, and substance use, which are prevalent among PLWH, have immune-suppressive effects which may also complicate COVID-19 [17]. In addition, public health responses to slowing SARS-CoV-2 transmission center on social distancing, which may contribute to social isolation, raising particular concern for many PLWH who are already socially marginalized [18]. The potential for COVID-19's synergistic relationships with HIV infection and their multiple co-occurring conditions have brought some social and behavioral HIV researchers to conceptualize COVID-19-HIV co-infection within a syndemics framework [19]. Defined as two or more epidemics that interact to synergistically facilitate greater disease burden [20], COVID-19 adds to the already multiple co-occurring conditions in HIV syndemics, including other infectious and non-infectious diseases, mental health conditions, emotional distress, and alcohol and other substance use [20]. A syndemics framework highlights how these conditions and others known to co-occur with HIV are exacerbated by COVID-19 [21].

Subclinical comorbidities such as urogenital inflammation, renal disease, metabolic syndrome, and others are also prevalent in PLWH and increase risks for severe COVID-19 [1]. In addition, social isolation promoted by physical distancing and self-quarantine increases the risk for adverse drug use events driven by limited access to clean drug use supplies and unaccompanied overdose [22]. Because of the synergistic nature of these comorbidities, changes in any one condition will have the potential to impact others.

Like medical and mental health comorbidities, structural inequalities also contribute to COVID-19-HIV syndemics. Food insecurity, for example, can lead to malnutrition, compromise general health status, and impede HIV treatment retention and ART adherence [23, 24]. Likewise, the adverse health effects of food insecurity contribute to risks for severe COVID-19 disease [25]. Housing instability has similar adverse impacts on HIV health outcomes [26], and housing instability can translate to dense congregate living conditions, which can in turn increase COVID-19 exposure risks. For example, in a cohort of marginally housed PLWH in San Francisco, housing instability worsened in early COVID-19 and contributed to increased risks for COVID-19-HIV co-infection [27]. Thus, along with mental health and substance use, structural inequalities fall within a syndemics framework and help explain HIV and COVID-19 health disparities.

Previous authors have conceptualized the complex factors influencing the course of HIV infection as interlocking gears, where changes in one cog invariably shift the next [28, 29]. This same conceptualization can be extended to the whole of HIV syndemics, along with their intersection with COVID-19. Figure 1 illustrates our adaptation of this concept to include the psychosocial sequelae of COVID-19 and their implications for HIV syndemics. In this adaptation, the psychosocial sequelae of COVID-19 such as fear and anxiety of infection, social distancing, and COVID-19 stigma exacerbate mental health conditions such as depression, social isolation, emotional distress, and substance abuse, which in turn contributes to food insecurity, housing instability and poor engagement in healthcare. Furthermore, these synergistic impacts can diminish motivation to engage in COVID-19 mitigation practices, and further suppress immune response, increasing vulnerability to severe COVID-19 [30, 31]. COVID-19 therefore amplifies existing social and health disparities in populations affected by HIV, including those attributed to race, gender, and geographic region [32]. Recognizing that HIV occurs in conjunction with multiple co-occurring epidemics informs clinical and social services as well as creates a framework for research [33]. Our review therefore conceptualizes COVID-19 from the perspective of HIV syndemics by recognizing the synergism of social and behavioral determinants of health that complicate both HIV infection and COVID-19. Our review

Fig. 1 Conceptualization of COVID-19 and HIV as interlocking conditions in a syndemics framework (adapted from Strathdee et al. (2012) and Pellowski et al., 2013)



therefore takes syndemics approach to examining the first year of social and behavioral research on the impacts of COVID-19 on PLWH.

Methods

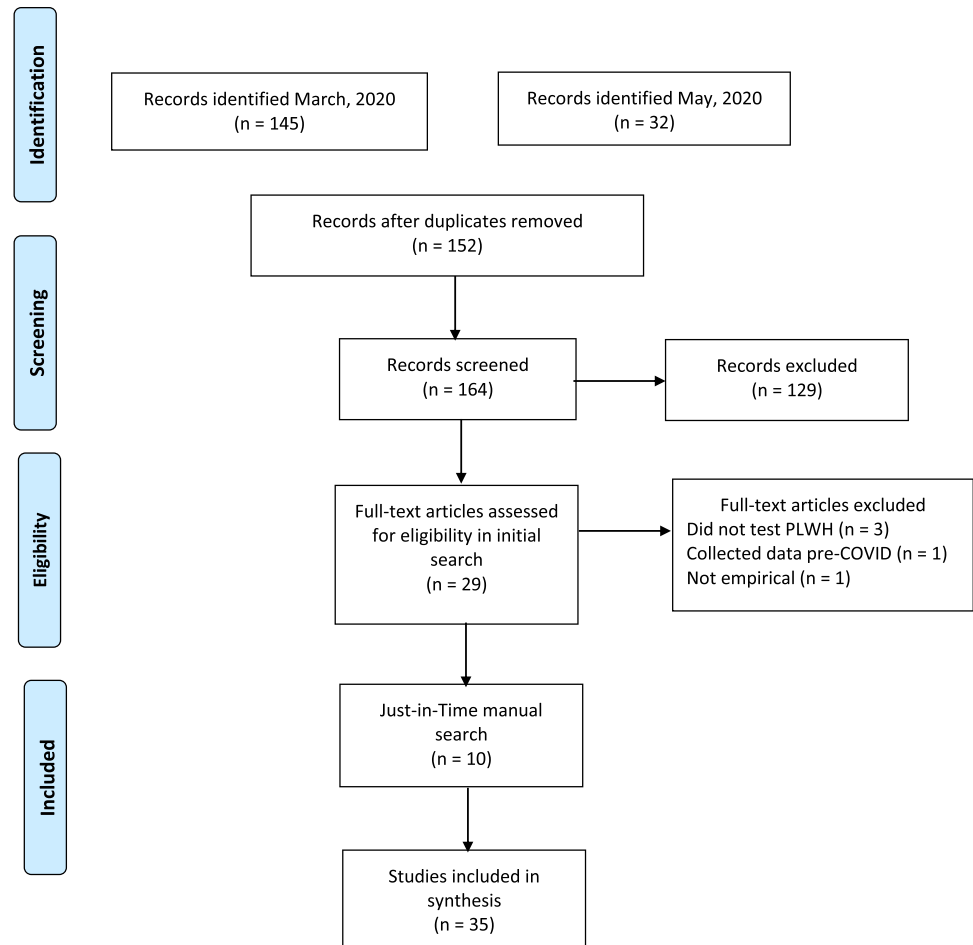
Search Strategy

We performed an initial search of PubMed and Google Scholar in March 2021 and repeated the search on May 25, 2021, to assure up-to-date completeness (see Fig. 2). We used a Boolean approach with search terms (hiv) AND (covid-19) AND (depression OR anxiety OR stress OR stigma OR mental health OR alcohol OR drug use OR substance use OR housing OR food insecurity). The first search did not impose time restrictions, and the second search was restricted to papers published between April and May 2021. Following the second search, there were a total of 177 articles identified, and after removing duplicates spanning across search terms, there were 152 articles screened for data-based studies using the titles and abstracts. Furthermore, we conducted a just-in-time manual search of key journals (*AIDS Care*, *AIDS and Behavior*, *Journal of Acquired Immunodeficiency Syndromes*, *AIDS Patient Care and STDs*, etc.) on November 12, 2021, after the review process and prior to press, identifying an additional 10 studies that are included in the table of study findings. We also removed studies that concerned COVID-19 impacts on HIV but did not include PLWH, such as samples of people at risk for HIV and studies of HIV pre-exposure prophylaxis. A total of 35 studies were included in our review.

Results

Methodological Considerations

The studies reviewed from the first year of COVID-19 demonstrated substantial limitations, some of which may have occurred simply because of the obvious time urgency to assess immediate impacts. Thus, studies from the early months of COVID-19 reviewed in this paper cannot tell a complete story of the impacts of COVID-19 on PLWH, as the events of the intersecting pandemics were still evolving. Most of the limitations with these studies are common to cross-sectional research, particularly lacking pre-COVID-19 base rates. Studies reporting high levels of anxiety, depression, social isolation, etc. may not have reflected actual impacts of COVID-19 populations with high base rates. The few studies that reported longitudinal data in this early period suggest that more such studies will become available. Studies that are conducted over time will likely report results from periods included in published cross-sectional studies and will require tracking for redundancy in future reviews. Another limitation in this early literature is the necessity to invent new measures without systematic psychometric development. Again, driven by the immediate urgency of an unfolding pandemic, measures were often developed rapidly and are idiosyncratic to a particular study. Finally, although we reviewed research from the first year of COVID-19, the evolution of the pandemic was not geographically uniform, with research occurring at different stages of local epidemics. Research reported from China, Italy, Spain, the UK, and the USA reflects different stages of COVID-19 in the first year of the pandemic than research from Kenya and

Fig. 2 Flow of search strategy and resulting papers for this review

Ukraine. These facets of the literature should be considered as the reviewed research is interpreted.

Mental Health

Our review of studies concerning the mental health implications of COVID-19 for PLWH identified five major impacts: social isolation, emotional distress, stigma, coping, and substance use (see Table 1).

Social Isolation

Initial public health responses to COVID-19 emphasized maintaining physical distance to avoid exposure to respiratory droplets and aerosolized virus particles. From a mental health perspective, the common use of the term “social distancing” implied social isolation as an unavoidable consequence of COVID-19 protective behaviors [34]. Cultural differences in living conditions, social relations, and options for interpersonal communication suggest that the social isolating effects of COVID-19 restrictions varied across countries. For example, social relations in Spain emphasize closeness in extended families, frequent gatherings, and community

structures for congregating in public spaces, all of which likely helped fuel the devastating early outbreaks of COVID-19 in Spain. Ballester-Arnal [35] described COVID-19 as a “socially cruel” disease, with its impacts on social interactions among PLWH compounded by concerns about continuing care and sustaining social support. Similar concerns, as well as evidence for similar COVID-19 impacts among PLWH, were reported in Italy [36]. In Kenya, adolescents and young adults living with HIV indicated that the greatest impacts of COVID-19 were those that restricted social interactions, including 25% of young people stating that closed churches and 92% of young people stating that closed schools were the greatest adverse impacts of COVID-19 they experienced [37]. However, the adverse social impacts of COVID-19 restrictions were not universal. In Australia, for example, 43% of PLWH reported that COVID-19 negatively impacted social relationships, while 13% reported that COVID-19 had a positive impact on their relationships [38].

Cultural variations notwithstanding, PLWH may have been particularly vulnerable to the adverse effects of social isolation given the limited social support they often experience due to HIV stigma and intersecting sources of rejection (e.g., racism, homophobia, sexism). For example, one study

Table 1 Summary of studies on COVID-19 impacts on people living with HIV

North America						
Wion & Miller, [80]	April, 2020	N = 85 PLWH	Online across the USA	Online cross-sectional survey	Increases in social isolation, depressive symptoms, anxiety, and stress and decreases in social support and overall HIV self-management were reported in retrospect to pre-COVID-19. Social support and the chronic nature of HIV aspects of self-management decreased relative to pre-COVID-19	
Cooley et al., [62]	April–May, 2020	N = 187 71% PLWH 64% men 36% women	St. Louis, MO, USA	Quantitative cross-sectional survey administered through telephone or email to past participants	10% of PLWH reported food insecurity in the past 30 days. PLWH also scored significantly higher on depression, anxiety, and loneliness as compared to those who were not living with HIV and had higher rates of marijuana use	
Friedman et al., [81]	April–June, 2020	N = 2078 PLWH 438% men 52% women 60% men 40% women	Multi-cities, USA	Telephone and video-conference quantitative interviews with enrolled cohort participants	Men living with HIV were more likely than HIV-negative men to experience social disruptions, whereas HIV-negative women were more likely than women with HIV to experience social disruptions. Participants who experienced social disruptions had significantly higher odds of depression symptoms, anxiety, and social support dissatisfaction	
Dale et al., [82]	October, 2019–July, 2020	143 Black women living with HIV	Miami, FL, USA	Daily text message ecological momentary assessment surveys of microaggressions	Microaggression-related distress increased from 52% at baseline/October, peaked at 70% during the holidays (November/December), declined to 55% in March when COVID-19 preventive measures were instituted, and peaked to 83% in June/July 2020 during widespread Black Lives Matters protests. Baseline viral suppression was associated with lower microaggressions across the 9 months of observation	

Table 1 (continued)

North America	
Diaz-Martinez et al., [50]	<p>July–August, 2020</p> <p>Miami, FL, USA</p> <p><i>N</i>=196 59% PLWH 49% men 51% women 75% Black 19% Hispanic</p> <p>Quantitative cross-sectional study administered through telephone to an existing cohort using the C3PNO COVID-19 survey</p> <p>As compared to those who were not living with HIV, PLWH reported less anxiety, less COVID-19-related worry, and more resilience</p> <p>During the pandemic, cocaine use dropped by 12% among PLWH. Alcohol use did not change during the pandemic but was higher among those who were not living with HIV. Psychological resilience may offer protection against mental health disorders</p>
Genberg et al., [64]	<p>April–June, 2020</p> <p>Baltimore, MD</p> <p><i>N</i>=443 People who inject drugs 33% PLWH</p> <p>Interviewer administered cross-sectional survey in existing cohort</p> <p>Sample of people with history of injection drug use found that active substance related to less physical distancing and greater depression, with no difference by HIV status</p>

Table 1 (continued)

North America					
Gwadz et al., [48]	April–August, 2020	<i>N</i> =96 75% African American/Black 25% Latinx 63% men 36% women	New York City, NY, USA	Cross-sectional mixed methods; 96 participants completed the quantitative aspect and 35 continued to participate in the qualitative aspect	Quantitative Due to COVID-19, 15% of participants reported that they were unable to get food they needed and 36% reported that they were unable to go to substance abuse treatment/support (e.g., AA or NA) meetings As for emotional experiences, 80% reported frustration or boredom, 70% reported increased anxiety, 67% reported loneliness, and 56% reported increased depression Qualitative One of the six major themes from the semi-structured interviews was stress and coping. Participants reported various strategies to cope with the effects of COVID-19 including: social support, meditation, art, spirituality, and prayer
Hochstatter et al., [71]	January–May, 2020	<i>N</i> =64 PLWH and substance use disorders 75% Men (<i>n</i> =48) 25% women 59% Black (<i>n</i> =38) 9% Latinx (<i>n</i> =6) 34% White (<i>n</i> =22)	Wisconsin, USA	Quantitative longitudinal study that collected data weekly over 12 weeks through opioid relapse prevention and HIV management mobile-health intervention	Use of illicit substances increased during the pandemic. Confidence to stay sober and attendance of recovery-support meetings decreased during the pandemic and participants reported being around people who used drugs more often. At baseline, participants were diagnosed with anxiety (30%), bipolar disorder (17%), depression (52%), panic disorder (2%), and PTSD (8%); however, mental health during the pandemic was not measured

Table 1 (continued)

North America	
Hall et al., [83]	<p>June–August, 2020</p> <p><i>N</i> = 32 PLWH 46% men 54% women</p> <p>Chicago, IL, USA</p> <p>Qualitative interviews with PLWH who tested for COVID-19, 10 were COVID-19 positive</p> <p>A majority of participants perceived themselves as having an increased risk of contracting COVID-19 due to their HIV status. Of those who tested positive for COVID-19, the majority regarded their HIV diagnosis as having a more profound impact on their lives but found similarities between COVID-19 stigma and HIV-related stigma. Many participants also expressed mistrust in the health care system</p>
Jones, Morgan et al., [84]	<p>May–August, 2020</p> <p><i>N</i> = 200 PLWH 43% men 57% women</p> <p>Miami, FL, USA</p> <p>Participants identified from an existing consent to contact database in HIV clinics completed phone interviews</p> <p>Psychological stress predicted COVID-19 financial and social burden and health factors associated with an increased risk of severe COVID-19 outcomes. History of traumatic events was associated with increased COVID-19 risk, and stress was associated with increased COVID-19 burden and COVID-19 risk</p>
Jones, Rodriguez et al., [40]	<p>May–December, 2020</p> <p><i>N</i> = 273 85% PLWH 45% men 55% women</p> <p>Miami, FL, USA</p> <p>Quantitative cross-sectional study administered through telephone in English or Spanish using the MACS/WIHS combined cohort study COVID-19 survey</p> <p>As compared to men, women report higher levels of stress and loneliness due to the pandemic. COVID-19 burden was associated with both stress and loneliness for women, but not for men. Women also reported losing mental health care significantly more than men. No sex differences for depression were reported and study outcomes were not significantly different based on HIV status</p>

Table 1 (continued)

North America	
Brouillette et al., [85]	<p>April–September, 2020</p> <p><i>N</i> = 77 90% men 10% women</p> <p>Montreal, Canada</p> <p>Participants contacted through an existing study database completed email-delivered weekly surveys</p> <p>Among middle-aged and older adults living with HIV in Montreal, 39.5% experienced an increase in psychological distress between the pre-COVID-19 and the first wave of the COVID-19 periods, and 32.5% met clinically defined psychological distress. During the first wave of COVID-19, some attenuation in distress was seen over time. Feeling lonely and financial insecurity were associated with distress</p>
Tamargo et al., [61]	<p>July–August, 2020</p> <p><i>N</i> = 299 61% PLWH 48% men 51% women</p> <p>Miami, FL, USA</p> <p>Quantitative longitudinal study using the C3PNO COVID-19 survey administered through telephone to an existing cohort</p> <p>17% reported that they did not have enough money to buy food and 15% reported having to ration their food to make it last longer; food insecurity was higher among those who were not living with HIV. Those who were not living with HIV reported higher levels of hazardous drinking. Smoking decreased during COVID-19 for PLWH. Cocaine use decreased during the pandemic regardless of HIV status, but binge drinking increased among those not living with HIV</p>
Kalichman et al., [1]	<p>April, 2020</p> <p><i>N</i> = 162 72% men</p> <p>Atlanta, GA, USA</p> <p>Interviewer administered cross-survey in existing cohort</p> <p>40% of PLWH were unable to access food during early COVID-19, 22% of those who were unable to access food were able to pre-COVID-19</p>
Kalichman et al., [49]	<p>April–August, 2020</p> <p><i>N</i> = 459 80% men 20% women 97% African American Mean age 34.3 years</p> <p>Atlanta, GA, USA</p> <p>Cross-sectional survey with community sample</p> <p>Trust in sources of COVID-19 information sources was related to general medical mistrust and the degree of social and healthcare disruptions PLWH experienced</p>

Table 1 (continued)

North America	
Pizzirusso et al., [45]	<p>April, 2020</p> <p>New York City, NY, USA</p> <p><i>N</i>=49 PLWH 61% men 39% women 34% African American 37% Latinx 29% Caucasian</p> <p>Quantitative longitudinal study administered through telephone to an existing cohort</p> <p>During quarantine, 43% of the sample experienced some symptoms of anxiety, and 14% met the threshold for anxiety disorder, with the greatest rate among Latinx participants (22%). Additionally, 45% of the sample experienced some symptoms of depression and 4% met the threshold for depressive disorder, with the highest rate among Caucasian participants (7%)</p>
Quinn et al., [58]	<p>April, 2020</p> <p>Chicago, IL; Milwaukee, WI; Detroit, MI; Minneapolis, MN; Houston, TX, USA</p> <p><i>N</i>=135 SMM living with HIV Mean age 44.8 years</p> <p>Quantitative cross-sectional survey—response to a single open-ended question “How has your experience with AIDS and HIV helped you cope with COVID-19”</p> <p>Experiences living with HIV helped to manage COVID-19 stress and resist stigmatizing people who contract COVID-19</p>
Pizzirusso et al., [45]	<p>April, 2020</p> <p>New York City, NY, USA</p> <p><i>N</i>=49 PLWH 61% men 39% women 34% African American 37% Latinx 29% Caucasian</p> <p>Quantitative longitudinal study administered through telephone to an existing cohort</p> <p>During quarantine, 43% of the sample experienced some symptoms of anxiety, and 14% met the threshold for anxiety disorder, with the greatest rate among Latinx participants (22%). Additionally, 45% of the sample experienced some symptoms of depression and 4% met the threshold for depressive disorder, with the highest rate among Caucasian participants (7%)</p>
Sachdev et al., [27]	<p>March–September, 2020</p> <p>San Francisco, CA, USA</p> <p><i>N</i>=193 PLWH coinfecting with COVID-19 91% men 6% women 2% trans-women</p> <p>Quantitative cross-sectional study using data from 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</p> <p>PLWH were more susceptible to COVID-19 than people who are not living with HIV and this may be explained by homelessness. Roughly half of the sample had stable housing (54%)</p>

Table 1 (continued)

North America	
Sherbuk et al., [68]	<p>April, 2020</p> <p>Rural Virginia, USA</p> <p><i>N</i>=170 PLWH 53% men 42% women 3% transgender 58% Black 31% White 6% Hispanic</p> <p>Quantitative study using case management screening and tracking use of housing assistance and food services at the Ryan White HIV/AIDS Program Clinic</p> <p>Among those who were employed before the pandemic, 74% lost. Their jobs and 26% reported decreased hours. Between December 2019 and April 2020, need for food bank/home delivered meals services doubled. During this time period, emergency financial assistance for house costs also increased</p>
Latin America	
Ballivian et al., [59]	<p>Not reported</p> <p>Buenos Aires, Argentina</p> <p><i>N</i>=1336 67% men 33% women</p> <p>Quantitative cross-sectional study using an online administered survey that was adapted from the MACS/WIHS Combined Cohort Study COVID-19 survey in English or Spanish</p> <p>Participants reported disruption to mental health services (11%) and substance abuse treatment (1%). 6% reported increased emotional abuse during quarantine and 24% reported drug use. Economic hardships due to COVID-19 were associated with poor mental health, stress, and loneliness, but all three relationships were buffered by resilience</p>
Diaz et al., [46]	<p>July–August, 2020</p> <p>Lima, Peru</p> <p><i>N</i>=156 59% men 41% women</p> <p>Quantitative cross-sectional survey administered through telephone to past participants</p> <p>Participants reported increased anxiety (64%) and stress (77%) since the beginning of the pandemic. Additionally, 43% had difficulty accessing mental health care</p>
Africa	
Folayan et al., [86]	<p>July–December, 2020</p> <p>Nigeria</p> <p><i>N</i>=919 PLWH 40% men 60% women</p> <p>Online/social media outlets using a modified respondent driven sampling procedure to complete measures of food insecurity</p> <p>Significantly fewer PLWH reported a positive COVID-19 test result and had lower odds of practicing COVID-19 risk preventive behaviors. In comparison with those living without HIV, PLWH had higher odds of cutting meal sizes as a food security measure and lower odds of being hungry and not eating</p>

Table 1 (continued)

North America						
Dyer et al., [37]	March–August, 2020	N=486 PLWH under age 24 35% men 65% women	Western Kenya	Quantitative cross-sectional survey administered through telephone to an existing cohort	10% of the sample reported mild to severe depression and participants ages 20–24 had the highest rates of depression (21%). Level of resilience did not differ across groups. 4% of the total sample reported that COVID-19 has effected basic needs and food scarcity	
Wagner et al., [87]	March–September, 2020	N=280 37% men 63% women	Kampala, Uganda	Participants in an RCT completed final assessment at start of COVID-19 lockdown and followed-up to complete phone interviews post COVID-19 lockdown	Elevated depressive symptoms nearly tripled to the post-lockdown assessment, and post-lockdown depressive symptoms were associated with being female, unemployment, low income, high food insecurity, and lower ART adherence during the 3-month lockdown period. Multiple regression analysis showed higher food insecurity and perception of negative COVID-19 impacts on ART adherence remained associated with a greater likelihood of elevated depressive symptoms	
West et al., [88]	August–December, 2020	N=16; 56% men 44% women Ages 18 * 49 years	Rakai, Uganda	Qualitative interviews with participants in an existing cohort study	Stress during COVID-19 was compounded by worry about accessing ART, distress over inadvertent disclosure of HIV status, and fear that coronavirus infection would have more severe outcomes for immunocompromised individuals and cause death. There was also added poverty and economic stress attributed to COVID-19	

Europe

Table 1 (continued)

North America						
Pantelic et al., [89]	May–July, 2020	N=653 PLWH	United Kingdom	Cross-sectional, mixed-method, and anonymous survey among PLWH attending care	A majority (77%) reported feeling more anxious; 71% reported feeling more depressed than usual; and 19% reported having suicidal thoughts since the start of the COVID-19 pandemic. Respondents commonly worried about running out of HIV medicine and being unable to access HIV services. Widespread resilience was also noted with 83% of respondents feeling that living with HIV had equipped them with the strength to adapt to the COVID-19 pandemic	
Delle Donne et al., [36]	March–May, 2020	N=98 75% men 46% age 51–60 years	Rome, Italy	Quantitative cross-sectional study using COVID-19 tailored Impact of Events Scale	45% had mild to severe psychological distress attributed to COVID-19. Women and older aged persons experienced greater impacts	
Kuman et al., [47]	April, 2020	N=307 PLWH 94% men 6% women	32 cities in Turkey	Quantitative cross-sectional survey administered online	25% of the sample reported having general anxiety. General anxiety scores were related to COVID-19-related anxiety. Participants had more anxiety about transmitting SARS-CoV-2 than transmitting HIV. Specifically, participants' greatest concern was COVID-19 spreading across the country and the least common concern was transmitting HIV	
Rozanova et al., [78]	May, 2020	N=123 PLWH and SUD 50 years old or older 53% men 47% women	Kyiv, Ukraine	Quantitative cross-sectional survey conducted through telephone on how COVID-19 interfered with HIV and/or addiction treatment	Although treatment services maintained throughout lockdown, participants reported being anxious that COVID-19 would disrupt treatment services. 55% reported depressive symptoms and 21% reported suicide ideation	

Table 1 (continued)

North America				
Asia–Pacific Islands				
Nitipolprasert et al., [90]	June–December, 2020	N = 26 PLWH 100% men	Bangkok, Thailand	Qualitative interviews with men participating in a larger study Participants perceived themselves as susceptible to COVID-19 and feared contracting the virus. Men worried that contracting COVID-19 would lead to HIV status disclosure and stigmatization. Concerns included worry about job loss as a result of the economic downturn, and challenges associated with relocation and re-engaging with HIV care. Financial stress and lack of basic necessities caused by job losses were common
Weerasuria et al., [38]	August–November, 2020	N = 153 PLWH 77% men 18% women 5% other gender	Victoria, Australia	Quantitative cross-sectional survey administered online 43% of participants reported that the pandemic negatively affected their personal relationships. 14% reported that the pandemic negatively affected their ability to access food. 38% used recreational drugs; increased use was reported by 15% of participants and 27% reported that alcohol intake increased during the pandemic. About a third reported that they were rarely or not at all optimistic about their future (34%). Two-thirds were worried about their physical and mental health (68%) and half worried about their financial situation (50%)

Multi-Country

Table 1 (continued)

North America	
Jones, Ballivian et al., [60]	<p>April–May, 2020 (Argentina) April–September, 2020 (USA)</p> <p><i>N</i> = 1554 PLWH 86% Argentina 14% USA 63% men 36% women</p> <p>Buenos Aires, Argentina Miami, FL, USA</p> <p>Quantitative cross-sectional study administered online or through telephone in English or Spanish using the MACS/WHS Combined Cohort Study COVID-19 survey</p> <p>Participants in the USA reported higher levels of depression and higher levels of resilient coping. Stress, loneliness, and social support did not differ between the groups. In Argentina, social support and resilient coping were associated with lower levels of depression. In the USA, social support was associated with less depression, but this relationship was not strengthened by resilient coping</p>
Siewe Fodjo et al., [43]	<p>July–November, 2020</p> <p><i>N</i> = 317 PLWH 71% men 27% women</p> <p>32 countries Belgium (32%) Brazil (28%)</p> <p>Quantitative cross-sectional multi-lingual survey administered online</p> <p>63% of participants reported recreational substance use (e.g., alcohol, tobacco, marijuana); 23% met the threshold for major depressive disorders; 22% met the threshold for generalized anxiety disorders</p>
Siewe Fodjo et al., [44]	<p>July–November, 2020</p> <p><i>N</i> = 247 PLWH 73% men 24% women 1% other 51% Low-/middle-income countries 48.2% high-income countries</p> <p>26 countries Belgium (33%) Brazil (33%)</p> <p>Quantitative cross-sectional multi-lingual survey administered online</p> <p>27% participants met the threshold for anxiety and 27% met the threshold for depression. Rates of both were highest in Brazil (39.8% anxiety; 41% depression). Women reported significantly higher rates of anxiety than men. Participants from low-/middle-income countries reported more fear of contracting COVID-19 than those from high-income countries. Overall, participants reported that financial situation (37%), sexual fulfillment (47%), family life (38%), and social life (66.5%) got worse during the confinement period</p>

Table 1 (continued)

North America	April–May, 2020	N = 473 PLWH 100% men	103 countries	Surveyed SMM recruited through a social networking app	PLWH anticipated greater financial loss due to COVID-19 than those not living with HIV, and anticipated financial loss was associated with anxiety and depression
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PLWH people living with HIV; SMM sexual minority men

reported that 72% of PLWH participating in a longitudinal cohort were already socially isolated, defined as living alone, not engaged in a relationship, lacking reliable sources of social support, and not being socially satisfied [18]. Subsequent data collection during early COVID-19 found that having recently experienced violence and having a mental illness were correlates of increased social isolation [39]. Other research conducted early in the COVID-19 pandemic reported increased loneliness among PLWH and suggested greater loneliness and stress among women than men [40]. However, there were PLWH who received increases in social support during COVID-19 lockdowns as service providers ramped up outreach efforts and PLWH and HIV care providers became technologically connected [41]. The duration of social isolation and loneliness experienced by PLWH during early COVID-19 may have been relieved as services, communities, and individuals adapted to socially distant communication [42].

Emotional Distress

People living with HIV are typically attuned to the fact that they can be more vulnerable to an array of infectious diseases. Increased vulnerability to co-infections, as well as non-infectious comorbidities, in the daily lives of PLWH provides a basis for the increased stress that was attributable to COVID-19 for many PLWH. Some studies in early COVID-19 reported high rates of depression and anxiety among PLWH [43, 44], although it is not possible to know if these rates in-and-of themselves represent a change from pre-COVID19 levels of distress. However, in Australia, two-thirds of PLWH reported worrying about their health and mental health specifically due to COVID-19 [38]. Other studies that were also able to account for pre-COVID-19 mental health examined changes over time and offer clearer answers. For example, a study of PLWH in New York City found 69% of PLWH experienced symptoms of emotional distress with 4% meeting the threshold for major depression and 14% meeting the criteria for general anxiety disorder during periods of quarantine and lockdown, and emotional distress were partly attributable to prior diagnoses of anxiety and depression [45]. In Peru, PLWH reported experiencing increases in anxiety and stress that they retrospectively attributed to changes in their lives resulting from early COVID-19 [46]. Similarly, one in four PLWH in Turkey reported general anxiety during early COVID-19. In this study, non-specific general anxiety was related to anxiety specifically attributed to COVID-19, and increased anxiety seemed to result from concerns about the transmissibility of COVID-19 [47]. During Italy’s early and severe COVID-19 outbreak, anxiety and stress were greatest among PLWH with additional underlying comorbidities [36].

Two studies concerning the emotional distress of COVID-19-HIV are particularly noteworthy for their methodological approaches. The first study built on assessments that were being conducted weekly before COVID-19 and continued during the outbreak. In this study, older adults living with HIV expressed concerns about potential exposures to COVID-19 and these concerns were the leading source of stress during the early weeks of COVID-19 [41]. In the second study, researchers used an adaptation of the Impact of Events Scale that specified COVID-19 as the impactful event. In this study, Delle Donne et al. [36] found that 45% of participants reported mild to severe symptoms of distress, most commonly depression and anxiety attributable to COVID-19, with greater emotional distress reported by women than men.

Studies also investigated factors that may have contributed to increased COVID-19 distress. For example, because of heightened concerns for contracting COVID-19 among PLWH, conflicting public health messaging and misinformation may have fueled COVID-19 stress [48]. One barrier to COVID-19 information messaging was a lack of trust in public health information sources, such as the CDC and health departments. Using the same measures, two independent studies showed that PLWH in New York City [48] and Atlanta, GA [49], demonstrated low levels of trust in COVID-19 information from all public health institutions, with greater trust in local and state health departments than trust in the CDC and other federal agencies. It is important to note that like social isolation, not all studies provide evidence for adverse effects of COVID-19 on emotional distress among PLWH. Specifically, in Miami, FL PLWH demonstrated less anxiety and COVID-19-related worries than a comparison group of people not living with HIV, and the difference was associated with resilience that served to buffer anxiety [50].

Stigma

Fueled by fear, stigma is an expected consequence of infectious disease outbreaks and serves as another source of COVID-19 stress for PLWH [51]. Past experience with emergent infectious diseases, including H1N1 influenza [52] and SARS [53], provided the groundwork for what to expect with regard to COVID-19 stigma. Characterizing a new infectious disease as originating from outsiders facilitates a process of “othering,” which reinforces the social construction of illness as a foreign invasion with ensuing xenophobia [34]. Because HIV itself is a highly stigmatized condition, stigmas attached to COVID-19 may be particularly stressful for PLWH. Among PLWH, endorsing prejudicial and discriminating attitudes toward COVID-19 is associated with greater concern over contracting COVID-19 and a greater

likelihood of implementing social distancing to prevent contracting COVID-19 [54, 55].

Along with HIV stigma, intersecting sources of social inequality have contributed to and have compounded the stress of COVID-19 for PLWH. In qualitative interviews, Gwadz et al. [48] found that experiences of racism and structural inequality often framed PLWH’s experiences with COVID-19. Participants in this study saw a direct link between their experiences living with HIV and COVID-19 health disparities. Just as would be true for people not living with HIV, fear of COVID-19 exposure may have also been greater among PLWH in cities and densely populated areas where social distancing is more difficult [48]. Interruptions to health services and medications as well as anticipated and actual loss of income attributed to COVID-19 also contributed to stress experienced by PLWH. A study of sexual minority men from 103 counties found that 46% of men living with HIV anticipated loss of income due to COVID-19 compared to 38% of men who were not living with HIV, which was a significant difference [56]. And while anxiety and depression did not differ between the two HIV status groups, anticipated loss of income was associated with overall anxiety and depression.

Adaptive Coping

Although the risk for severe COVID-19 is greater for people with HIV, prior experiences living with HIV may serve as a source of resilience for some PLWH. For example, contrary to expectations that PLWH would be adversely affected by COVID-19 stigma [57], Quinn et al. [58] found that men living with HIV believed that having lived through the HIV pandemic helped them manage the stress brought about by COVID-19, including resisting stigmatizing people who contract COVID-19 and facilitating a sense of responsibility for preventing the spread of COVID-19. In Argentina, resilience (defined as responding adaptively to adversity), buffered the association between economic hardship incurred during COVID-19 and perceived COVID-19 stress and loneliness [59]. Resilience has therefore emerged as a key characteristic of adaptive coping with COVID-19, including limiting the adverse effects that COVID-19 has on the mental health and well-being of PLWH [50, 60]. Like other aspects of COVID-19 impacts, there are cultural differences in the influence that resilience has on coping with COVID-19 in PLWH, with resilient coping reducing depression in PLWH in Argentina, but not in the USA [60]. While there were no studies concerning aspects of adaptive coping other than resilience, studies did consider substance use as a maladaptive coping strategy.

Substance Use

The emotional distress of COVID-19 has the potential to prompt increased substance use and relapse to use among individuals in recovery. Increased substance use carries several detrimental implications for the health of PLWH. Studies that examined substance use among PLWH during early COVID-19 reported variable results with no consistent pattern. Some studies reported increases in alcohol consumption [38, 61] and other drug use [44], although it is unclear if these increases differed from those of people not living with HIV. Counter to expectations, some studies reported reductions in drug use among PLWH, including tobacco consumption [50, 61]. There is also mixed evidence for increased adverse consequences from COVID-19 that are expected with increased substance use. Using a 30-day retrospective assessment strategy during early COVID-19, PLWH reported greater marijuana use compared to their HIV-negative counterparts, including a greater increase in use since a previous pre-COVID-19 assessment, and greater use was associated with depression symptoms [62]. In contrast, a study of PLWH in the state of Wisconsin found that while alcohol and marijuana use did not increase during early COVID-19, use of other drugs nearly doubled from 10% reporting use to 18% [63]. Among people who inject drugs, active substance use was associated with less physical distancing to prevent COVID-19 and greater depression, with no differences between participants living with HIV and those not living with HIV [64].

Structural Inequalities

Three major COVID-19 impacts on structural inequalities were assessed in the early COVID-19 studies: food insecurity, housing instability, and accessing health services.

Food Insecurity and Housing Instability

Food insecurity increased in the general US population during early COVID-19, specifically between March and June 2020 by as much as 10% [21]. Decades of research has reported that PLWH have high rates of both food insecurity and housing instability [23, 65, 66], making PLWH a particularly vulnerable population for COVID-19 disruptions in food access and housing security. The impacts of COVID-19 on food security and housing stability were therefore expected to be greater than in other populations, with the greatest disruptions occurring for the least resourced [67]. People living with HIV themselves anticipated greater loss of financial support due to COVID-19 than did people not living with HIV, and the anticipated financial losses were expected to increase depression and anxiety. However, despite no differences between PLWH

and their HIV-negative counterparts in terms of job loss or salary reductions during COVID-19, PLWH reported greater increases in financial stress and food insecurity [62]. One study in New York City found that 14% of PLWH were unable to obtain food they needed during the early months of COVID-19 [48]. In St. Louis, Missouri, during the early months of COVID-19, PLWH experienced greater food insecurity including not having enough food they needed and experiencing hunger, than their HIV-negative counterparts [62]. In another major US city, Atlanta, GA, 40% of PLWH reported not being able to access food during the early weeks of COVID-19, with one in five food-insecure participants becoming food insecure during early COVID-19 [1]. For patients receiving Ryan White Care services in a rural area of the Southern United States, 69% of patients who had been employed prior to COVID-19 reported adverse impacts on their employment, including 74% of those patients losing their jobs. In addition, Ryan White services for food support increased 66% and emergency housing services increased 69% in April 2020 [68].

Similar vulnerabilities to structural inequalities exacerbated by COVID-19 were observed across continents. Among young PLWH in Kenya, 25% reported that the early COVID-19 impacted their employment and income [37]. Similarly, 25% of PLWH in Australia reported negative effects of COVID-19 on their incomes [38]. In addition, 13% of PLWH in Australia indicated that they experienced reductions in access and affordability of food during periods of COVID-19 restrictions [38]. In Argentina, the rate of PLWH experiencing financial hardship during COVID-19 was 41% [59].

Access to Health Services

Among the most consistent research findings for PLWH during early COVID-19 were concerns that lockdowns would reduce access to HIV care services. Disruptions to clinical and social services were reported during the earliest days of local responses to COVID-19 [42, 69, 70]. Even when services themselves were available, PLWH expressed concern about losing access and lacked confidence that they could attend upcoming appointments because of COVID-19-related restrictions [71]. Clinic and pharmacy closures had an obvious short-term effect on all patients, including those living with HIV. One factor contributing to healthcare interruptions was trust in public health guidelines. In a study 459 people living with HIV in Atlanta, expressing greater trust in the CDC for COVID-19 information was related to experiencing fewer disruptions to healthcare, suggesting that PLWH were positively impacted by trusting credible COVID-19 information [49].

The impacts of early COVID-19 disruptions on ART adherence also varied across studies. It was widely expected

that COVID-19 would interrupt access to ART with adverse effects on adherence, particularly given ubiquitous disruptions to accessing care, pharmacies, and the impacts on factors known to influence adherence, such as stress and substance use [72]. Globally, an estimated one in five PLWH were unable to access their HIV care provider, and close to half of PLWH were unable to access ART refills remotely, with the least access occurring in Belarus, Brazil, Kazakhstan, Mexico, and Russia [73]. During the early weeks of COVID-19, Hochstatter et al. [71] reported that 12% of participants missed taking their ART as compared to 5% during pre-pandemic assessments. Similarly, in Argentina 8% of PLWH were unable to take their ART during early COVID-19 [40].

However, adverse impacts of COVID-19 on ART adherence are not universal. In Australia, 99% of PLWH were able to access their ART without interruption [43]. Some studies reported increased ART adherence during early COVID-19. In Atlanta, Kalichman et al. [1] found that adherence increased in a sample of young PLWH from 53% of ART taken pre-COVID-19 to 78% taken in the first months of COVID-19. In New York City, Gwadz et al. [48] also reported some PLWH improving adherence in early COVID-19, with shelter-in-place orders, increased daily routines, and health consciousness forming a basis for improved adherence.

There is little evidence that substance use treatment and harm reduction services were disrupted in the early months of COVID-19 [74–76], while HIV testing may have increased in these settings [77]. Finally, in a study of older adults receiving ART, 42% of participants with substance use disorders, individuals reported being able to sustain ART adherence and substance use treatment during periods of early COVID-19 lockdowns, despite feedings of anxiety and social isolation [78].

Conclusions

The COVID-19 pandemic impacts the mental health and structural inequalities of PLWH, and these impacts can be conceptualized within the context of HIV syndemics. However, the degree to which COVID-19's impacts on PLWH varied from individuals not living with HIV is unclear. Greater risks for severe COVID-19 among PLWH, especially persons who are not HIV suppressed and/or have HIV comorbidities, suggest that the impacts would be greater for PLWH. However, studies that included both PLWH and people not living with HIV found few consistent differences in COVID-19 impacts. One reliable exception was the greater impact of COVID-19 on the persistent healthcare of PLWH. Greater disruption to services would be expected for PLWH given that they are managing a chronic illness that relies on

regular contact with health services. The adverse effects of healthcare disruptions along with risk for severe COVID-19 were among the greatest concerns expressed by PLWH. Because COVID-19 is still evolving, with different countries at varying stages in their epidemiology and vaccination rates, understanding the long-term impacts of COVID-19 will require additional research and future reviews. While studies conducted in the first year of the COVID-19 outbreak did not demonstrate clear patterns of impact on mental health and substance use, and some impacts expected by commentators were not fully realized, such as increases in depression, stigma [2], and interpersonal violence [59, 79], future research on the co-occurring COVID-19 and HIV pandemics may tell a different story.

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Declarations

Conflict of Interest The authors declare no competing interests.

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