THE EUROPEAN SOCIETY OF MEDICINE
Medical Research Archives, Volume 12 Issue 11

RESEARCH ARTICLE

Associations Between Long COVID Symptoms and Health-related Quality of Life among a Medicaid Managed Care Population Living with HIV

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OPEN ACCESS

PUBLISHED
30 November 2024

CITATION
Wu, Y., Brandenburg, C., et al., 2024. Associations Between Long COVID Symptoms and Health-related Quality of Life among a Medicaid Managed Care Population Living with HIV. Medical Research Archives, [online] 12(11).
https://doi.org/10.18103/mra.v12i11.5867

DOI
https://doi.org/10.18103/mra.v12i11.5867

ISSN
2375-1924

ABSTRACT

Background: Lasting symptoms following an infection of acute COVID-19, known as post-acute sequelae of SARS-CoV-2 infection (PASC), negatively impact health-related quality of life in the general population. Although people living with HIV (PLWH) face a higher disease burden compared to people without HIV, there is limited research on how PASC is associated with health-related quality of life among people living with HIV.

Methods: This study recruited 107 people living with HIV with a documented diagnosis of COVID-19 from a Medicaid-managed care plan, yielding 105 valid responses. Data were collected via an online survey which collected information on general health status, comorbidities, experiences of PASC symptoms and health-related quality of life. Health-related quality of life was assessed through the EQ-5D instrument. A $20 e-gift card was given to each participant as compensation. Ordinary least squares regression was employed to examine the association between the number of PASC symptoms, comorbidities, and health-related quality of life, controlling for age, gender identity, and race/ethnicity. The study protocol received approval from the Institutional Review Board (IRB) from the City University of New York.

Results: The participants had an average age of 48.1 years (SD=10.5). The sample consisted of 54% cisgender males, 34% cisgender females, and 12% transgender/gender-diverse individuals, and 53% identified as sexual minorities. The largest racial/ethnic group was non-Hispanic Black (45%), followed by Hispanic (43%). Most PLWH (90%) reported undetectable HIV viral loads. On average, participants reported 2.2 comorbidities in addition to HIV (SD=1.5), and 42% rated their health as good/excellent. Nearly half (49%) reported one or more PASC symptoms lasting six months or more (M=5.3, SD=8.0). The number of PASC symptoms was significantly associated with poorer health-related quality of life ($\beta=.33$, $R^2=.31$), with more variance in health-related quality of life than comorbidities and self-rated health combined (βs=.32 and .28, respectively, $R^2=.14$).

Conclusions: PASC adversely affected health-related quality of life among people living with HIV. Routine assessment for PASC symptoms should be a standard practice in clinical settings for people living with HIV who have been diagnosed with COVID-19. These findings also underscore the importance of ongoing support for PLWH with a history of COVID-19 infection, and the need to focus on domains of health beyond HIV.

Introduction

Post-acute sequelae of SARS-CoV-2 infection (PASC), more commonly known as long COVID, refers to a wide range of persistent symptoms that develop following the acute phase of the COVID-19 infection[1]. The most commonly identified PASC symptoms include fatigue, chest pain, joint pain, brain fog, difficulty sleeping, and loss of smell and taste[2-3]. In the United States, it is estimated that 10%-30% of individuals who contract SARS-CoV-2 experience PASC, with many cases persisting beyond six months and some even lasting over a year[4-5]. Although the emergency phase of the COVID-19 pandemic ended in 2023, new infections of this virus continue. Thus, there remains a critical need to understand the ongoing health burden caused by PASC, particularly for those living with chronic conditions, such as people living with HIV (PLWH). Prolonged symptoms of PASC can significantly impair not only an individual's physical health but also their overall health-related quality of life[6-7].

HEALTH-RELATED QUALITY OF LIFE

Health-related quality of life (HRQoL) refers to individuals' perception of their emotional, physical and social functionality[8]. Assessment of this multidimensional concept reflects a person's health status, ability to perform tasks of daily living, engagement in social activities, and overall life satisfaction[8-9]. A study by Carlile and colleagues among 6,070 participants found that those who experienced PASC reported significantly poorer health-related quality of life than those who did not have PASCs[10]. Research finds that PASC specifically limits one's functional mobility and mental health[6-7, 10-11]. A UK-based study highlighted the severe impact of PASC, finding that the health-related quality of life scores among PASC patients were similar to those of individuals with advanced-stage cancer[12].

HIV, PASC, & HEALTH-RELATED QUALITY OF LIFE

Once considered as a fatal illness, HIV is now classified as a serious chronic disease due to significant advancements in medical treatments that are effective in controlling the virus[13-14]. As with other chronic disease populations, health-related quality of life is an important metric for evaluating disease burden among PLWH and informing interventions aimed at optimizing long-term patient outcomes[15]. Numerous factors can affect health-related quality of life among PLWH, including their current health status, other comorbidities, and sociodemographic factors such as age and gender[16-18]. The outbreak of the COVID-19 pandemic raised concerns regarding the impacts of COVID-19 infection in this population, and recent findings indicate poorer health-related quality of life scores among PLWH infected with SARS-CoV-2[19]. Such findings, along with the growing evidence of the detrimental effects of PASC on quality of life in the general population, suggest a potential exacerbation of burden of disease among PLWH experiencing PASC. Nevertheless, few studies have directly investigated the impact of PASC on health-related quality of life among PLWH, underscoring a critical gap in the current body of literature. Thus, the objective of the current study is to describe the impact of PASC on health-related quality of life among those living with HIV. Considering the substantial overlap between the social determinants of health that influence HIV and SARS-CoV-2 outcomes[20], we recruited participants from a Medicaid-Managed Care Plan serving PLWH and those at risk for HIV, who were low-income and primarily people of color. Our primary aim was to explore the association between health-related quality of life and the number of PASC experienced for 6 months or longer while controlling for self-rated health and other comorbidities and to understand the additional disease burden imposed by PASC in this population.

Methods

PARTICIPANTS

This study was part of a broader research project on the prevalence and impact of PASC on the health of Medicaid recipients living with and without HIV[21]. A total of 153 participants were enrolled and of these, 11 surveys were discarded due to missing data. This yielded an overall sample of N=142 surveys were usable. Of these, 107 participants reported living with HIV. Among the HIV-positive sample, 105 participants provided valid data on the health-related quality of life assessment, and this group was retained for the current study. Demographic characteristics of the sample are presented in Table 1.

PROCEDURES

We partnered with a Medicaid Managed Care plan that primarily served people living with chronic diseases residing in New York, a significant proportion of whom were living with HIV. Based on members' medical record the plan helped identify a pool of 1,176 prospective participants with a documented COVID-19 diagnosis. We contacted this pool of participants through either text messages or mailed flyers containing a link or a QR code to access the online survey. Any enrolled member of the Medicaid Managed Care plan who was 18 years of age or older was eligible to participate. We used Qualtrics survey software to collect participant responses. The survey started with an informed consent page that presented detailed information regarding the purpose of the study, participants' right, assurance of anonymity and confidentiality, and contact details. To proceed, participants had to confirm their understanding of the consent form and consent to participate by clicking the "continue" button at the bottom of the page and proceeding to the survey questions. Participants received a $20 e-gift card as compensation for their time completing the survey. All the materials used for recruitment, informed consent, and the survey were available in both English and Spanish. Approval for the study protocol was granted by the Institutional Review Board of the City University of New York.

MEASURES

Subsequent to questions about participants' socio-demographic information (age, gender identity, race/ethnicity, income adequacy), participants were prompted to provide basic health information (height, weight etc), rate their current health, indicate their HIV serostatus, and report any substance use. We asked about the presence of ten comorbidities associated with risks for poor COVID-19 outcomes, i.e., diabetes, hypertension, stroke/heart disease, asthma/COPD, cancer, depression/anxiety, fibromyalgia, bone/joint problems, hepatitis C/liver disease, and kidney disease. Participants who reported a positive HIV status were also asked to provide CD4 t-cell counts (most recent and nadir below 200) and if their HIV viral load was detectable or undetectable.

PASC SYMPTOM ASSESSMENT

Participants were asked to identify PASC symptoms that they had experienced and the duration of each symptom (1 month or less, 2-5 months, 6 months or more) from a checklist of 49 PASC symptoms. This assessment was adapted from a validated instrument of long-COVID symptoms[22]. Modifications included adding additional symptoms (e.g. erectile dysfunction) based on the emerging literature on PASC, and changing the framing of the questions to "...new or worsening symptoms" because some of the symptoms (e.g., weight loss, sweats/fevers/chills) overlapped with symptoms of HIV infection. We computed the proportion of participants who experienced one or more symptoms for each of the time periods, as well as the number of COVID symptoms experienced for each level of duration by summing the number of symptoms reported. Symptoms domains were:

- *General* (weight loss, loss of appetite, sweats, fever and chills, hot flashes, fatigue, sleeping more, difficulty sleeping, heat/cold intolerance, changing mood/impact on morale, body aches)
- *Thorax* (rib cage pain, chest pressure, sharp sudden pain, chest burns, heart beating too fast/slow/irregular, cough)
- *Neurological* (headache, tremor, dizziness/malaise, word finding problems, brain fog/difficulty concentrating, memory problems, pricking/ tingling/ creeping feeling on skin, impaired/ decreased sense of touch, change/loss of taste, change/loss of smell)
- *Digestive* (abdominal pain, nausea/vomiting, diarrhea)
- *Ear/nose/throat* (sore throat/tongue/mouth, trouble swallowing, ear pain, clogged ears, tinnitus, congested/runny nose, sensitivity to sound)
- *Vision* (dry eyes, blurry vision, sensitivity to light)
- *Musculoskeletal* (bone and joint pain, heavy legs/swelling of legs, muscle aches, neck/back/low back pain)
- *Blood and lymph node circulation* (bulging veins, unexplained bruising, swollen lymph nodes, high or low blood pressure)
- *Skin and hair* (dry/peeling skin, hair loss, skin rash, discoloration/swelling of hands and feet)
- *Urinary and gynecological problems* (changes in menstrual cycle, problems with urination, erectile dysfunction)

HEALTH-RELATED QUALITY-OF-LIFE

The EQ-5D-5L (EuroQol Research Foundation, 2019) was used to assess health-related quality of life[23]. The EQ-5D-5L has five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Responses range from no problems (level 1) to extreme problems (level 5). Items are summed with higher scores indicating poorer health-related quality of life. Cronbach's alpha for the EQ-FD-FL in the current sample was .80.

DESIGN AND ANALYSIS

For the current study, we focused only on PASC symptoms experienced at 6 months or longer since symptoms of long duration were the most likely to impact health-related quality of life. SPSS v.27 was used to clean and analyze the survey data. We performed univariate analyses to assess central tendency and distribution of continuous variables, and to calculate the frequencies and percentages for categorical variables. For categorical variables with three or more categories, dummy-coding was applied before bivariate and multivariate analyses. The reference categories for the dummy-coded variables were: race/ethnicity (non-Hispanic White, Asian, and other race); age group (20 to 39 years); gender identity (cisgender male), and income adequacy (enough money/money not a problem).Prior to ordinary least squares regression (OLS) analysis, we examined the bivariate correlations among independent variables and health-related quality of life to examine potential multicollinearity (i.e., $r > .49$) and identifying factors that had a significant bivariate association with health-related quality of life.

Independent factors that showed a significant bivariate association with health-related quality of life, along with -were included in the regression analysis. OLS regression analysis examined the associations of health-related quality of life with the number of PASC symptoms experienced at six months, the number of comorbidities, and self-rated health after adjusting for demographic characteristics. We used a hierarchical regression model with three sets of variables (Block 1–demographic characteristics; Block 2-number of PASC symptoms at 6 months or longer, Block 3-number of comorbid health conditions and self-rated health). Collinearity diagnostics were computed and did not show any significant multicollinearity among the independent variables. The regression was evaluated based on the significance of the independent variables using t-tests of the regression coefficients and the percentage of variance explained by each block of variables in the model (R^2).

Results

PARTICIPANT DEMOGRAPHIC CHARACTERISTICS

The average age of participants was 48.1 years (SD=10.5), and the majority were cisgender males (54%). Cisgender females constituted 33% or the sample, while 12% identified as transgender or gender diverse. More than half (53%) reported sexual minority identities and most of these were gay and bisexual men. The predominant racial/ethnic group was non-Hispanic Black (45%), followed by Hispanic (43%), while 12% were non-Hispanic White, Asian, or from another racial/ethnic background. Additionally, the majority (90%) reported undetectable viral loads, and almost half (49%) had CD4 T-cell counts of 500 or more. On average, participants reported 2.2 comorbidities in addition to HIV (SD=1.5), and 42% rated their health as good or excellent.

OVERALL PASC SYMPTOMS PREVALENCE

Nearly half of our sample reported experiencing one or more PASC symptoms lasting six months or more (49%), with an average of 5.3 symptoms (SD = 8.0). Neck/back pain was the most-commonly-reported symptom (26%), followed by bone/joint pain (24%), muscle aches (23%), brain fog (22%), memory problems (20%), fatigue (19%), tingling sensations in the skin (18%), difficulty sleeping (17%), body aches (17%), dry eyes (17%), and light sensitivity (17%).

PASC SYMPTOMS AND HEALTH-RELATED QUALITY OF LIFE

The mean EQ-5D-5L score was 9.45 (SD=3.7). As demonstrated in Table 2, of the five domains assessed, nearly 20% of all participants reported experiences of severe or extreme pain or discomfort. Among those with PASC, the average health-related quality of life score was 10.80 (SD=3.58), with 26.9% reporting severe or extreme pain/discomfort and 15.4% reporting severe and extreme anxiety/depression.

Although age, gender identity and race/ethnicity were not significantly correlated with health-related quality of life [Shown in Table 1], we adjusted the regression model on these factors based upon the extensive literature on the impact of these characteristics on health as shown in Table 3[24-26]. None of the sociodemographic factors in Block One were significantly associated with health-related quality of life in multivariate analysis. However, the number of PASC symptoms in Block 2, emerged as a strong predictor of poorer health-related quality of life (β=.33, R^2=.31). The association of PASC symptoms and health-related quality of life remained significant even after the inclusion of the number of comorbidities and self-rated health in Block 3 (βs=.32 and .28, respectively, R^2=.14). The OLS regression indicated that the number of PASC symptoms at 6-months bore a somewhat stronger association of poor health-related quality of life compared to the number of comorbidities and self-rated health, and explained over twice the variance in health-related quality of life relative to these other indicators of burden of disease.

Table 1 Demographic Characteristic by Health-Related Quality of Life (HRQoL)

	Total		**HRQoL**		
	N	**%**	**M**	**SD**	**ANOVA**
Age Groups					F (2,72)=1.868
20 to 39	21	26.2	8.19	2.63	
40 to 49	20	25.0	8.75	3.04	
50 and older	39	48.8	9.98	4.29	
Race and Ethnicity					F(2,102)=.871
Non-Hispanic Black	47	44.8	9.89	3.92	
Hispanic	45	42.9	9.27	3.61	
Non-Hispanic White, Asian, Mixed, Other	13	12.3	8.46	2.96	
Gender Identity					F(2,102)=3.058
Cisgender Male	57	54.3	8.75	3.63	
Cisgender Female	35	33.3	10.66	3.58	
Transgender/Gender Diverse	13	12.4	9.23	3.61	
Sexual Identity					F (1,103)=.188
Heterosexual	49	46.7	9.62	3.76	
Queer	56	53.3	9.30	3.64	
Income Adequacy					F(2,102)=1.09
Not enough money	35	33.3	10.20	4.26	
Just manage to get by	58	55.2	9.07	3.11	
Enough or not a problem	12	11.4	9.08	4.42	
Note. N = 105 *p<.05, **p<.01, ***p<.001					

Table 2 Domains of Health-Related Quality of Life Among Participants With and Without PASC

	Total		With PASC		Without PASC	
	N	%	N	%	N	%
Mobility						
I have no problems walking	59	55.1	25	48.1	34	61.8
I have slight problems walking	18	16.8	8	15.4	10	18.2
I have moderate problems walking	22	20.6	16	30.8	6	10.9
I have severe problems walking	4	3.7	2	3.8	2	3.6
I am unable to walk	2	1.9	0	0	2	3.6
Self-care						
I have no problems washing or dressing myself	77	72.0	35	67.3	42	76.4
I have slight problems washing or dressing myself	15	14.0	8	15.4	7	12.7
I have moderate problems washing or dressing myself	10	9.3	7	13.5	3	5.5
I have severe problems washing or dressing myself	2	1.9	1	1.9	1	1.8
I am unable to wash or dress myself	0	0	0	0	0	0
Usual activities						
I have no problems with performing my usual activities	54	50.5	17	32.7	37	67.3
I have slight problems with performing my usual activities	33	29.7	21	40.4	12	21.8
I have moderate problems with performing my usual activities	13	24.6	9	17.3	4	7.3
I have severe problems with performing my usual activities	7	6.5	5	9.6	2	3.6
I am unable to perform my usual activities	0	0	0	0	0	0
Pain/discomfort						
I have no pain or discomfort	37	34.6	9	17.3	28	50.9
I have slight pain or discomfort	29	27.1	13	25.0	16	29.1
I have moderate pain or discomfort	22	20.6	15	28.8	7	12.7
I have severe pain or discomfort	11	10.3	9	17.3	2	3.6
I have extreme pain or discomfort	6	5.6	5	9.6	1	1.8
Anxiety/depression						
I am not anxious or depressed	28	26.2	7	13.5	21	38.2
I am slightly anxious or depressed	31	29.0	15	28.8	16	29.1
I am moderately anxious or depressed	33	30.8	21	40.4	12	21.8
I am severely anxious or depressed	10	9.3	7	13.5	3	5.5
I am extremely anxious or depressed	3	2.8	1	1.9	2	3.6
Note. N (total)=105; N(With PASC)=51. N(Without PASC)=54.						

Table 3: Multiple Regression Analysis on Health-Related Quality of Life

Variable	***r***	**B**	**SE**	**β**	***t***	***p***	***R^2* Change**
Block One:							
Age over 50	.263	.003	.033	.009	.096	.924	
Non-Hispanic Black	-.150	1.633	.968	.220	1.688	.096	
Hispanic	-.063	.992	.921	-.135	1.077	.285	
Cisgender Female	.296	.732	.692	.095	1.057	.294	
Trans or Gender Diverse	-.031	1.448	.981	.125	1.476	.144	
							.125
Block Two:							
The number of PASC	.576**	0.156	0.046	.331	3.418	.001	
							.306***
Block Three:							
The number of Comorbidities	.542**	0.773	0.239	.321	3.240	.002	
Self-Rate Health	.535**	1.245	0.393	.282	3.170	.002	
Note. N=80. Total *R^2* = .567. * p < .05, ** p < .01, *** p < .001							

Discussion

In this study, the number of PASC symptoms of 6-months or longer duration was significantly associated with poorer health-related quality of life among PLWH, even when considering other factors that impact burden of disease such as the number of health comorbidities and self-rated health. In line with previous research exploring PASC symptoms among PLWH[2], the predominant PASC symptoms identified in this study include bone or joint pain, muscle aches, brain fog, fatigue, and memory problems. As indicated by numerous studies, mental health is a particularly vulnerable aspect during the COVID-19 pandemic within the PLWH population[19, 27]. Correspondingly, our findings emphasized that perceptions of mental health deterioration are more pronounced compared to other domains of health-related quality of life, a trend observed in participants both with and without PASC.

Despite the growing research attention on PASC, awareness of this condition remains limited in the general population, and diagnostic tools and strategies are still inadequate in clinical practices[1, 28-29]. As a result, PASC often goes unrecognized and untreated[30]. While the link between an increased health burden and comorbidities among PLWH has been well established[31-32], this study reveals that PASC exerts an even greater impact on health-related quality of life.

To date, whether HIV alone contributes to heightened risks for PASC prevenance and severity remains inconclusive[2,21,33]. Nevertheless, it is generally agreed that certain demographic factors, such as low socioeconomic and racial/ethnic minority statuses, disproportionately represented among PLWH, exacerbate their vulnerability to adverse health outcomes[2,21]. This study is one of very few studies to specifically examine the health-related quality life in PLWH who reported PASC symptoms, with the majority also being from low-income and racial/ethnic minority backgrounds. The findings contribute to the growing literature of knowledge concerning health disparities within this population. To gain a more wholistic understanding of how social determinants of health (SDOH) affects PASC outcomes among PLWH, future research should pay a closer attention to the intricate interplay of specific SDOH, thus supporting ongoing efforts aimed at designing strategies that target structural inequalities and enhancing disease outcomes.

LIMITATIONS

This study is subject to several limitations, including a constrained sample size derived from a specific clinical population and reliance on retrospective self-reported data concerning PASC symptoms. Additionally, the geographical scope is limited, as all participants were residents of New York. Consequently, the generalizability of these findings may be limited to populations beyond Medicaid enrollees, those not living with HIV, and populations outside of New York City and the United States. However, the homogeneity of the sample facilitated comparisons among individuals with comparable access to healthcare and benefits. Moreover, our multivariate analysis accounted for over one-third of the variance in long-duration PASC symptoms, aligning with findings reported in other studies.

Conclusion

It is important for primary and HIV healthcare providers to routinely and systematically evaluate PLWH for signs of PASC and promote PASC awareness among their patients with a history of COVID-19 infection. Our findings emphasize a critical need for PLWH to remain engaged in care following COVID-19 infection in order to identify and treat potential PASC in this population in addition to monitoring of and treatment for HIV. This may be accomplished through targeted interventions and comprehensive support programs to reinforce HIV health engagement such as targeted case management and comprehensive care models[34]. Moreover, given the persistence of COVID-19 infections and mutations of this pathogen, continuous promotion of current vaccines remains necessary in the post-emergency pandemic era. HIV care providers should also consider integrating COVID-19 immunization and evaluation into their routine clinical practice.

Conflicts of Interest Statement

There are no competing interests exist.

Funding Statement

This research was fully funded by an Investigator Sponsored Research Grant (CO-US-540-6404) from Gilead Sciences.

Acknowledgments

This work would not have been possible without the participants of this study. Furthermore, we want to express our deep gratitude to our colleagues at Amida Care and its Member Advisory Committee for their support in recruitment and operational support.

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