

Changes in depression and anxiety symptoms and their association with healthcare service use after COVID-19

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Abstract

COVID-19 may cause persistent psychiatric symptoms, but few studies have examined changes in depression and anxiety and their association with healthcare utilization. This longitudinal study analyzed adults with confirmed COVID-19 from the Sulcovid-19 cohort, assessed 6 and 24 months after infection. Depression and anxiety trajectories were classified as no symptoms, remission, incident symptoms, or persistent symptoms. Outcomes included use of Primary Health Care Centers (PHCCs), private healthcare services, emergency departments, Urgent Care Centers (UPAs), and psychological/psychiatric services. Associations were examined using logistic regression models adjusted for sex, age, educational attainment, and skin color. Among 1,885 participants, most remained free of depressive (72.5%) and anxiety (61.7%) symptoms throughout follow-up. Persistent symptoms occurred in 15.0% and 16.6% of participants, respectively, while incident symptoms occurred in 6.5% and 11.9%. Incident depression was associated with increased use of emergency departments (OR = 1.77), Urgent Care Centers (OR = 1.63), and psychological/psychiatric services (OR = 8.85). Persistent anxiety was associated with greater use of emergency departments (OR = 1.72), Urgent Care Centers (OR = 2.06), and psychological/psychiatric services (OR = 11.58). Persistent and incident depression and anxiety symptoms were associated with increased healthcare utilization, particularly emergency and mental health services.

Clinical trial registration

Not applicable.

Introduction

In 2020, the World Health Organization (WHO) recognized SARS-CoV-2 as a highly transmissible virus and declared COVID-19 a global pandemic, highlighting its substantial impact on population health (Ochani et al., 2021). Beyond its acute manifestations, increasing attention has been given to long COVID, a condition characterized by persistent symptoms lasting for more than three months after infection. Long COVID has been associated with cognitive impairment and prolonged psychological distress and has been described as a “second wave” of the pandemic in the field of mental health (Bayum et al., 2024).

Scientific evidence has consistently demonstrated the magnitude of these mental health consequences. A systematic review and meta-analysis found that between 14% and 61% of individuals infected with SARS-CoV-2 experienced psychiatric or neuropsychiatric manifestations during the acute phase, including depression, memory impairment, insomnia, anxiety, and post-traumatic stress disorder. These outcomes remained highly prevalent after the acute phase, with estimates ranging from 14.8% to 76.9% (Rogers et al., 2020). Furthermore, it has been estimated that the COVID-19 pandemic resulted in approximately 53 million additional cases of major depressive disorder and 76 million additional cases of anxiety disorders worldwide (Santomauro et al., 2021).

Studies have also shown that individuals previously infected with SARS-CoV-2 are at greater risk of psychological distress than those who were not infected, suggesting that both biological mechanisms, such as persistent inflammatory processes, and psychosocial factors related to the experience of illness contribute to the development of mental health symptoms (Mazza et al., 2020; Taquet et al., 2022). In the post-pandemic period, healthcare systems have experienced increased demand driven by the persistence of COVID-19-related symptoms and the exacerbation of pre-existing health conditions. Previous studies suggest that long COVID symptoms may increase primary healthcare utilization by up to 35% and emergency care utilization by up to 50% (Vieira et al., 2025). This growing demand has exposed important challenges, including barriers to healthcare access, socioeconomic inequalities, prolonged waiting times, and increased reliance on emergency services, all of which indicate substantial pressure on healthcare systems (Portela et al., 2025; Delpino et al., 2024; Vieira et al., 2025). However, to our knowledge, no previous studies have specifically examined healthcare service utilization among individuals with a history of COVID-19 according to the longitudinal course of mental health symptoms.

Despite the growing body of evidence, longitudinal studies examining changes in mental health symptom status among individuals who have had COVID-19 remain scarce. Understanding longitudinal changes in mental health is essential for identifying patterns of symptom persistence, remission, or delayed onset, particularly in the context of long COVID. Moreover, a longitudinal approach enables a more comprehensive assessment of the relationship between these mental health trajectories and healthcare service utilization, providing valuable evidence to inform healthcare planning and resource allocation.

Therefore, the present study aimed to examine longitudinal changes in symptoms of depression and anxiety among individuals previously infected with COVID-19 and to investigate their association with healthcare service utilization.

Materials and Methods

Study design and sample

This longitudinal study was conducted as part of the Sulcovid-19 cohort, which follows adults and older adults with RT-PCR-confirmed COVID-19 diagnosed in the municipality of Rio Grande, Rio Grande do Sul, Brazil, between December 2020 and March 2021 (Saes et al., 2024). Participants were assessed at two time points: T1, approximately six months after SARS-CoV-2 infection, and T2, approximately 24 months after infection.

Outcomes

Symptoms of depression and anxiety were assessed at both time points and categorized into four longitudinal trajectories: (i) no symptoms at either T1 or T2; (ii) remission (symptoms at T1 but not at T2); (iii) incident symptoms (no symptoms at T1 but symptoms at T2); and (iv) persistent symptoms (symptoms

at both T1 and T2). Healthcare service utilization was assessed through self-reported use of Primary Health Care Centers (PHCCs), private healthcare services, emergency departments, Emergency Care Unit (ECU), and psychological/psychiatric services.

Statistical analysis

All statistical analyses were performed using Stata® version 15.0. Associations between trajectories of depression and anxiety symptoms and healthcare service utilization were examined using logistic regression models. Crude and adjusted odds ratios (ORs) with their corresponding 95% confidence intervals (95% CIs) were estimated. Adjusted models included sex, age, skin color, and educational attainment as covariates. Statistical significance was defined as a two-sided p value of < 0.05.

Results

A total of 2,919 participants were assessed at T1 (631 losses to follow-up and 272 refusals), and 1,927 were reassessed at T2 (970 losses to follow-up and 23 deaths). The present analyses included the 1,885 participants with complete data at both follow-up assessments (T1 and T2) for the evaluation of longitudinal changes in depression and anxiety symptom status.

Table 1 summarizes the characteristics of the study sample. Most participants were women, aged 18–59 years, self-identified as White, and had 9–11 years of formal education. The table also presents the distribution of participants according to longitudinal changes in depression and anxiety symptom status. Women showed a higher prevalence of persistent depressive (20.5%) and anxiety (22.4%) symptoms than men. Regarding age, participants aged 18–59 years exhibited a higher prevalence of persistent anxiety symptoms (17.9%), whereas the prevalence of persistent depressive symptoms was similar across age groups. Concerning educational attainment, participants with 0–8 years of schooling showed higher frequencies of remission and persistent depressive symptoms, whereas those with 9–11 or ≥12 years of education had higher proportions of persistent anxiety symptoms.

A higher prevalence of persistent depressive and anxiety symptoms was observed among participants who reported using healthcare services, particularly psychological and psychiatric services. Among users of these services, 37.0% experienced persistent depressive symptoms and 44.4% experienced persistent anxiety symptoms throughout the follow-up period. Furthermore, participants who used Urgent Care Centers (UPAs) and emergency departments exhibited higher frequencies of persistent symptoms, particularly persistent anxiety.

Table 1. Characteristics of the sample according to changes in depression and anxiety symptom status and use of health services after COVID-19. SULCOVID-19 Study, Rio Grande, Brazil (n = 1,885).									
Variables	Overall sample	Depression				Anxiety			
		No symptoms (%)	Remission (%)	Developed (%)	Persisted (%)	No symptoms (%)	Remission (%)	Developed (%)	Persisted (%)
Sex									
Female	58.6	64.6	7.0	7.9	20.5	53.4	11.3	12.8	22.4
Male	41.4	85.0	4.1	4.5	6.3	74.9	7.44	10.3	7.3
Age									
18–59 years	83.3	73.3	5.1	6.6	15.0	60.5	9.5	12.1	17.9
≥60 years	16.7	68.5	9.7	6.7	15.1	67.3	11.2	10.9	10.6
Skin color									
White	77.9	71.5	6.0	6.9	15.6	60.6	10.3	12.7	16.4
Black/Brown/Indigenous/Asian	22.1	75.5	5.7	5.7	13.0	65.5	8.2	8.9	17.4
Educational attainment									
0–8 years	25.4	68.8	8.0	6.9	16.3	64.3	11.3	10.9	13.5
9–11 years	44.2	75.0	4.4	6.2	14.3	60.6	8.1	13.6	17.7
≥12 years of education	30.4	71.6	6.3	7.1	15.0	61.1	10.6	10.5	17.8
Use of primary health care services (UBS)									
No	41.3	78.2	4.7	5.6	11.4	67.3	9.2	8.3	15.2
Yes	58.7	70.0	7.0	7.1	15.9	58.2	9.9	14.3	17.6
Private health care									
No	53.2	74.0	6.1	5.6	14.2	65.5	9.3	11.0	14.2
Yes	46.8	71.1	6.0	7.7	15.2	57.2	10.2	13.3	19.3
Emergency department									
No	90.0	73.0	6.2	6.2	14.6	62.4	9.7	11.6	16.2
Yes	10.0	65.7	5.0	10.0	19.4	52.2	9.6	15.2	23.0
Emergency Care Unit (UPA)									
No	54.8	76.0	6.1	5.2	12.7	67.9	9.5	9.6	12.9
Yes	45.2	68.9	5.8	7.9	17.4	54.2	10.0	14.4	21.4
Psychological/psychiatric services									
No	82.2	79.7	5.8	4.1	10.3	70.0	9.7	9.4	10.9
Yes	17.8	38.2	7.4	17.4	37.0	21.5	9.4	24.7	44.4

Figure 1 illustrates the distribution of longitudinal changes in depression and anxiety symptom status. Most participants remained free of depressive symptoms (72.5%; 95% CI: 70.4–74.5) and anxiety symptoms (61.7%; 95% CI: 59.5–63.9) throughout the follow-up period. Persistent symptoms were more frequent for anxiety (16.6%; 95% CI: 15.0–18.3) than for depression (15.0%; 95% CI: 13.5–16.7). Similarly, the incidence of new cases was higher for anxiety (11.9%; 95% CI: 10.5–13.4) than for depression (6.5%; 95% CI: 5.5–7.7).

Table 2 presents the associations between depression symptom trajectories and different types of healthcare service utilization. Participants who developed depressive symptoms at T2 had higher odds of using emergency departments (OR = 1.77; 95% CI: 1.03–3.04), Urgent Care Centers (UPAs) (OR = 1.63; 95% CI: 1.10–2.40), and psychological/psychiatric services (OR = 8.85; 95% CI: 5.80–13.50). Participants with persistent depressive symptoms across both assessments also had increased odds of utilizing Primary Health Care Centers (PHCCs) (OR = 1.37; 95% CI: 1.02–1.85), Urgent Care Centers (UPAs) (OR = 1.38; 95% CI: 1.05–1.82), and psychological/psychiatric services (OR = 7.33; 95% CI: 5.32–10.11).

Table 2. Association between depression trajectory and use of health services: SULCOVID-19 Study, Rio Grande, Brazil (n = 1,885).				
Variable	Crude OR (95% CI)	p	Adjusted OR (95% CI)	p
Use of primary health care services (UBS)				
Did not use and did not start using	1		1	
Used and stopped using	1.69 (1.11–2.58)	0.015	1.52 (0.99–2.34)	0.056
Did not use and started using	1.40 (0.94–2.09)	0.096	1.32 (0.88–1.98)	0.182
Used and continued using	1.55 (1.16–2.06)	0.003	1.37 (1.02–1.85)	0.037
Private health care				
Did not use and did not start using	1		1	
Used and stopped using	1.02 (0.69–1.51)	0.916	0.99 (0.65–1.51)	0.967
Did not use and started using	1.43 (0.98–2.09)	0.065	1.46 (0.98–2.18)	0.063
Used and continued using	1.11 (0.85–1.45)	0.428	1.13 (0.85–1.51)	0.409
Emergency department				
Did not use and did not start using	1		1	
Used and stopped using	0.90 (0.44–1.82)	0.765	0.70 (0.31–1.54)	0.374
Did not use and started using	1.80 (1.05–3.07)	0.032	1.77 (1.03–3.04)	0.040
Used and continued using	1.47 (0.99–2.20)	0.059	1.41 (0.93–2.15)	0.107
Emergency Care Unit (UPA)				
Did not use and did not start using	1		1	
Used and stopped using	1.04 (0.70–1.55)	0.828	0.97 (0.65–1.46)	0.892
Did not use and started using	1.67 (1.14–2.46)	0.009	1.63 (1.10–2.40)	0.014
Used and continued using	1.52 (1.16–1.98)	0.002	1.38 (1.05–1.82)	0.021
Psychological/psychiatric services				
Did not use and did not start using	1		1	
Used and stopped using	2.69 (1.65–4.39)	<0.001	2.85 (1.71–4.73)	<0.001
Did not use and started using	8.72 (5.81–13.09)	<0.001	8.85 (5.80–13.50)	<0.001
Used and continued using	7.46 (5.51–10.09)	<0.001	7.33 (5.32–10.11)	<0.001
Adjusted for sex, age, skin color, and educational attainment.				

Regarding the association between anxiety symptom trajectories and healthcare service utilization, participants who developed anxiety symptoms during follow-up had higher odds of using Primary Health Care Centers (PHCCs) (OR = 1.93; 95% CI: 1.39–2.68). In addition, both participants with incident anxiety symptoms and those with persistent symptoms were more likely to use private healthcare services (OR = 1.53; 95% CI: 1.12–2.09 and OR = 1.68; 95% CI: 1.27–2.22, respectively) (Table 3). For emergency department utilization, only persistent anxiety symptoms remained significantly associated with increased service use (OR = 1.72; 95% CI: 1.15–2.59). Regarding the use of Urgent Care Centers (UPAs), both participants who developed anxiety symptoms and those with persistent symptoms showed higher odds of utilization (OR = 1.81; 95% CI: 1.34–2.45 and OR = 2.06; 95% CI: 1.57–2.70, respectively). The strongest associations were observed for psychological and psychiatric service utilization. Participants who developed anxiety symptoms had approximately nine times higher odds of using these services (OR = 8.63; 95% CI: 5.90–12.62), whereas those with persistent symptoms had more than eleven times higher odds (OR = 11.58; 95% CI: 8.19–16.38). Moreover, even participants whose anxiety symptoms remitted remained more likely to use psychological and psychiatric services (OR = 2.98; 95% CI: 1.86–4.79) (Table 3).

Table 3. Association between anxiety trajectory and use of health services: SULCOVID-19 Survey, Rio Grande, Rio Grande do Sul, Brazil (n = 1,885).				
Variable	Crude OR (95% CI)	p	Adjusted OR (95% CI)	p
Use of primary health care services (UBS)				
Did not use and did not start using	1		1	
Used and stopped using	1.24 (0.89–1.73)	0.198	1.16 (0.82–1.63)	0.408
Did not use and started using	2.00 (1.45–2.76)	<0.001	1.93 (1.39–2.68)	<0.001
Used and continued using	1.34 (1.03–1.75)	0.030	1.22 (0.93–1.61)	0.157
Private health care				
Did not use and did not start using	1		1	
Used and stopped using	1.25 (0.91–1.73)	0.169	1.24 (0.88–1.74)	0.229
Did not use and started using	1.39 (1.03–1.86)	0.030	1.53 (1.12–2.09)	0.007
Used and continued using	1.55 (1.20–2.01)	0.001	1.68 (1.27–2.22)	<0.001
Emergency department				
Did not use and did not start using	1		1	
Used and stopped using	1.17 (0.68–2.02)	0.565	1.15 (0.66–2.02)	0.618
Did not use and started using	1.56 (0.99–2.46)	0.057	1.54 (0.97–2.46)	0.070
Used and continued using	1.70 (1.15–2.51)	0.008	1.72 (1.15–2.59)	0.009
Emergency Care Unit (UPA)				
Did not use and did not start using	1		1	
Used and stopped using	1.32 (0.96–1.82)	0.092	1.21 (0.87–1.68)	0.267
Did not use and started using	1.87 (1.39–2.52)	<0.001	1.81 (1.34–2.45)	<0.001
Used and continued using	2.08 (1.60–2.69)	<0.001	2.06 (1.57–2.70)	<0.001
Psychological/psychiatric services				
Did not use and did not start using	1		1	
Used and stopped using	3.12 (1.97–4.96)	<0.001	2.98 (1.86–4.79)	<0.001
Did not use and started using	8.51 (5.89–12.30)	<0.001	8.63 (5.90–12.62)	<0.001
Used and continued using	13.22 (9.49–18.43)	<0.001	11.58 (8.19–16.38)	<0.001
Adjusted for sex, age, skin color, and educational attainment.				

Discussion

The findings of this longitudinal study indicate that both persistent and incident symptoms of depression and anxiety following COVID-19 were associated with greater healthcare service utilization, particularly emergency care and specialized mental health services. These findings are consistent with previous studies reporting increased demand for mental healthcare among individuals experiencing persistent psychiatric symptoms after COVID-19 (Vieira et al., 2025; Malta et al., 2025).

The particularly strong association observed with psychological and psychiatric service utilization, especially among individuals with incident or persistent anxiety symptoms (adjusted OR > 8), underscores the importance of both newly developed and chronic mental health symptoms as determinants of healthcare-seeking behavior. This pattern is consistent with reports of increased utilization of mental health services during and after the COVID-19 pandemic (Hayek et al., 2025; Adepoju & Valdez, 2023).

Another noteworthy finding was the association between incident or persistent symptoms and the use of emergency healthcare services, including emergency departments and Urgent Care Centers (UPAs). This pattern may reflect both physical comorbidities related to long COVID and somatic manifestations of anxiety and depressive disorders that are not adequately recognized or managed in primary healthcare settings. From a healthcare perspective, these findings suggest that emergency services may be burdened by conditions that could potentially be managed at lower levels of care through earlier identification and appropriate referral within primary healthcare.

Several limitations should be considered when interpreting these findings. First, healthcare service utilization was assessed through self-report, making the results susceptible to recall bias. Second, losses to follow-up between the two assessment waves may have introduced selection bias. Finally, because the study was conducted in a single municipality, the findings may not be generalizable to other populations or healthcare settings.

Overall, these findings highlight the need to strengthen mental healthcare services in the post-pandemic period, with particular emphasis on the early identification of depression and anxiety symptoms in primary healthcare and improved integration across different levels of care. Such strategies may help reduce unnecessary demand on emergency services while improving timely access to specialized mental healthcare.

Conclusion

Persistent and incident symptoms of depression and anxiety following COVID-19 were associated with increased healthcare service utilization, particularly emergency and mental health services. These findings highlight the importance of longitudinal monitoring of mental health among individuals affected by COVID-19 and underscore the need to strengthen healthcare systems to ensure appropriate care for this population.

Declarations

Acknowledgments section

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Authors' contributions

Conceptualization: J.Q.S.R., T.R.A., and M.O.S. Formal Analysis: T.L.C., P.P.O., J.Q.S.R., T.R.A., and M.O.S. Writing – Original Draft: T.L.C., P.P.O., and M.J.V. Writing – Review and Editing: T.L.C., P.P.O., M.J.V., T.R.A., and J.Q.S.R. Methodology: J.Q.S.R. and M.O.S. Data Curation, Investigation, Project Administration, and Supervision: M.O.S.

Declaration of conflicting interest

The authors report there are no competing interests to declare.

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Ethical statement

This research involves human participants and was conducted in accordance with the relevant guidelines and regulations of the Declaration of Helsinki. The study protocol was approved by the Ethics Committee in Health Research of the Federal University of Rio Grande (Certificate of Submission for Ethical Evaluation No. 39081120.0.0000.5324).

Consent to participate

Informed consent was obtained from all participants prior to their participation in the study, in accordance with Resolution No. 466/2012 of the Brazilian National Health Council.

Consent for publication

Not applicable.

Data Availability Statement

Datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Clinical trial registration

Not applicable.

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Figures

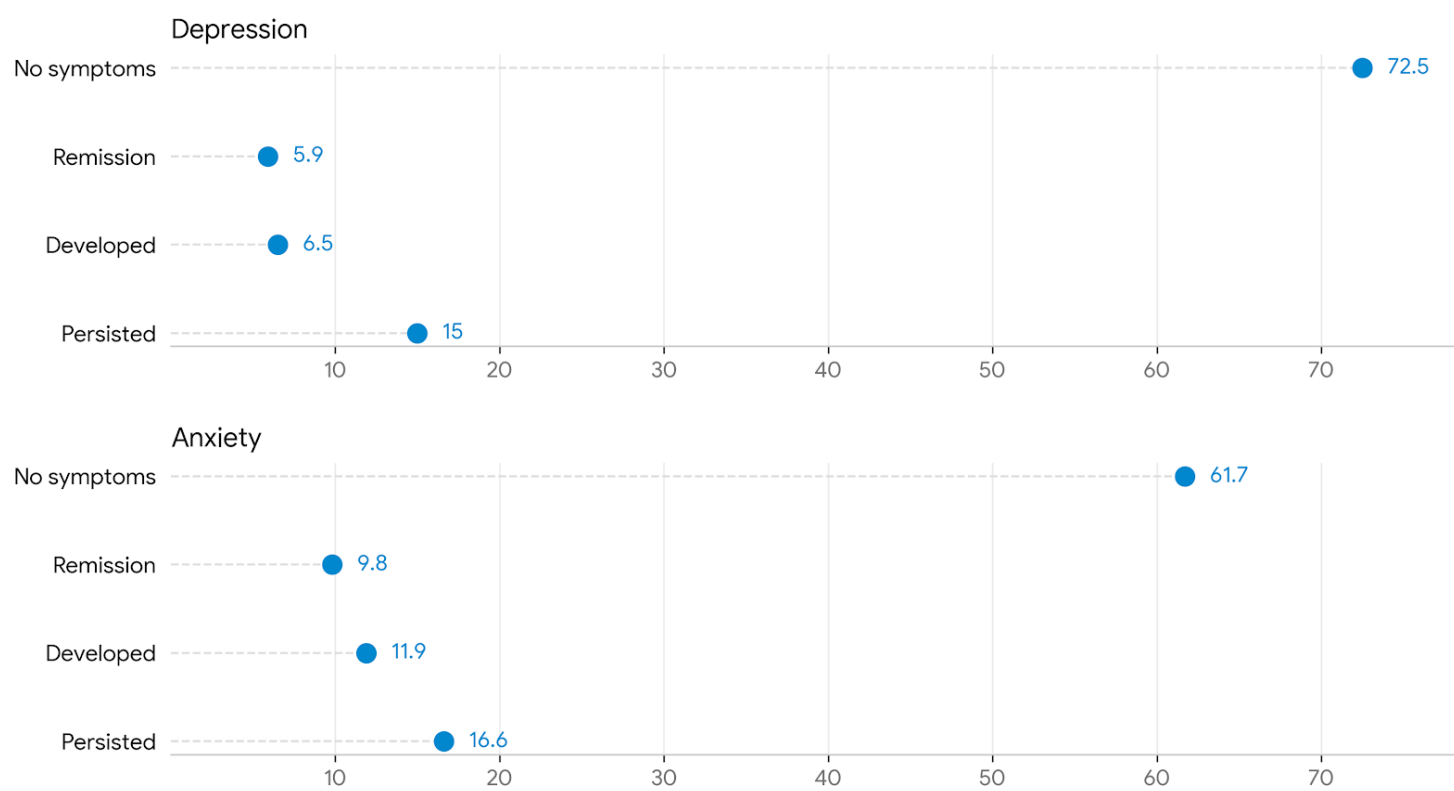


Figure 1

Distribution of changes in depression and anxiety symptom status between 6 and 24 months after COVID-19 infection. Sulcovid Study, Rio Grande, Brazil (n=1,885).