DEPARTAMENTO DE SALUD

Poster: Association between Post-Acute Sequelae of COVID-19 (PASC) and Limitations in Activities of Daily Living (ADL) in Puerto Rico

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Association between Post-Acute Sequelae of COVID-19 (PASC) and Limitations in Activities of Daily Living (ADL) in Puerto Rico (PR)

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Background:

Research has identified a significant deterioration in activities of daily living (ADL) functioning after acute COVID-19 infection (1). Difficulties in performing ADL stand out as particularly severe (2). Factors such as vaccine status, age, gender, and smoking status show limited or no association with the quantity, intensity, and frequency of the symptoms (2). Patients with mild COVID-19 may also experience persistent impairment in ADL (3). A review of 34 articles also revealed common physical health issues post-COVID-19, including fatigue (reported by 28% to 87% of individuals), pain (myalgia: 4.5% to 36%; arthralgia: 6.0% to 27%), reduced physical capacity (measured by the six-minute walking test, ranging from 180 to 561 meters), and difficulties in physical role functioning and daily activities (observed in 15% to 54% of patients) (4). Fatigue is a substantial predictor of physical health, and its severity is associated with changes in shortness of breath, pain, alterations in functional abilities (such as self-care, mobility, and daily activities), and overall physical activity levels (5).

This study aimed to investigate the relationship between PASC and limitations in ADL. Previous analysis estimated a prevalence of post-acute sequelae of COVID-19 (PASC) in Puerto Rico of 42.9% (IC 95%: 39.3%- 46.5%). This is the first Puerto Rican population study to assess how PASC affects ADL.

Methods:

Design: Two phases cross-sectional study

Sample: The study included a representative random sample of individuals aged ≥21 years (n=720) who tested positive for SARS-CoV-2 from September 2020 to August 2021 (Phase 1) and December 2021 to July 2022 (Phase 2). Participants were identified from the Puerto Rico Department of Health (PRDOH) BioPortal database for all COVID-19 cases in Puerto Rico.

In the PRDOH-Bioportal, 827,661 (119, 906 in Phase 1 and 707,755 in Phase 2) confirmed or probable cases of COVID-19 were identified. After applying the inclusion and exclusion criteria, 617,613 (80,428 in Phase 1 and 537,185 in Phase 2) potentially qualified candidates to participate in the survey were obtained. The established inclusion criteria were as follows: individuals aged 21 or older at the time of diagnosis, being a

confirmed or probable case of COVID-19, and having a positive test between September 1, 2020, to August 31, 2021, and from December 7, 2021, to July 31, 2022. The exclusion criteria were cases detected by a serological test, individuals younger than 21 years of age at the time of diagnosis, individuals who died from COVID-19, or individuals without a phone number documented. The following diagrams describe the sample selection process for Phase 1(Diagram 1), and Phase 2 (Diagram 2) and a summary of the process in both phases (Diagram 3):

Diagram 1. The sampling selection process for Phase 1

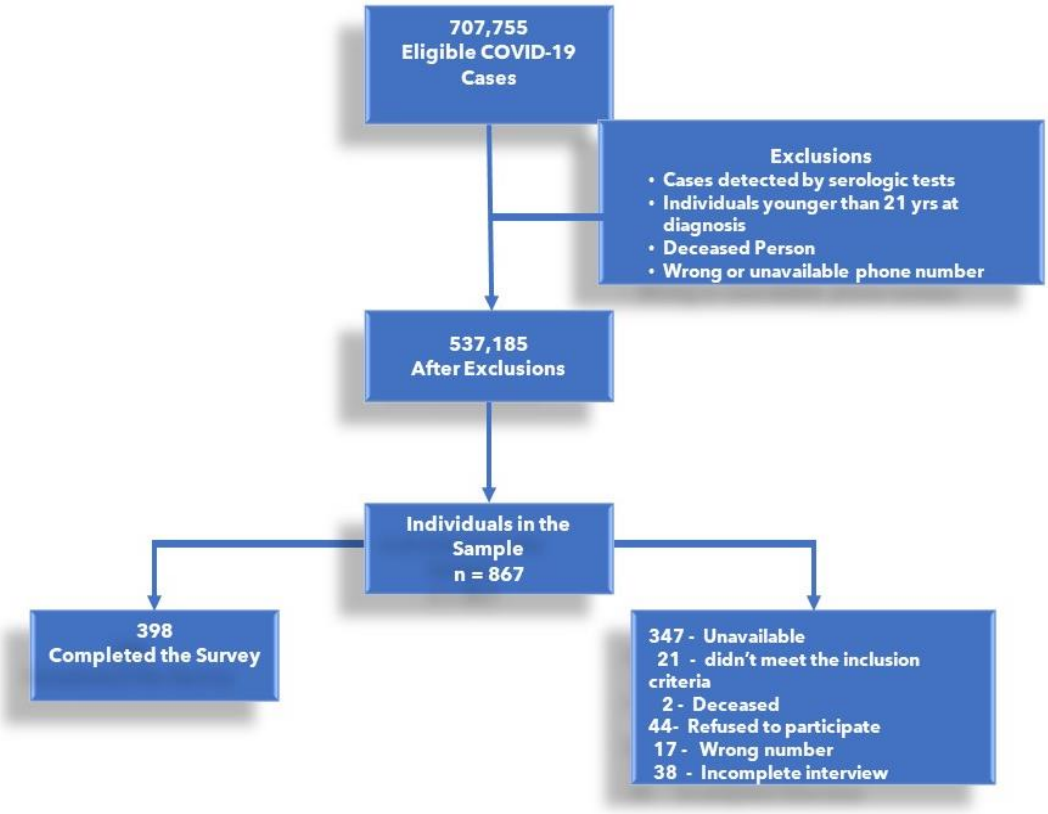


Diagram 2. The sampling selection process for Phase 2

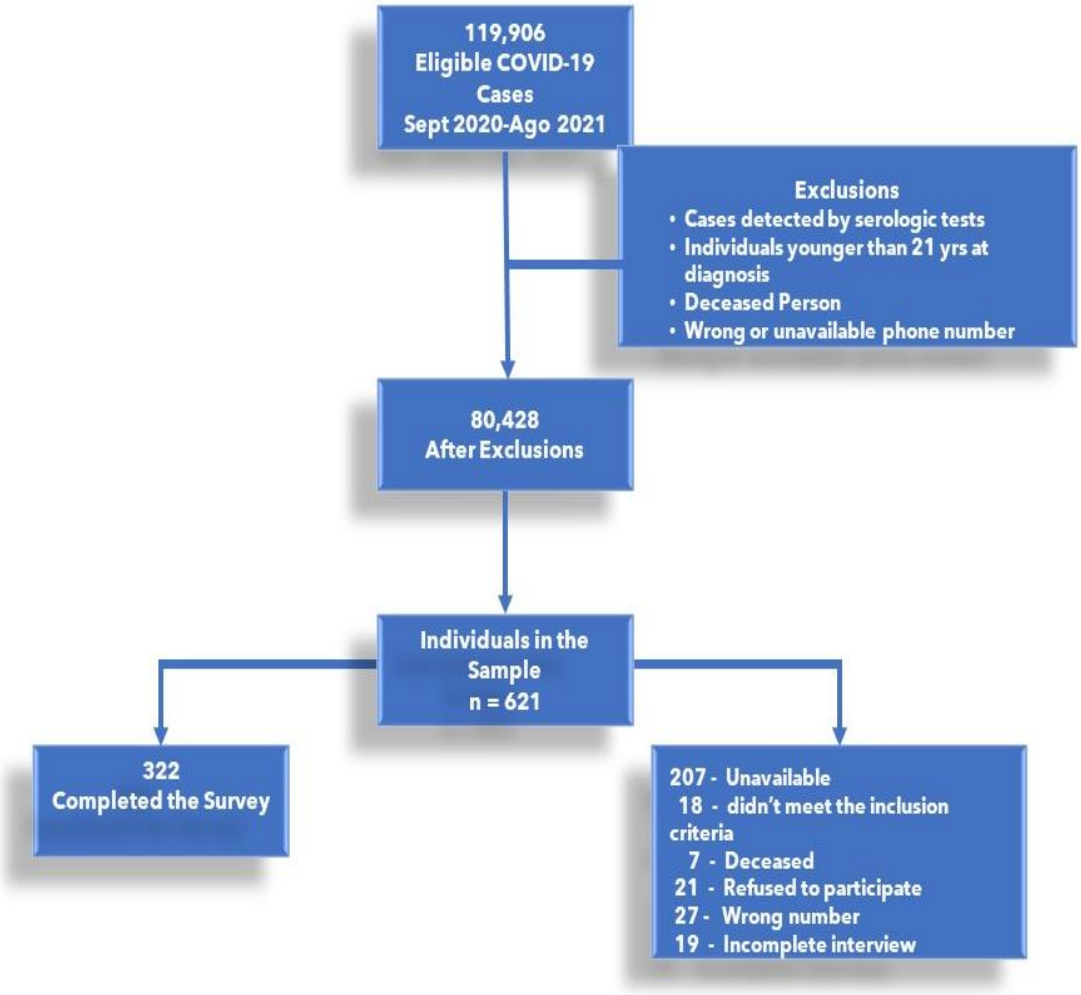
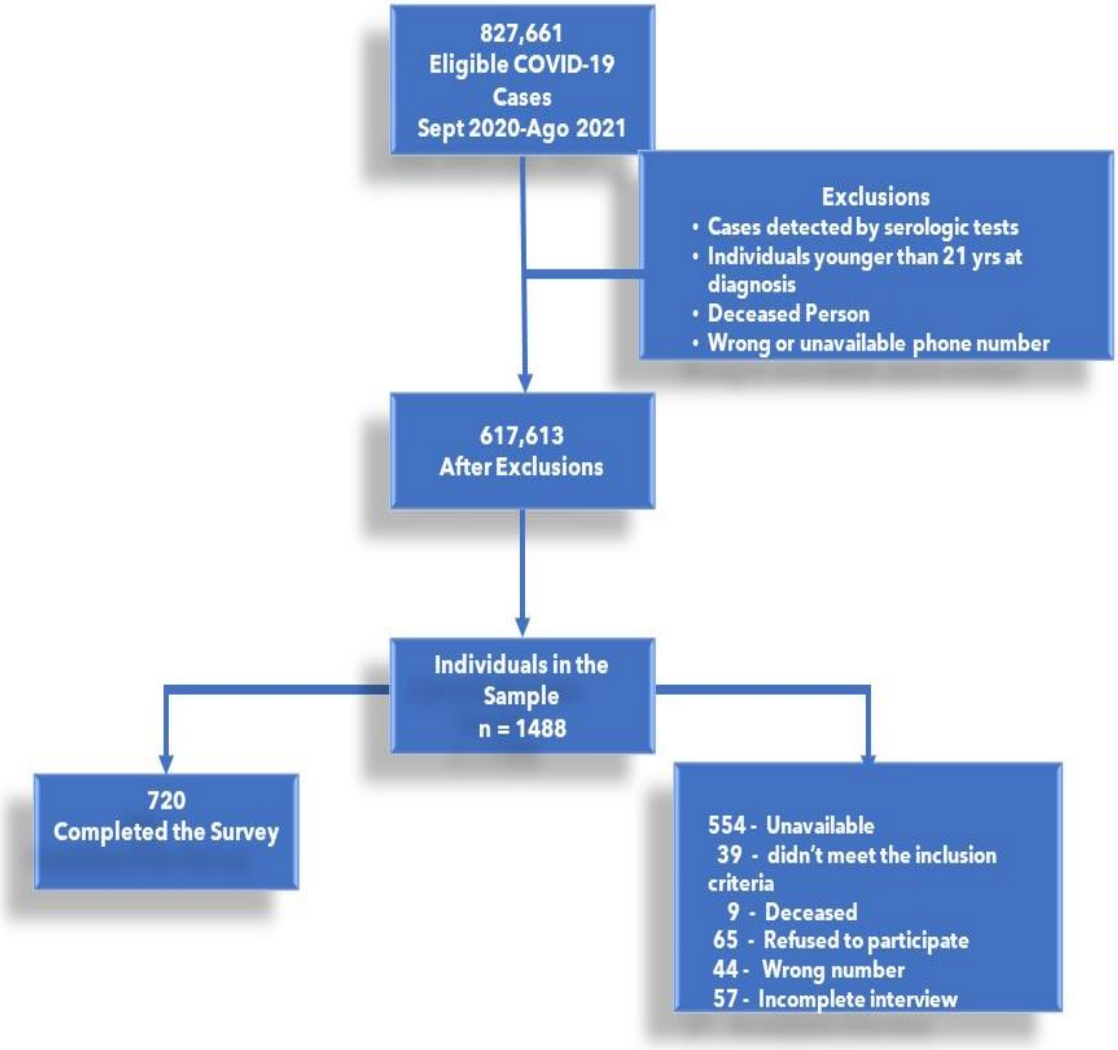


Diagram 3. A summary of the sampling selection process for Phase 1 and Phase 2



Definitions: PASC or post-COVID-19 condition occurs in individuals with a history of probable or confirmed SARS-CoV-2 infection, usually 3 months from the onset of COVID-19 with symptoms lasting at least 2 months and cannot be explained by an alternative diagnosis. Symptoms may be new onset, following initial recovery from an acute COVID-19 episode, or persist from the initial illness. Symptoms may also fluctuate or relapse over time (6).

ADL was defined with examples as working, doing house chores, standing up, and walking. ADLs is a phrase that encompasses basic abilities necessary for self-care and independent living, including tasks like eating, bathing, and getting around (7).

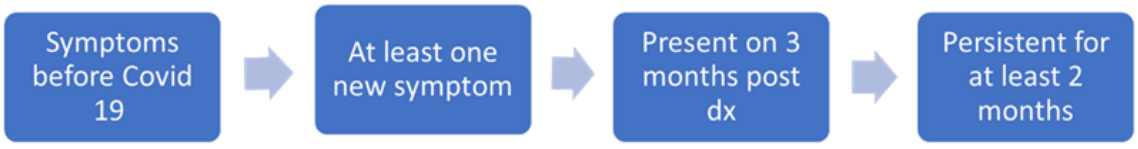
Data Collection:

The information analyzed in the survey was obtained from PRDOH-BioPortal and the participants' self-reported information through telephone interviews to supplement PRDOH-Bioportal information. Information collected from COVID-19 cases from the PRDOH-BioPortal consisted of identification number, demographic information, phone number, municipality of residence, date of diagnosis, and date of hospitalization, if applicable. The personal information obtained from the PRDOH-BioPortal was validated during the interview with the participant. The telephone interview collected socio-demographic information and clinical data.

Identification of PASC in participants with pre-COVID-19 symptoms:

An algorithm was used to detect participants who had any pre-COVID-19 symptoms and who developed any new symptoms during the first three months after acute infection. The developed algorithm allowed identifying whether the new symptom persisted for two months or more to classify the respondent according to the case definition of PASC (Diagram 4).

Diagram 4. Algorithm to detect participants who had any pre-COVID-19 symptoms and who developed any new symptoms during the first three months after acute infection.



Data Analysis:

Statistical analysis was applied in R (v. 4.2.2; R Foundation). A crude odd ratio (OR) was calculated to estimate the magnitude of the association between PASC and limitation in ADL. Adjusted ORs for age and sex were also calculated through logistic regression. The fatigue or tiredness variable modified the effect of the association between PASC and limitation in ADL. Hence, adjusted ORs were stratified by fatigue or tiredness.
In addition, hypothesis tests were conducted to assess if there was a statistically significant difference between participants with persistent tiredness or fatigue and those who did not report this symptom. Another hypothesis test was used also to evaluate if there was a statistically significant difference between participants with and without PASC who developed ADL versus those who did not. Finally, a logistic regression was performed to assess the relationship between PASC cases, ADL, and the health region.

Results:

The final sample size was 720 individuals; the average age was 45.4 years, 57.6% were female, 60.7% were in the age group of 21-49 years, 60.3% had a higher education than a high school diploma, 19.4% were smokers, 54.0% were confirmed cases of COVID-19, 95.3% were not hospitalized due COVID-19, 33.5% informed limitation in ADL, 42.9% reported PASC and 96.5% and 94.3% had the first and second dose of COVID-19 vaccine. Most individuals with limitation in ADL (65.1%) were women and 54.8% of these individuals were 21-49 years, 66.0% had a higher education than a high school diploma, 20.7% were smokers, 55.2% were confirmed cases of COVID-19, 90.5% were not hospitalized due COVID-19, 74.7% reported PASC and 96.7% and 94.6% had the first and second dose of COVID-19 vaccine (Table 1.).

Table 1. Description of the sample

Characteristics	Total n (%)	With ADL n (%)	Without ADL n (%)
Total	720 (100.0)	241 (33.5)	479 (66.5)
Sex			
Male	305 (42.4)	84 (34.9)	221 (46.1)
Female	415 (57.6)	157 (65.1)	258 (53.9)
Age			
21-49	437 (60.7)	132 (54.8)	305 (63.7)

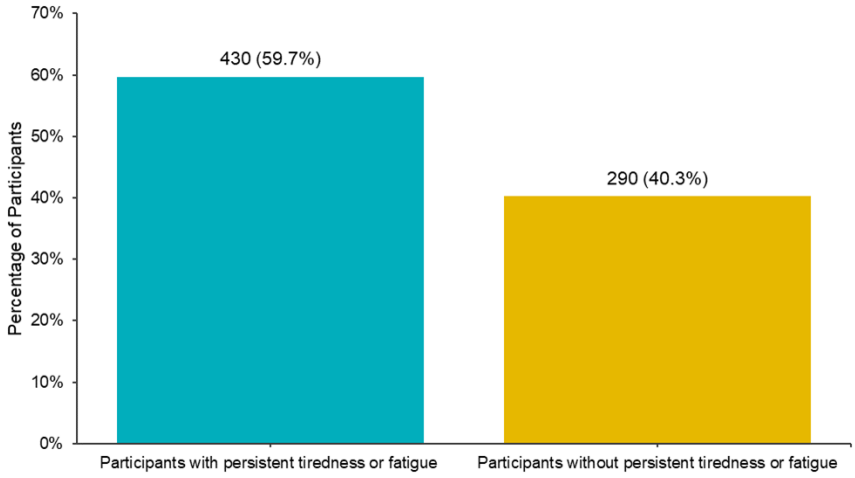
50-64	189 (26.2)	82 (34.0)	107 (22.3)
65+	94 (13.1)	27 (11.2)	67 (14.0)
Education[*]			
Less than a High School Diploma	50 (7.1)	17 (7.2)	33 (7.1)
High School Diploma	210 (29.9)	63 (26.8)	147 (31.4)
More than a High School Diploma	443 (63.0)	155 (66.0)	288 (61.5)
Smoker[†]			
Yes	139 (19.4)	50 (20.7)	89 (18.7)
No	577 (80.6)	191 (79.3)	386 (81.3)
Case Type			
Confirmed	389 (54.0)	133 (55.2)	256 (53.4)
Probable	331 (46.0)	108 (44.8)	223 (46.6)
Hospitalized[§]			
Yes	31 (4.7)	22 (9.5)	9 (2.1)
No	625 (95.3)	209 (90.5)	416 (97.9)
PASC	309 (42.9)	180 (74.7)	129 (26.9)
Vaccines			
1st dose	695 (96.5)	233 (96.7)	462 (96.5)
2nd dose	679 (94.3)	228 (94.6)	451 (94.2)
Booster[¶]	433 (72.8)	140 (70.0)	293 (74.2)

[*]17 people who did not report their level of education.

[†]4 people did not report whether they smoked or not. (smoke at least 100 cigarettes in their entire life)
[§]64 people did not report whether they were hospitalized or not.
[¶]125 people did not report whether they received at least one booster dose.

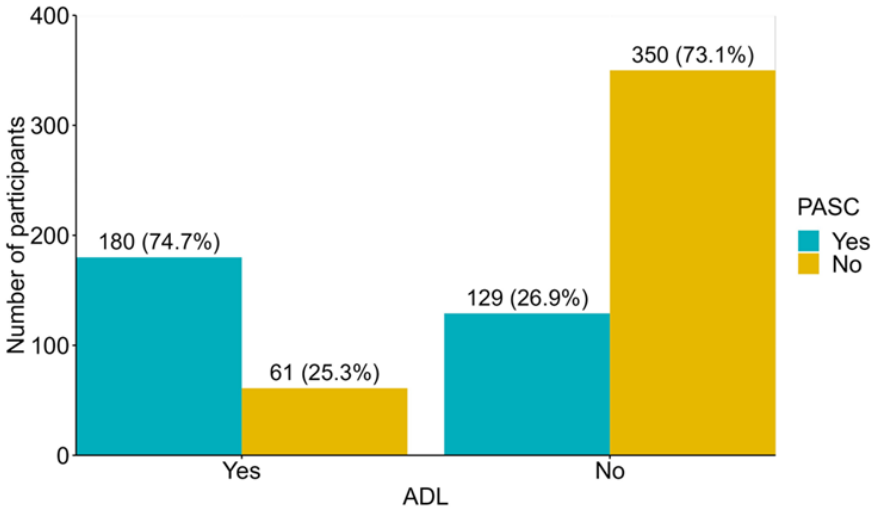
Of the participants, 59.7% (n=430) reported persistent tiredness or fatigue, while 40.3% (n=290) did not (Graph 1). The differences were statistically significant (p-value <0.0001).

Graph 1. Participants with and without persistent tiredness or fatigue (n=720)



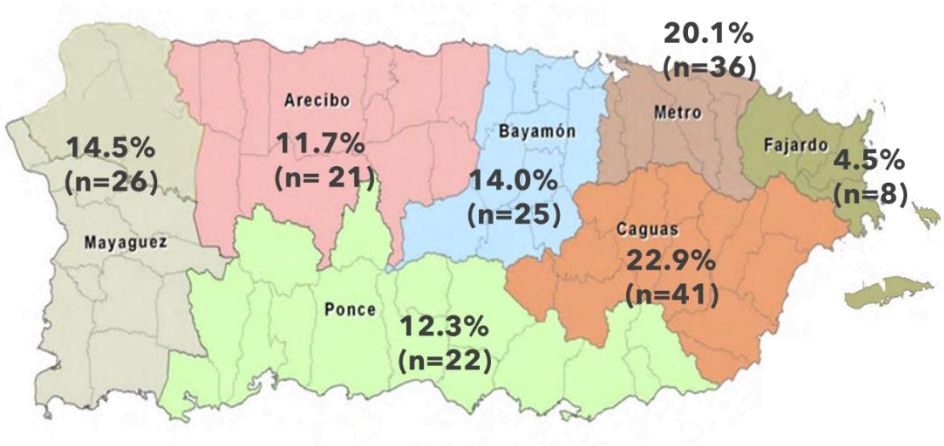
The prevalence of limitation in ADL in people with PASC is estimated to be 58.3% (IC 95%: 52.8% - 63.7%). Of participants with PASC, 74.7% (n=180) reported limitations in ADL while 26.9% (n=129) did not report limitations in ADL. Instead, of participants without PASC, 25.3% reported limitations in ADL while 73.1% did not report limitations in ADL (Graph 2). The differences were statistically significant (p-value <0.0001).

Graph 2. Percentage of individuals who developed ADL limitation among those with PASC and without PASC (n=720)



The proportion of cases with PASC and limitation in ADL by health region was as follows: Caguas 22.9% (n=41), Metropolitan 20.1% (n=36), Mayagüez 14.5% (n=26), Bayamón 14.0% (n=25), Ponce 12.3% (n=22), Arecibo 11.7% (n=21), and Fajardo 4.5% (n=8). However, the differences in the proportion of cases with PASC and ADL by region were not statistically significant (p>0.05).

Figure 1. Proportion of cases with PASC and ADL by region



Association of PASC and limitation in ADL

After stratifying by the presence or absence of persistent fatigue or tiredness, the results were as follows for both Phases (Phase 1 and Phase 2) analyzed together:

(i) Among individuals with persistent fatigue or tiredness, limitation in ADL was not statistically associated with PASC (adjusted OR: 0.80; 95% CI: 0.17-2.91; p > 0.05).

(ii) Among individuals without persistent fatigue or tiredness, limitation in ADL was statistically associated with PASC (adjusted OR: 5.21; 95% CI: 3.30-8.26; p < 0.05) (Table 2).

Among individuals with persistent fatigue or tiredness in Phase 1 (n=188), limitations in ADL were associated with PASC. However, the result was not statistically significant (adjusted OR: 1.45; 95% CI: 0.18-8.54; p>0.05). Instead, individuals without persistent fatigue or tiredness, and limitation in ADL were statistically associated with PASC (adjusted OR: 4.08; 95% CI: 2.07-8.79; p < 0.05).

Among individuals with persistent fatigue or tiredness in Phase 2 (n=242), limitations in ADL were not statistically associated with PASC (adjusted OR: 0.46 95% CI: 0.02-3.21; p>0.05). Instead, individuals without persistent fatigue or tiredness, and limitation in ADL were statistically associated with PASC (adjusted OR: 7.11; 95% CI: 3.79-13.56; p < 0.05).

Table 2. Association of PASC and limitation in ADL by Phases

Period	OR crude	95% Confidence Interval	OR adjusted in individuals with persistent tiredness or fatigue	95% Confidence Interval	OR adjusted in individuals without persistent tiredness or fatigue	Confidence Interval
Phase 1	7.86	4.97-13.62 (p<0.05)	1.45	0.18-8.54 (p>0.05)	4.08	2.07-8.79 (p< 0.05)
Phase 2	8.20	5.15-13.32 (p<0.05)	0.46	0.02-3.21 (p>0.05)	7.11	3.79-13.56 (p < 0.05)
Overall	8.01	5.65-11.47 (p<0.05)	0.80	0.17-2.91 (p> 0.05)	5.21	3.30-8.26 (p<0.05)

The interview date occurred, on average, 310 days (10.2 months) after the occurrence of COVID-19 in individuals with ADL. In individuals with ADL, the maximum time between the occurrence of COVID-19 and the interview was 545 days (17.9 months). On the other hand, the minimum time between the occurrence of COVID-19 and the interview was 183 days (6.0 months) in individuals with ADL.

Conclusions:

Results suggest that PASC may heighten the likelihood of limitation in ADL in individuals who did not report persistent fatigue or tiredness. Further analysis is required to explore interactions among other symptoms, disease severity, ADL, and PASC. Surveillance activities play a crucial role in elucidating and guiding public health practices. A comprehensive understanding of individuals with PASC and their impact on daily living activities requires further research and clinical investigation.

Limitations:

Some of the limitations of the survey include: (1) data related to pre-existing symptoms and medical conditions were self-reported by the participants and lacked verification through a medical assessment. (2) There was no standardized way to measure limitations in ADL among the participants. (3) Another limitation is the possibility of memory bias due to the time elapsed between the diagnosis of COVID-19 and the time of the interview.

It's also possible that the characteristics of non-participating individuals may differ from those of the participants. (4) Similarly, a standardized questionnaire was used to collect information, but it was not validated, and limitations in the comprehension of some questions were identified during the interview period. (5) Lastly, other interactions with pre-existing conditions and symptoms were not evaluated.

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