REFACS

Original Article
Rev. Fam., Ciclos Vida Saúde Contexto Soc.
http://seer.uftm.edu.br/revistaeletronica/index.php/refacs/index
ISSN: 2318-8413 DOI: 10.18554/refacs.v12i1.7636

Functional independence measure, sequelae, and comorbidities in individuals with COVID-19: a cross-sectional study

Medida de independência funcional, sequelas e comorbidades em indivíduos com COVID-19: estudo transversal

Medida de independencia funcional, secuelas y comorbilidades en individuos con COVID-19: un estudio transversal

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Received: 06/06/2024 **Accepted:** 28/06/2024 **Published:** 07/07/2024

Objective: to verify whether there is loss of functionality and association between sequelae, comorbidities and between the Functional Independence Measure with sociodemographic data and clinical aspects in individuals affected by COVID-19. **Method:** this is a cross-sectional, descriptive, exploratory and quantitative study, carried out between 2020 and 2021. Participants were contacted by telephone and answered a questionnaire covering sociodemographic and clinical aspects; post-COVID-19 sequelae, presence of comorbidities and Functional Independence Measure Scale. **Results:** 172 individuals participated with an average age of 41.42±14.21 years, 54.7% were female, 34.9% had comorbidities, 80.2% had post-COVID sequelae, 90.1% did not require hospitalization and 93.6% were vaccinated. The total Functional Independence Measure score was 120.73±11.3, corresponding to complete independence. There was an association between the cognitive domain and female sex (p=0.022) and white individuals (p=0.025), and between the motor domain, age between 18 and 59 years (p=0.014) and not being vaccinated against COVID-19 (p=0.046). **Conclusion:** comorbidities are associated with post-COVID-19 sequelae. Non-vaccinated individuals, when infected with COVID-19, may present impairment in the motor domain.
Descriptors: Functional status; Comorbidity; Post-acute COVID-19 syndrome.

Objetivo: verificar se há perda de funcionalidade e associação entre sequelas, comorbidades e a medida de independência funcional com dados sociodemográficos e aspectos clínicos em indivíduos acometidos pela COVID-19. **Método**: estudo transversal, descritivo, exploratório e quantitativo, realizado entre 2020 a 2021. Os participantes foram contatados por telefone e responderam a um questionário abordando aspectos sociodemográficos e clínicos; sequelas pós-COVID-19, presença de comorbidades e Escala de Medida de Independência Funcional. **Resultados:** participaram 172 indivíduos, com idade média de 41,42±14,21 anos, 54,7% eram do sexo feminino, 34,9% apresentavam comorbidades, 80,2% apresentavam sequelas pós-COVID, 90,1% não necessitaram de internação e 93,6% foram vacinados. A pontuação total da Medida de Independência Funcional foi de 120,73±11,3, correspondendo à independência completa. Houve associação entre o domínio cognitivo e sexo feminino (p=0,022) e indivíduos brancos (p=0,025), e entre o domínio motor, idade entre 18 e 59 anos (p=0,014) e não estar vacinado contra COVID-19 (p=0,046). **Conclusão:** as comorbidades estão associadas às sequelas pós-COVID-19. Indivíduos não vacinados, quando infectados pela COVID-19, podem apresentar comprometimento no domínio motor.
Descritores: Estado funcional; Comorbidade; Síndrome de COVID-19 pós-aguda.

Objetivo: verificar si existe pérdida de funcionalidad y asociación entre secuelas, comorbilidades y entre la Medida de Independencia Funcional con datos sociodemográficos y aspectos clínicos en individuos afectados por COVID-19. **Método**: se trata de un estudio transversal, descriptivo, exploratorio y cuantitativo, realizadas entre 2020 y 2021. Los participantes fueron contactados por teléfono y respondieron a un cuestionario que abarcaba aspectos sociodemográficos y clínicos; secuelas post-COVID-19, presencia de comorbilidades y Escala de Medida de Independencia Funcional. **Resultados**: Participaron 172 individuos con una edad media de 41,42±14,21 años, el 54,7% eran mujeres, el 34,9% presentaban comorbilidades, el 80,2% tenían secuelas post-COVID, el 90,1% no necesitaron hospitalización y el 93,6% estaban vacunados. La puntuación total de la Medida de Independencia Funcional fue de 120,73±11,3, correspondiente a una independencia completa. Hubo una asociación entre el dominio cognitivo y el sexo femenino (p=0,022) y las personas de color blanco (p=0,025), y entre el dominio motor, la edad entre 18 y 59 años (p=0,014) y no estar vacunado contra la COVID-19 (p=0,046). **Conclusión**: las comorbilidades están asociadas a las secuelas posteriores a la COVID-19. Los individuos no vacunados, cuando se infectan con COVID-19, pueden presentar deterioro en el dominio motor.
Descriptores: Estado funcional; Comorbilidad; Síndrome postagudo de COVID-19.

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INTRODUCTION

The COVID-19 pandemic has resulted in millions of deaths worldwide and has led to global health crises and resource overload. With the sequencing of virus's genome, vaccine development has substantially contributed to reducing disease severity and fatalities[1].

However, beyond the extreme peak of severe cases and deaths, a new issue has emerged, related to the persistent effects of the disease on individuals who contracted COVID-19[2]. Post-COVID Syndrome, or Long COVID, is characterized by symptoms that persist after the disease, negatively impacting activities of daily living, often resulting in functional losses, difficulty in performing tasks, and impairment of one or more body systems[3].

The extent of functional sequelae related to COVID-19 is not yet fully understood but may be associated with the severe form of the disease, especially in those with significant pulmonary impairments who remained immobile for long periods of time and those who mechanical ventilation in Intensive Care Units[4].

This study is justified by the need for clarification on the relationship between post-COVID-19 sequelae, comorbidities, and functional independence, aiming to facilitate efficient monitoring and care for affected individuals.

This research aims to verify whether there is loss of functionality and association between sequelae, comorbidities and between the Functional Independence Measure with sociodemographic data and clinical aspects in individuals affected by COVID-19.

METHODS

This is a cross-sectional, descriptive, exploratory and quantitative study. Approved by the Research Ethics Committee of the Universidade Federal do Triângulo Mineiro, under No. 4.647.292.25.

The sample was made up of men and women aged 18 or over, affected by COVID-19, registered with the Municipal Health Department of a municipality in the Triângulo Mineiro region, from March 2020 to July 2021, corresponding to the first and second waves of COVID-19 in Brazil[2].

The sample was recruited through probabilistic technique, specifically simple random sampling. The sample size calculation was performed according to the simple proportion formula for an infinite population, with a margin of error of 5% and a confidence level of 95%[5].

Participants were contacted by telephone, and the calls lasted between 18 and 25 minutes. Sociodemographic aspects (age, sex, race, marital status and education), clinical

characteristics (comorbidities, post-COVID-19 sequelae) were collected. The level of functional independence was assessed using the Functional Independence Measure (FIM) scale, validated by Riberto *et al*. (2004)[6] and organized into two major dimensions (motor and cognitive), including self-care, sphincter control, transfers, locomotion, communication, and social cognition. The total FIM score is calculated by the sum of the points assigned to each item, with a minimum total score of 18 and a maximum of 126 points. The motor domain of the FIM ranges from 13 to 91 points (13 items), and the cognitive domain ranges from five to 35 points (five items)[7].

Data analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 22.0, employing descriptive statistics (mean, standard deviation, absolute and percentage frequencies) and association between variables. The reliability of the FIM scale was estimated through internal consistency, evaluated by the Cronbach's alpha coefficient, which ranges from 0 (no reliability) to 1 (high reliability), being considered unsatisfactory when it is below 0.70[8].

The Shapiro-Wilk test was used to assess adherence to normal distribution. To compare sociodemographic and clinical variables with the FIM domains, the Mann-Whitney U test and the T test for Independent Samples were applied. To determine the association between sequelae and comorbidities, the Chi-square test or Fisher's Exact test was used. The significance level adopted was 5% for all tests. Cramer's V test was used to measure the power of the test.

RESULTS

During the period considered, there were 31,123 cases, and the calculated sample was 168 to be included. To this end, 1074 telephone calls were made, out of which 898 were not included and 4 were excluded, resulting in a sample of 172 participants. The mean age was 41.42±14.21 years, predominantly female (54.7%), black (50.6%), and married (59.3%). Regarding education, 37.8% of the sample had completed high school, incomplete higher education, or technical education.

Concerning comorbidities, 34.9% had comorbidities, with cardiac (43.3%) and metabolic (21.6%) disorders, being the most prevalent. Post-COVID-19 sequelae were identified in 80.2% of the participants, with decreased physical conditioning (10.6%) and hair loss (10%) being the most prevalent. 90.1% did not require hospitalization. Regarding immunization, 89.5% of the participants reported contamination before receiving the first dose of the vaccine, 8.1% after the first dose, and 2.4% after the second dose of the vaccine.

The average FIM score was 120.73 ± 11.3. The highest score was in the motor domain (personal care), specifically in the item "toilet use" (6.95 ± 0.48). The lowest score was observed in the cognitive domain (personal cognition), particularly in the item "memory" (5.54 ± 2.23). (Table 1). The internal consistency of the FIM instrument was considered adequate (Cronbach's alpha consistency of 0.88).

Women (p=0.022) and white individuals (p=0.025) exhibited greater impairment in the cognitive domain, while individuals aged 18 to 59 years (p=0.014) and those unvaccinated (p=0.046) showed more alterations in the motor domain (Table 2). A greater number of participants with comorbidities presented sequelae (p=0.019) (Table 3).

Table 1. FIM domain scores, mean scores (M) and standard deviation (SD) of the FIM for individual items, March 2020 to July 2021. Uberaba/MG, Brazil.

Domains/Item	Possible score	Min-Max Score	M	SD
1. Personal cares	6-42	13-42	40.8	4.69
Food			6.79	0.89
Personal hygiene			6.74	1.09
Bath			6.72	1.13
Dressing above the waist			6.78	1.00
Dressing below the waist			6.89	0.72
Using the toilet			6.95	0.48
2. Sphincter control	2-14	4-14	13.26	2.06
Urine control			6.51	1.45
Stool control			6.75	1.07
3. Mobility	3-21	6-21	20.5	2.45
Bed, chair, wheelchair			6.86	0.81
Toilet			6.84	0.86
Shower/bathtub			6.86	0.81
4. Locomotion	2-14	4-14	13.2	2.38
Walking/wheelchair			6.65	1.25
Steps			6.57	1.39
5. Communication	2-14	4-14	13.7	1.33
Understanding			6.89	0.72
Expression			6.89	0.72
6. Social Cognitive	3-21	9-21	19.0	2.95
Social interaction			6.67	1.21
Solve problems			6.73	0.90
Memory			5.54	2.23
Total FIM Score	18-126	54-126	120.73	11.3

Data expressed as mean (M) and standard deviation (SD); FIM: Functional Independence Measure; Min: Minimum; Max: Maximum.

Table 2. Comparison of the motor and cognitive domain of the FIM with the sociodemographic and clinical data of post-COVID-19 individuals, March 2020 to July 2021. Uberaba/MG, Brazil.

Variables	Motor Domain- FIM			Cognitive Domain- FIM		
	M	SD	p*	M	SD	p*
Sex			0.856			**0.022***
Feminine	88.22	8.56		32.29	3.89	
Masculine	87.51	11.17		33.40	3.21	
Age			**0.014***			0.193
18 to 59 years	87.96	10.31		32.90	3.67	
60 to 98 years	87.54	5.93		32.13	3.32	
Race			0.352			**0.025***
White	87.14	11.10		32.34	3.74	
Black	88.64	8.35		33.23	3.48	
Hospitalization			0.829			0.687
Yes	89.41	4.48		33.35	2.31	
No	87.74	10.22		32.73	3.74	
Vaccination			**0.046***			0.631
Yes	87.84	10.12		32.88	3.43	
No	88.82	2.52		31.55	5.92	
Comorbidities						
Cardiovascular			0.087			0.533
Yes	90.69	1.08		32.81	2.68	
No	87.40	10.56		32.79	3.78	
Respiratory			0.844			0.672
Yes	90.17	2.04		32.67	2.58	
No	87.82	9.97		32.80	3.67	
Metabolic			0.821			0.552
Yes	88.77	5.74		33.54	2.29	
No	87.83	10.08		32.73	3.71	
After-effects of COVID-19						
Decrease in physical fitness						
Yes	87.87	9.15		32.61	3.58	
No	87.92	10.38		32.95	3.68	
Muscle weakness			0.335			0.294
Yes	87.70	8.70		32.37	3.93	
No	88.00	10.35		33.00	3.47	
Shortness of breath at rest or after exercise			0.760			0.102
Yes	88.88	5.27		32.51	2.86	
No	87.51	11.11		32.90	3.90	
Vision changes			0.883			0.416
Yes	88.53	6.52		32.61	3.11	
No	87.74	10.52		32.84	3.76	

* p<0.05. Mann-Whitney Test; FIM: Functional Independence Measure; M: Mean; SD: Standard Deviation.

Table 3. Association of health problems (comorbidities) and sequelae in post-COVID19 individuals, March 2020 to July 2021. Uberaba/MG, Brazil.

	Sequelae			
	Yes n (Pr)	**No n (Pr)**	**p**	**Cramer's V**
Health issues before COVID-19			**0.026****	**0.019**
Yes	54 (90.0)	6 (10.0)		
No	84 (75.0)	28 (25.0)		
Cardiovascular			0.300	0.253
Yes	23 (88.5)	3 (11.5)		
No	115 (78.8)	31 (21.2)		
Respiratory			0.600	0.216
Yes	6 (100.5)	0 (0)		
No	132 (79.5)	34 (20.5)		
Metabolic			0.074	0.063
Yes	13 (100.0)	0 (0)		
No	125 (78.6)	34 (21.4)		

n= number of participants, Pr = proportion. Data expressed as frequency and proportion. p= significance level; ** p<0.05. Exact Test Fisher and Cramer's V

DISCUSSION

It was noted that 54.7% of the sample were female, which can be partially explained by the higher prevalence of female residents (51.2%)[9] in the municipality in question. Additionally, data indicate that females are more affected, although the highest percentage of deaths is concentrated in males[10].

Most participants (65.1%) did not report pre-existing comorbidities and, among those who did (34.9%), the most frequent were cardiac (43.3%) and metabolic (21.6%) changes. Richardson *et al*. (2020)[11] found similar results reporting that the most common comorbidities were hypertension (56.6%), obesity (41.7%) and diabetes (33.8%), in hospitalized patients in New York City.

Considering the Post-COVID-19 Syndrome, 80.2% of the participants in the present study reported experiencing symptoms, with the most prevalent being decreased physical conditioning (10.6%), hair loss (10%), anxiety (8.4%), and muscle weakness (7.6%). These findings are consistent with study who identified symptoms lasting ≥ 28 days (13.3%), ≥ 8 weeks (4.5%), and ≥ 12 weeks (2.3%) in their sample, with the most frequent being fatigue (97.7%), intermittent headaches (91.2%), followed by anosmia and respiratory symptoms[12]. The literature presentes heterogeneous symptomatology, with over 200 associated symptoms affecting different organs and systems, the majority of which are fatigue, cardiorespiratory symptoms, and dysautonomia[13]. These sequelae negatively impact the quality of life and functionality of these individuals, emphasizing the need for functional capacity assessment to guide appropriate treatment and resources[14].

To assess functionality, there are several instruments[6,15-17]. At the start of the interviews, there were no robust and validated instruments in the literature for identifying functionality specifically in individuals affected by COVID-19. Only in July 2021 the Post-COVID-19 Functional Status Scale (PCFS)[18] was validated. Thus, due to the FIM scale's ability to assess motor and cognitive domains in a multidimensional way, it was considered suitable for this population, being a validated functional assessment instrument for the Brazilian population, capable of evaluating a person who may be incapacitated for tasks involving self-care, transfers, locomotion, sphincter control, and cognitive skills[6].

The mean FIM score of the participants was 120.73 ± 11.3, characterizing them as completely independent[7]. It is possible that, due to the majority of participants (90.1%) not requiring hospitalization for COVID-19 treatment, which suggests a milder form of the disease, they presented better functionality. As observed in a controlled prospective observational

study, COVID-19 patients who required prolonged hospitalization showed decreased functionality[19].

The majority of participants in this study (86.4%) were adults, and this age group was significantly associated with greater impairment in the motor domain (p=0.014). However, researches reports that motor impairment is common in the aging process, as well as in elderly individuals affected by COVID-19[20]. Our findings can be justified by two factors: the sample is composed mostly of adults (86%), and the method used is self-reporting. In this context, it is plausible that the elderly already presented some motor decline due to aging, with greater perception of this in adults, where it is less intense in the absence of COVID.

It was noted that, among unvaccinated individuals, there was an association with the motor domain of the FIM scale (p=0.046), indicating impairment in this domain. Nowadays, literature and epidemiological statistics confirm the effectiveness of vaccines, both in reducing infections and the severity of the disease.

Being female and white were associated with greater impairment in the cognitive domain. So far, we haven't found scientific evidence supporting these findings, so they should be approached with caution and require further investigation. When examining the association between comorbidities and sequelae, a statistically significant association was noted (p=0.026), although weak (Cramer's V=0.019) between the variables. These findings are consistent with the other studies regarding the presence of one or more comorbidities being related to worse clinical outcomes and the presence of sequelae[21].

CONCLUSION

COVID-19 infection in individuals who did not require hospitalization does not compromise functionality, as measured by the FIM Scale. The presence of comorbidities is associated with post-COVID-19 sequelae. Unvaccinated adults, when affected by COVID-19, may show impairment in the motor domain of the FIM Scale. Being female and of white is associated with impairment in the cognitive domain; however, these results should be analyzed with caution and require further investigation.

This study has limitations related to its cross-sectional design, limiting the possibility of establishing a causal relationship between sequelae, comorbidities, and functionality, in addition to data collection being based on self-reporting. However, the research was conducted during the rising wave of COVID-19 cases, which precluded in-person assessment applications. As a strength, we consider that it was conducted on a representative sample of the population affected by COVID-19 in the evaluated municipality.

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Associated Publisher: Rafael Gomes Ditterich.

Conflict of Interests: the authors declared there is no conflict of interests.

Financing: this study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Finance Code 001.

CONTRIBUIÇÕES
Lohanne Carolina Martins Silva, **Ana Carolina Otoni Oliveira**, **Isabel Aparecida Porcatti Walsh** e **Marilita Falangola Accioly** collaborated in the conception, data collection and analysis, writing and review. **Daniel Grabaski Accioly** participated in data collection and analysis, writing and review. **Laianne Liliane Pereira Troncha de Castro** contributed to the design, collection and analysis of data.

Como citar este artigo (Vancouver)
Silva LCM, Accioly DG, Oliveira ACO, Castro LLPT, Walsh IAP, Accioly MF. Functional independence measure, sequelae, and comorbidities in individuals with COVID-19: a cross-sectional study. Rev Fam, Ciclos Vida Saúde Contexto Soc. [Internet]. 2024 [cited in *insert day, month and year of access*]; 12(1):e7636. Available from: *insert access link*. DOI: *insert DOI link*.

Como citar este artigo (ABNT)
SILVA, L. C. M.; ACCIOLY, D. G.; OLIVEIRA, A. C. O.; CASTRO, L. L. P. T.; WALSH, I. A. P.; ACCIOLY, M. F. Functional independence measure, sequelae, and comorbidities in individuals with COVID-19: a cross-sectional study. **Rev. Fam., Ciclos Vida Saúde Contexto Soc.**, Uberaba, MG, v. 12, n. 1, e7636, 2024. DOI: *insert DOI link*. Available from: *insert access link*. Available from: *insert access link*.

Como citar este artigo (APA)
Silva, L. C. M., Accioly, D. G., Oliveira, A. C. O., Castro, L. L. P. T., Walsh, I. A. P., & Accioly, M. F. (2024). Functional independence measure, sequelae, and comorbidities in individuals with COVID-19: a cross-sectional study. *Rev. Fam., Ciclos Vida Saúde Contexto Soc.*, 12(1), e7636. Retrieved in *insert day, month and year of access* from *insert access link*.