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SHORT PAPER

Self-perceived functioning in relation to existing symptoms 12 months after SARS-CoV-2 infection in workers of an industrial facility in Aveiro Region – an observational study.

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ABSTRACT

Background/Objective: Most individuals recover after acute SARS-CoV-2 infection, but some may suffer persistent symptoms with potential medium and long-term consequences. The present study aims to analyze self-perceived functioning concerning existing symptoms 12 months after SARS-CoV-2 infection in workers of an industrial facility in the Aveiro Region.

Methods: Observational study, including workers with a positive SARS-CoV-2 RT-PCR/TRAg test. After 12 months of the infection, the occupational health team collected information on sociodemographic variables, manifested symptoms, and perceived functioning assessed using the WHODAS-2.0–12 items - where '12 points' means the highest functioning. Data analysis included descriptive statistics and univariate and multivariate linear regression.

Results: Eighty-five workers were infected with SARS-CoV-2, 77.7% were male, with a mean age of 36y1m±9y8m, 36.8% have a higher education level and 17.7% reported at least one chronic condition. Thirty workers (35.3%) reported persistent symptoms, with fatigue (27.7%) and arthralgia (14.4%) being the most described. Whodas 2.0 mean score was 15,7±5,0, and items most frequently reported as presenting limitations were difficulties in working (43.5%), concentrating (35.3%), and walking one kilometer (35.3%). Self-perceived functioning depended on educational level (β=-2.37, CI95% -4.53 ; -0.21) or the existence of a chronic illness (β=3.53, CI95% 0.81 ; 6.24), and the level of functioning is associated with the persistence of symptoms of fatigue (β=4.02, CI95% 1.75 ; 6.29), headache (β=4.13, CI95% 0.84 ; 7.42), and myalgia (β=3.30, CI95% 0.14 ; 6.45).

Conclusions: Persistent symptoms 12 months after symptomatic SARS-CoV-2 infection have an influence on self-perceived functioning. Occupational health services should regularly address the assessment of persistent symptoms of SARS-CoV-2 infection to prevent possible impacts on daily activities and participation.

Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a highly transmissible and pathogenic coronavirus that emerged in late 2019 causing a pandemic that threatened global safety and public health [1]. Since then, more than 759 million people worldwide have been infected, and more than a third of these cases were confirmed in Europe [2].

Acute SARS-CoV-2 infection can be asymptomatic or cause Coronavirus Disease 2019 (COVID-19) with mild, moderate, severe, or critical severity [3]. Symptoms of the acute phase most reported are fatigue, dyspnea, headache, muscle pain, arthralgias, cough, chest pain, anosmia and/or ageusia, and diarrhea [4].

Most individuals recover after acute SARS-CoV-2 infection, but some may suffer persistent symptoms with potential medium and long-term consequences [5] or even appearing new symptoms [6], depending on the extent and severity of viral invasion in different types of cells and organs [7], with implications for their daily functioning [8] without other explanation [9].

Persistent symptoms, after a SARS-CoV-2 infection, are more frequent than those usually observed among individuals with other viral infections, such as Influenza [10]. Several studies [8][11] have revealed that the most prevalent persistent symptoms are fatigue/weakness, dyspnea, anosmia, headache, muscle pain, arthralgia, depression, anxiety, memory loss, concentration, and insomnia. A quarter of individuals show at least one symptom 12 months after symptomatic SARS-CoV-2 infection, most of whom had a mild

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disease in the acute phase, which can indicate that an important number of individuals infected suffer from persistent symptoms.

Although the persistent symptomatology of SARS-CoV-2 infection is widely studied, little is known about the impact of this infection on the functioning of infected workers.

Human functioning, enlightened by the International Classification of Functioning, Disability, and Health (ICF) "is understood as a continuum of health states, and everyone exhibits some degree of functioning in each domain, at the level of the body, the person, and society" [12]. This is also understood as the person's ability to carry out activities of daily living and to participate in various situations of life and society, including the physical, emotional, and cognitive dimensions [12]. Functioning assessment is relevant to detect risk situations, monitor functional decline, and identify intervention needs and resource mobilization [13].

The present study aims to analyze self-perceived functioning concerning existing symptoms 12 months after SARS-COV-2 infection in workers of an industrial facility in the Aveiro Region.

Methods

An observational study was developed in the context of occupational health service in an industrial facility of the Aveiro region in Portugal. The board of the industrial facility granted authorization for conducting the study and all participants gave written informed consent.

Twelve months after a positive SARS-COV-2 RT-PCR/TRAg test, workers fulfilled a questionnaire that included sociodemographic items, persistent (actual) symptoms after SARS-COV-2 infection, and the Portuguese short version of the World Health Organization Disability Assessment Scale 2.0 (Whodas 2.0 PT12) [14].

The World Health Organization developed Whodas 2.0 as a generic instrument to measure health and disability across cultures [12]. The short version comprises the exact six domains (cognition, mobility, self-care, getting along, life activities, and participation) as the original one, but is reduced to twelve items (two per domain). For the Portuguese short version of Whodas 2.0, previous works have shown good results in terms of psychometric properties [15] including for different application modalities [15]. Results range from 12 points (maximum functioning) to 60 points.

Based on the literature [3][4], a list of ten common symptoms during SARS-COV-2 infection was made available to participants who ticked those that currently persist. Sociodemographic variables included age, sex, marital status, education level, and working schedule. The existence of a chronic condition, like diabetes or hypertension, was also added to the questionnaire.

Descriptive analysis was performed by presenting frequencies and percentages for nominal data or mean and standard deviation for quantitative data. Univariate linear regression was performed with Whodas 2.0 score as the dependent variable and as fixed factors for gender, marital status, education level, working schedule, the existence of a chronic condition, and each one of the symptoms. Only factor age was set as a covariate. Multivariate linear regression analysis was performed using Enter as a method with significant factors. "In order to carry out the analysis using linear regression, assumptions related to the linear relationship between variables, homoscedasticity, and normal distribution of residuals were graphically verified, and independence of residuals by the Durbin-Watson test'. The significance level was set to 5%, and as effect size, r2 was calculated. The conduction of analysis was made with JASP 0.16.3 software [16].

Results

Eighty-five workers were infected with SARS-CoV-2 under the period of analysis, with a mean age of 36y1m±9y8m, of which 57.7% (n=49) were married, 37.6% (n=32) have a higher education level, and 61.2% worked in shifts (n=52). Most workers were male (n=66, 77.7%). A chronic condition was reported by 17.7% (n=15) of the participants – Table 1.

Persistent symptoms were reported by 35.3% (n=30) of the workers (max=5). The most frequent symptoms reported were fatigue (n=23, 27.7%) and arthralgia (n=12, 14.4%). No one of the participants reported hyperthermia as a persistent symptom – Table 1.

For Whodas 2.0 the mean score was 15,7±5,0. The Whodas 2.0 items most frequently reported by workers as presenting limitations were related to difficulties in working (n=37, 43.5%), concentrating (n=30, 35.3%), and walking one kilometer (n=30, 35.3%).

The items reported with less frequency were related to limitations concerning washing all body (n=6, 7.1%), dressing (n=7, 8.2%), and maintaining a friendship (n=8, 9.4%).

Table 1 shows, in univariate analysis, the dependence of self-perceived functioning on different sociodemographic or clinical variables, such as educational level (β=-2.37, CI95% -4.53 ; -0.21) or the existence of a chronic illness (β=3.53, CI95% 0.81 ; 6.24). In the same sense, the persistence of different symptoms is associated with the level of functioning: arthralgia (β=4.53, CI95% 1.60 ; 7.46), cough (β=4.85, CI95% 1.08 ; 8.62), dyspnea (β=8.19, CI95% 0.52 ; 11.86), fatigue (β=5.96, CI95% 3.92 ; 8.00),

headache (β=7.38, CI95% 4.06 ; 10.69) or myalgia (β=6.13, CI95% 2.70 ; 9.57). The multivariate analysis revealed a significant model (F (3,81)=16.04, p<0.001, r2=0.379) only for the following persistent symptoms: fatigue (β=4.02, CI95% 1.75-6.29), headache (β=4.13, CI95% 0.84-7.42), and myalgia (β=3.30, CI95% 0.14-6.45).

Table 1 - Results of the univariate linear regression concerning the covariate & fixed factors in relation to the Whodas 2.0 – PT12 sum scores

Covariate/Fixed factors	Descriptive	Regression coefficient (95% CI)	p-value	r^2
Age, mean (sd)	36.1 (9.8)	-0.02 (-0.13 ; 0.09)	0.665	0.002
Sex (male), n (%)	66 (77.7)	-1.68 (-4.24 ; 0.97)	0.194	0.020
Marital status (not married), n (%)	36 (42.3)	-0.29 (-2.47 ; 1.89)	0.793	0.001
Educational level (university), n (%)	32 (37.7)	-2.37 (-4.53 ; -0.21)	0.032	0.043
Work schedule (fixed), n (%)	33 (38.8)	1.78 (-0.40 ; 3.95)	0.107	0.031
Chronic health condition (yes), n (%)	15 (17.7)	3.53 (0.81 ; 6.24)	0.011	0.075
Ageusia (yes), n (%)	7 (8.2)	2.51 (-1.36 ; 6.39)	0.201	0.020
Arthralgia (yes), n (%)	12 (14.1)	4.53 (1.60 ; 7.46)	0.003	0.102
Asnomia (yes), n (%)	6 (7.1)	2.84 (-1.32 ; 6.99)	0.178	0.022
Chest pain (yes), n (%)	2 (2.3)	6.46 (-0.50 ; 13.41)	0.068	0.039
Cough (yes), n (%)	7 (8.2)	4.85 (1.08 ; 8.62)	0.012	0.073
Dyspnea (yes), n (%)	3 (3.5)	8.19 (0.52 ; 11.86)	0.033	0.054
Fatigue (yes), n (%)	23 (27.1)	5.96 (3.92 ; 8.00)	< 0.001	0.289
Headache (yes), n (%)	8 (9.4)	7.38 (4.06 ; 10.69)	< 0.001	0.191
Hyperthermia (yes), n (%)	0 (0,0)	-	-	-
Myalgia (yes), n (%)	8 (9.4)	6.13 (2.70 ; 9.57)	< 0.001	0.132

Discussion

This work indicates that some symptoms persist over 12 months after SARS-CoV-2 infection and have an influence on self-perceived functioning. The multivariate model presents three persistent symptoms (fatigue, headache, and myalgia) as significant, explaining a considerable amount of variability.

The proportion of participants reporting the existence of at least one persistent symptom is lower in this work than that described by Lopez-Leon & colleagues [10], who estimated a proportion of 80% (CI95% 65 ; 92), because the studies included in the systematic review have considered a different time for the registration of persistent symptoms (14 to 110 days). Results reported by Han et al. [17] in another systematic review are close to those found in this work when considering the period of analysis as twelve months. Similar to this work, fatigue, arthralgia, myalgia, and headaches are the most common persisting symptoms reported in the literature [17].

Not having knowledge of the normative values for Whodas 2.0 - PT12 in the Portuguese population, the average value obtained in self-perceived functioning reveals that there are areas of activity and participation with at least some limitations. For example, difficulties in working, concentrating, and walking long distances are the items where most participants perceive difficulties, perhaps directly related to the symptoms that are also more frequent. It is important to try to understand how the workers that reported having difficulties in performing these activities made the necessary adjustments to fulfill their professional obligations. In this case, the articulation between the occupational health service and the management of human resources can help to prevent possible situations of loss of efficiency in production and a decrease in the well-being of workers.

Although the association of self-perceived functioning and sociodemographic variables proved to be statistically significant for educational level, that was not confirmed in the multivariate model. As expected, as a sign of the internal validity of the study, the presence of chronic diseases has a statistically significant association with self-perceived functioning.

Different limitations exist in this study. The risk of selection bias may occur because not all cases of infection were symptomatic and could have escaped testing. Information bias includes failure to record data on the need for medication or hospitalization and on the level of severity of the infection, which could better explain both the existence of persistence of symptoms or self-reported functioning.

The occupational health team should implement workers' health surveillance after SARS-CoV-2 infection, with active and continuous monitoring of the persistence of symptoms, implementing a rehabilitation program with an individual plan for each worker, adapted to their health and recovery needs. Future research could explore functioning by comparing infected and non-infected workers, reinfections, and COVID-19 vaccination status.

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