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## STUDY OF PERSISTENT COVID CASES IN HEALTH WORKERS

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## ABSTRACT

**Introduction:** The COVID-19 disease presents an acute affection that can continue in a sustained manner beyond 12 weeks from the onset of the initial symptoms, being called Persistent COVID (Post COVID, Long COVID). Objective: Assess the incidence of Persistent Covid that the workers at the Sant Joan de Reus Hospital and Reus-Baix Camp Primary Care (EDPSSJRBC) have presented, during the period from March 2020 to November 2022, predominant clinical, work impact. Methods: Descriptive observational study of active workers on 9/30/2022, who after COVID-19 developed Persistent Covid during 2020 to 2022. Study by survey of workers with COVID-19 with Persistent Covid symptoms and subsequent in-person evaluation through questionnaires, health examinations and complementary tests. Final assessment of work capacity against Persistent Covid in the context of the Health Surveillance of the Occupational

Risk Prevention Service. Results: The profile of the worker affected by Persistent Covid in our study is characterized by: female sex, over 40 years of age, care work profile, with predominant symptoms of sleep disorder, memory disorder, difficulty concentrating, changes in mental status, mood, arthralgia, fatigue and headache. They presented abnormal results in the tests: Post COVID-19 Functional Scale, Insomnia Severity Index and Montreal Cognitive Assessment Test. Conclusions: Clinical impact of Persistent Covid of the workers in our study who improved over time and after cognitive rehabilitation treatments in the Cognitive Impairment Unit and regular physical exercise prescribed by the Sports Medicine Unit. Persistent Covid did not prevent the development of their work activity

**Keywords:** Post-Acute COVID-19 Syndrome; COVID-19; Health Personnel; Work Capacity Evaluation.

## INTRODUCTION

COVID-19 disease due to infection with the SARS-CoV-2 Coronavirus (1,2) presents an acute clinical picture, which can persist over time, which has been called Persistent COVID (Post COVID, Long COVID). The definition of Persistent COVID includes a patient diagnosed with COVID-19 through PCR tests and/or serology who, after 12

weeks from the onset of the first symptom, presents symptoms that were part of the acute phase of the SARS-CoV-2 infection and that persists today (3,4). The symptomatic picture of Persistent COVID may include respiratory, rheumatic, neurological, digestive, otorhinolaryngological, cardiological and/or general symptoms (3-6). Exacerbations or reactivations of previous pathologies and symptoms that appear after the initial clinical presentation will

be excluded from the diagnosis of Persistent COVID. In the Health Surveillance Unit of the EDPSSJRBC Prevention Service, a medical procedure was implemented for the detection, assistance and monitoring of workers with Persistent COVID symptoms.

The continuity of Persistent COVID symptoms, apart from the possible impact on workers' daily activities, may have an implication on the development of their work activity, with the need for temporary or permanent work disability or adaptations to their job, to be assessed by the Health Surveillance Services (7-9).

The purpose of this study is to record the symptoms presented by the workers at the Sant Joan de Reus Hospital and Primary Care of Reus and Baix Camp, the healthcare, rehabilitation and follow-up care provided to the workers in the period from March 2020 to November 2022. Since the study has been carried out within the framework of the Health Surveillance Unit, the work impact of the workers derived from Persistent COVID and the need for functional adaptation that they may have required in their work place has also been assessed during the study period.

## METHODS

This is an observational, descriptive study of the workers of the EDPSSJBC company, in September 2022, who suffered from COVID-19 and the symptoms of Persistent COVID developed in the period 2020 to 2022. The workers who were excluded: not belonging to EDPSSJBC; workers in a situation of incapacity for work and those who did not complete all phases of the study.

To evaluate the Persistent COVID clinic from the Health Surveillance Unit of the Occupational Risk Prevention Service, the Procedure for care action in workers with Persistent COVID (2021), in force at EDPSSBC, was applied.

This procedure consists of: sending a survey of symptoms compatible with Persistent COVID (Fever, low-grade fever or chills, fatigue that prevents daily activity, myalgia at rest or daily activity, arthralgia of extremities at rest, dyspnea at rest or daily activities, persistent cough, chest pain at rest or daily activity, anosmia or ageusia, headache, diarrhea, memory loss, changes in mood, sadness, crying, nervousness, insomnia, alopecia) to workers who had suffered from COVID-19. Those who responded affirmatively to Persistent symptoms of more than 12 weeks were scheduled to undergo a health examination. This health examination included a nursing part with the completion of a new Persistent COVID symptoms questionnaire at the time of the visit, application of different tests and scales, all with validity and reliability (10,11).

These scales include: EQ5D functional quality of life scales (EuroQol) (Cronbach 0.75) (12.13), mMRC Test for evaluation of dyspnea (Pearson coef 0.92) (14.15), Test Hamilton anxiety/depression scale

(HAD) (Cronbach 0.89) (16.17), Post COVID-19 Functional Status Scale (PCFS) ((kappa 0.63)) (18.19), Modified Impact of Fatigue (MFIS) (Cronbach 0.81) (20.21), Sleep Scale: Insomnia Severity Index (Cronbach 0.82) (22.23), Pain Assessment Questionnaire (Bpi) (Cronbach 0.82) (24.25) and Montreal Cognitive Assessment (MOCA) (Cronbach's 0.891) (26.27). In addition, the specific analytical determination was carried out: total SARS CoV-2 antibodies (Ab), blood count, ESR, albumin, total and direct bilirubin, serum calcium, total cholesterol and cholesterol fractions, complement CH50, C3, C4, creatinine, glomerular filtration rate, rheumatoid factor, ferritin, iron, folate, alkaline phosphatase, phosphorus, GGT, GOT, GPT, glucose, glycosylated hemoglobin, ionogram (sodium and potassium), C-reactive protein, total proteins, transferrin, triglycerides, urea, vitamin B12, vitamin D, antithrombin III, prothrombin time, activated partial thromboplastin, antinuclear antibodies, DNA autoantibodies, TSH, T3 and T4, apoprotein, creatine kinase, fibrinogen, lactic dehydrogenase, and antiphospholipid syndrome. Anthropometric data were recorded: weight, height and abdominal circumference. Measurement of blood pressure, pulse, oxygen saturation, body temperature was carried out. And a spirometry and an electrocardiogram were performed.

Subsequently, it was scheduled for the medical health examination to: evaluate the data collected by the nursing staff, the analytical results and the tests performed, as well as the tests completed by the workers. A clinical history was taken: directed anamnesis of the COVID-19 disease (onset, symptoms, treatment performed, hospital/ICU admissions, mechanical ventilation requirements...), anamnesis of previous history, chronic treatments and assessment of Persistent COVID symptoms. A directed physical examination was performed: neurological examination (cranial nerves, coordination and balance tests, Romberg test...), cardiorespiratory, oropharyngeal and abdominal examination, lumbar fist percussion, musculoskeletal examination, eye examination, otoscopy, skin examination; assessment of the need for treatment. Complementary tests were requested: Chest radiology or lung CT, respiratory functional tests, echocardiogram... or referrals to other medical specialties: Sports Medicine and/or Physiotherapy Unit, Cognitive Impairment Unit, Medicine Unit Internal, Otorhinolaryngology Unit, Cardiology Unit, Digestology Unit, Rheumatology Unit, Dermatology Unit...

Subsequent follow-up visits were made to the workers who required it with an in-person or telephone appointment to evaluate the results of the complementary tests requested, treatments performed, consultations with other medical specialties requested and/or relevant referrals to other Hospital services. as well as assessment of the health status of the professional.

The results of the workers who presented symptoms of Persistent COVID and who participated in the study of the EDPSSBC Health Surveillance Unit were analyzed. The variables considered were: age,

sex, professional category, results of surveys and tests, anthropometric data, analytical and physical examination results, complementary tests (electrocardiogram, spirometry, blood pressure), referrals to medical specialties and possible work impact.

The treatment and analysis of the data from the study project is carried out by health personnel from the EDPSSBC Health Surveillance Unit. Finally, an assessment of the worker's work aptitude was made considering the possible impact of Persistent COVID. To compare the results, the categories have been referenced: sex, age (in groups of 1-40 and >40) and professional category (grouped into care and non-care).

The incidence of the results and 95% confidence interval (95%CI) were calculated. Differences between variables were quantified using incidence rates, odds ratio (OR) and 95% CI. To calculate the demographic incidence rates, the population of Hospital workers and the values of the variables (COVID-19, Persistent COVID) detected respectively based on gender, age and professional group have been taken into account. To calculate the incidence rates of the clinical variables (results of tests, tests performed and physical examinations performed), the results obtained for each variable have been taken into account with respect to the total number of Persistent COVID surveys per 100.

To calculate the incidence rates of interhospital referrals, the number of referrals made to the different medical services has been expressed, with respect to the total number of referrals made multiplied by 100. Regarding the functional impact on work, the rate of incidence of occupational impairment of workers affected by Persistent COVID with respect to the total number of workers with Persistent COVID studied. To calculate the 95%CI, the Excel 365 statistical function was used for a Z

value of 1.96 and to calculate the OR, MedCalc Statistical Software version 20.210 (Med-Calc Software bv, Ostend, Belgium) was used; <https://www.medcalc.org>; 2020).

**BIOETHICAL COMMUNICATION**

Approval of the EDP Salut Sant Joan de Reus-Baix Camp Clinical Research Ethics Committee (IISPV Drug Research Ethics Committee), which considers that: -The necessary suitability requirements of the protocol are met in relation to the objectives of the study and the foreseeable risks and discomforts for the subject are justified. -The capacity of the researcher and the available means are appropriate to carry out the study. -The proposed waiver of consent for this study is accepted. -The scope of the planned economic compensation does not interfere with respect for ethical postulates. -This committee in its meeting dated 06/27/2023, minute number 006/2023, has evaluated and decided to issue a Favorable Report for the study to be carried out, and accepts that said study be carried out at: Hospital Universitari Sant Joan de Reus by GARCIA GRAU, MERCE of the Health Surveillance Unit as main researcher. (Code CEIm104/2023 final version: Version 002 date: 6/13/2023)

**RESULTS**

The EDPSSBC staff workers as of September 2022, who suffered from the COVID-19 disease in the study period were 398 workers out of a total of 2,120 workers, representing 18.77%. In the resulting data (Table 1), COVID-19 is observed in women with an incidence rate of 18.90% (CI95:16.98-20.83%); greater affectation in the age group under 40 years (rate of 22.12) (OR 1.50; CI95:1.21-1.87%) and in care workers (rate of 20.63) (OR 2.71; CI95:1.81-4.02%), versus non-care

TABLE 1  
DEMOGRAPHIC ASPECTS OF WORKERS AFFECTED BY COVID-19

INCIDENCE RATE		POPULATION	HEALTHY	COVID-19			Q	OR	IC95	
		Frequency No.	Frequency No.	Frequency No.	RATE %	IC95 %				
Gender	Women	1587	1287	300	18.90	16.98	20.83	0.7914	1.0347	(0.80 - 1.33)
	Men	533	435	98	18.39	15.10	21.68			
	Total	2120	1722	398	18.77	17.11	20.44			
Age (years)	17 to 40	990	771	219	22.12	19.54	24.71	0.0002	1.5091	(1.21-1.87)
	41 to >70	1130	951	179	15.84	13.71	17.97			
	Total	2120	1722	398	18.77	17.11	20.44			
	Half	37.96		35						
	Mode	30		26						
	Max	74		67						
	Min	17		19						
	Std Dev	12.5		12.31						
Professional Group	Assistance	1789	1420	369	20.63	18.75	22.50	<0.0001	2.7061	(1.81 -4.02)
	Non-Assistance	331	302	29	8.76	5.72	11.81			
	Total	2120	1722	398	18.77	17.11	20.44			

Thus, 158 workers (39.7%) also responded affirmatively to the Persistent COVID symptomatology screening surveys. Of those who responded to the screening surveys, 70 workers (44.30%) showed symptoms compatible with the definition of Persistent COVID (Table 2).

The incidence of Persistent COVID in the study population (Table 2) predominates in women at a

rate of 48.03%, with a higher rate of COVID-19 and response to screening; in the population over 40 years of age (rate 49.40%) (population with a greater response to screening and with the presence of previous pathologies that may influence the symptoms of Persistent COVID); and in the healthcare population (rate 44.37%), front-line personnel, with a higher response rate to screening.

TABLE 2  
DISTRIBUTION ACCORDING TO COVID-19 IN THE STUDY POPULATION, DATA FROM SURVEYS RECEIVED BY COVID SCREENING AND DATA ON PERSISTENT COVID IN THE PARTICIPANTS

Incidence rate		Healthcare workers	Workers with COVID-19	Surveys received			Surveyed workers with Persistent COVID				
				Frequency No.	RATE %	IC95 %	Frequency No.	RATE %	IC95 %		
Gender	Women	1587	300	127	42.33	33.74	50.93	61	48.03	39.34	56.72
	Men	533	98	31	31.63	15.26	48.00	9	29.03	13.05	45.01
	Total	2120	398	158	39.70	32.07	47.33	70	44.30	36.5	52.05
Age (Years)	17 to 40	990	219	75	34.25	23.51	44.99	29	38.67	20.94	56.39
	41 to >70	1130	179	83	46.37	35.64	57.10	41	49.40	34.09	64.70
	Total	2120	398	158	39.70	32.07	47.33	70	44.30	32.67	55.94
	Half	37.96	35	37.72		46.37	39.23				
	Mode	30	26	40				3	4		
	Max	74	67	67				64			
	Min	17	19	21				22			
	Stand. Dev.	12.5	12.31	11.79				12,13			
Professional group	Assistance	1789	389	142	38.48	30.48	48.49	63	44.37	32.10	56.63
	Non-Assistance	331	29	16	55.17	30.80	79.54	7	43.75	7.00	80.50
	Total	2120	398	158	39.70	32.07	47.33	70	44.30	32.67	55.94

Finally, 50 workers (71.42%) attended evaluation for PERSISTENT COVID in the Health Surveillance Unit (20 workers did not attend a medical appointment and were excluded from the study). In reference to the symptoms of Persistent COVID (table 3): workers reported sleep disorders 32% followed by memory loss or difficulty concentrating 30%, mood changes, sadness, crying or nervousness 28%, pain joint pain at rest 28%, feeling fatigue or tiredness in daily activities 24% and headache 22%. If we analyze the pathological results of the tests applied to the workers, we observe: post-COVID functional status assessment test 77.42% (although the majority indicate minimal or mild functional limitation), insomnia test and MOCA test (51.61%; CI95: 34.02-69.21%) in both respectively, followed by the pain test (45.16%; CI95: 27.64-62.68%) and quality of life, sleep and emotions. (45.16%; CI95:27.64-62.68%).

Of the tests carried out in the health examinations carried out (Table 3), the majority of workers present

alterations in the analytical parameters 94.59%, followed by a body mass index of Obesity in 45.16% and alterations ECG 22.58% (left bundle branch block, first degree atrioventricular block, left anterior hemiblock, extrasystole, tachycardia, sinus bradycardia and nonspecific repolarization alteration). The most significant laboratory analytical parameters detected are: Vitamin D deficiency 64.86%, dyslipidemia 51.35%, immunological parameters 40.54% (positive antinuclear antibodies and altered complement factors), followed by a decrease in iron/ferritin 24.32% and altered coagulation parameters 21.62%. The most relevant findings in the physical examination of the workers (Table 3) were musculoskeletal involvement of the spine in 73.08% and upper extremities: shoulders (tendonitis)30.77% as well as venous vascular insufficiency in lower extremities (venous insufficiency)38.46%, not solely attributable to the pathology of Persistent COVID.

TABLE 3  
CLINICAL VARIABLES

Persistent COVID survey results	Survey Frequency No.	Cases Frequency No.	Rate %	IC95 %
Joint pain at rest without inflammatory signs	50	14	28.00	15.55 40.45
Muscle pain at rest or during normal daily activities	50	9	18.00	7.35 28.65
Mood changes, sadness, crying, or nervousness	50	14	28.00	15.55 40.45
Diarrhea more than once a week	50	6	12.00	2.99 21.01
Difficulty falling asleep or frequent awakenings at night	50	16	32.00	19.07 44.93
Dyspnea without physical effort	50	8	16.00	5.84 26.16
Chest pain with breathing	50	3	6.00	-0.58 12.58
Fever, low-grade fever, or chills more than once a week	50	2	4.00	-1.43 9.43
Headache more than once a week or more than 15 days a month	50	11	22.00	10.52 33.48
Lack of taste or smell	50	7	14.00	4.38 23.62
Memory loss or difficulty concentrating	50	11	30.00	17.30 42.70
Feeling of fatigue or tiredness that prevents you from carrying out daily activities	50	12	24.00	12.16 35.84
Dry or unproductive cough more than once a week	50	10	20.00	8.91 31.09

  

Abnormal test results	Test Frequency No.	Cases Frequency No.	Rate %	IC95 %
Anxiety Scale (Hamilton)	31	4	12.90	1.10 24.70
Post-COVID Functional Status Test (PFCS)	31	24	77.42	62.70 92.14
Post-COVID Functional Status Test (PFCS) grade 1-2 (negligible and slight)	31	19	61.29	44.14 78.44
Post-COVID functional status (PFCS) grade 3 (moderate)	31	5	16.13	3.18 29.08
Post-COVID functional status (PFCS) grade 4 (severe)	31	0	0.00	0.00 0.00
Dyspnea test (dyspnea medical research-Mmrc)	31	5	16.13	3.18 29.08
Pain test (BPI)	31	14	45.16	27.64 62.68
Depression Scale Test (Hamilton)	31	4	12.90	1.10 24.70
Insomnia test (ISI)	31	16	51.61	34.02 69.21
MOCA test	31	16	51.61	34.02 69.21
Quality of life, sleep and emotions test (euroQol-5D test)	31	14	45.16	27.64 62.68
Fatigue Impact test (MFIS- Cognitui)	31	0	0.00	0.00 0.00
Fatigue Impact Test (MFIS- Physical Effort)	31	0	0.00	0.00 0.00
Fatigue Impact Test (MFIS-Psychosocial)	31	0	0.00	0.00 0.00
Fatigue impact test (MFIS-Total)	31	6	19.35	5.45 33.26

Test results	Evidence Frequency No.	Cases Frequency No.	Rate %	IC95 %	
Pathological ECG	31	7	22.58	7.88	37.30
Pathological spirometry: mild obstructive pattern	31	2	6.45	-2.20	15.10
BMI >30: Obesity	31	14	45.16	27.64	62.68
Arterial hypertension	31	4	12.90	1.10	24.70
Altered analytics	37	35	94.59	87.31	101.88
Immunological parameters	37	15	40.54	24.72	56.36
Immunological parameters: ANA POSITIVE	15	8	53.33	28.09	78.58
Immunological parameters: complement factor	15	7	46.67	21.42	71.91
Liver function	37	5	13.51	2.50	24.53
Renal function	37	4	10.81	0.81	20.82
Iron metabolism: decrease in iron/ferritin	37	9	24.32	10.50	38.15
Thyroid function	37	3	8.11	-0.69	16.90
Hyperglycemia	37	3	8.11	-0.69	16.90
Dyslipidemia	37	19	51.35	35.25	67.46
Calcium, Phosphorus or Vitamin D Metabolism: Vitamin D Deficiency	37	24	64.86	49.48	80.25
Coagulation	37	8	21.62	8.36	34.89
Acute phase reactants	37	7	18.92	6.30	31.54
Hematological	37	7	18.92	6.30	31.54
Axillary temperature	37	0	0.00	0.00	0.00
Oxygen saturation	37	0	0.00	0.00	0.00

  

Pathological physical examination results	Physical exploration Frequency No.	Cases Frequency No.	Rate %	IC95 %	
Spine: trapezius contracture (Cervicalgia and low back pain)	26	19	73.08	56.03	90.13
Upper extremities: shoulders (Tendinitis)	26	8	30.77	13.03	48.51
Superior limbs (Joint involvement in hands and fingers)	26	6	23.08	6.88	39.27
Respiratory (Bronchitis)	26	3	11.54	-0.74	23.82
Cardiac (murmurs, arrhythmia)	26	5	19.23	4.08	34.38
Abdominal (Abdominalgia)	26	3	11.54	-0.74	23.82
Vascular in lower extremities (Venous insufficiency)	26	10	38.46	19.76	57.16

Interhospital referrals were made (Table 4) mainly in the Cognitive Impairment Unit (Neurodegenerative) 34.62%, with a medical assessment that indicated “no significant impairment”; referrals to the Sports Medicine Unit 26.92% with symptomatic improvement in fatigue symptoms and improvement in functional capacity. To a lesser extent, referral to the Pulmonology Unit 7.69%.

**TABLE 4**  
**INTERHOSPITAL REFERRALS**

Medical specialties referrals	Derivation Frequency No.	Cases Frequency No.	Rate %	IC95 %
Pulmonology Referral	26	2	7.69	-2.55 17.94
Rheumatology Referral	26	1	3.85	-3.55 11.24
Digestology Derivation	26	1	3.85	-3.55 11.24
Sports Medicine Referral	26	7	26.92	9.87 43.97
Neurodegenerative bypass	26	9	34.62	16.33 52.90

The majority of the workers (90%) in the current study had a self-limiting COVID condition that allowed them to carry out the activities of their workplace (table 5). It must be taken into account that the workers assessed with Persistent COVID were actively working.

**TABLE 5**  
**WORK FUNCTIONAL IMPACT**

Assessment of persistent COVID work functional impairment	Fitness Frequency No.	Cases Frequency No.	Rate %	IC95 %
Self-limited Persistent COVID	50	45	90.00	81.68 98.32
Not assessable (incomplete study)	50	5	10.00	1.68 18.32

## DISCUSSION

The strengths of this study to consider would be the comprehensive assessment of the worker with Persistent COVID with information collection, medical health examinations, analytical and complementary tests and with an assessment of work capacity. The limitations in the study were a low participation of workers with COVID-19, to assess the symptoms of Persistent COVID. Some workers with COVID-19 did not participate in the study because they were in follow-up with other medical specialties for Persistent COVID, others because they were on temporary disability, and others did not complete all phases of the study. The active state of the COVID-19 pandemic must also be taken into account, which implied coinciding with the study of Persistent COVID, the care of new acute episodes of COVID-19 and its subsequent study of Persistent COVID.

The results of Persistent COVID obtained, with respect to gender (mostly female), are referenced to an initial population sample in number of female workers that tripled that of male workers, and a greater number of women with COVID-19 compared to the number of men. In similarity with other studies (28,29) where a predominance in women is also observed. Likewise, this research, like other studies, found a greater impact on older workers (28,29) who were more predisposed to getting sick and with the

presence of previous pathologies that could influence the manifestation of Persistent COVID.

Regarding the professional group, a greater impact of Persistent COVID was observed in healthcare workers (on the front line of health care, more exposed to Sars-CoV-2 infection in this period), versus non-care workers. The most prevalent Persistent COVID symptoms were: sleep impairment, memory loss, concentration difficulties, mood changes, arthralgias, fatigue and headache, observed in other Persistent COVID studies (30-33).

Regarding the results of the complementary tests, analytical alterations were observed, highlighting immunological parameters. The alterations in the electrocardiogram are nonspecific, not attributable to Persistent COVID exclusively. The findings in the physical examination of the study participants are not justified solely by the existence of Persistent COVID. The persistence of muscle involvement in the form of fatigue was observed in the study and treatment was prescribed in the Sports Medicine Unit. Through targeted physical exercise programs, significant improvements in symptoms were observed in the majority of workers, as in other studies (34).

The Persistent COVID symptoms observed in this study evolved favorably over time and with targeted guidelines for physical exercise and cognitive

rehabilitation, in the majority of our cases. In a minority, who are currently being monitored, some symptoms persist, without it being disabling at work (the workers are still active). Coinciding with other investigations (35,36)

The fact of having suffered the COVID-19 disease more than once improved the symptoms of Persistent COVID, in one case of the current investigation. It is expected that future research in the field of Persistent COVID will allow progress in the diagnosis, treatment and recovery of the disease.

## CONCLUSIONS

There was clinical involvement of Persistent COVID among the workers in the current investigation. They improved over time and after cognitive rehabilitation treatments in the Cognitive Impairment Unit and

regular physical exercise prescribed by the Sports Medicine Unit. The impact of Persistent COVID did not prevent the development of their work activity

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## CONFLICT OF INTERESTS

The authors declare that they have no conflicts of interest.

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