POST-COVID-19 SYNDROME – A NEW CHALLENGE WITH AN UNKNOWN END

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Abstract. *The long-term effects of SARS-CoV-2 infection (or the so-called post-COVID-19 syndrome) have a lasting physical, psycho-social and socioeconomic impact on survivors and their relatives and especially among some specific work groups (e.g. health workers). Concomittant chronic diseases (obesity, hypertension, diabetes mellitus and respiratory disorders) also affect patients' ability to work and their return to work. Globally, between 30% and 50% of those infected with COVID-19 experience long-term symptoms of COVID (long Covid, LC), with over 85% of patients of working age. Various author collectives report that symptoms of long-term COVID (a total of 203 of which the most frequent are dyspnea on exertion and at rest, fatigue, cognitive dysfunction, asthenia, arthralgias and myalgias, sleep disorders, cough), which can last up to 9 and more months after an infection, hinder and delay the return to work (RTW), reduce the patients' ability to work, force them to return to work with restrictions (reduced working hours, changed duties at the workplace, etc.), to change their job or lose it. Returning to work after a post-critical illness is often delayed or does not occur at all, causing an impact on the overall quality of life among survivors and their families (the so-called „family syndrome"). Some patients (especially those who have had severe COVID or have been hospitalized in an intensive care unit) are forced to take periodic sick leave and delay their return to work for at least 5 weeks from the onset of symptoms of COVID-19, such as the main cause is fatigue or weakness. Social functioning was assessed as impaired, as up to 90% of survivors did not reach their functional level 6 months after intensive care unit (ICU) discharge. Differences in return to work are based on mean age of patients (better outcomes are seen in younger patients), country (presenteeism is common in China, where the best RTW outcomes have been reported) and social policy (not all US employees are entitled to paid sick leave). A large proportion of patients (up to 64.4%) reported moderate to severe financial difficulties and an inability to cover the costs of research or treatment. Some authors recommend specific rehabilitation for patients after acute COVID-19 to restore physical and neuropsychological performance and to improve performance. Patients have better outcomes following an integrative health approach that combines traditional medical treatment, non-pharmacological treatments including physical therapy, and behavioral and lifestyle changes.*

Key words: *post-COVID-19 syndrome, ability to work, return to work (RTW)*

Introduction

In the last two years, a new nosological unit was formed – the so-called post-COVID-19 syndrome, which has a lasting physical, psycho-social, as well as socioeconomic impact on society [1-23]. Among the most frequently reported symptoms reported by multiple authors' collectives are: astheno-adynamia, polyarthralgias, polymyalgias, dyspnea during physical exertion, cough with or without expectoration, fatigue, impaired concentration, as well as reduced work capacity [10-38]. Numerous editorials and reports from international associations and agencies [4, 39-41] emphasized the importance of occupational health research in the prevention and management of COVID-19 [7]. Research has focused on specific occupational groups with a high prevalence of COVID-19, particularly health care workers, and has examined associations between exposure to SARS-CoV-2 and the incidence of COVID-19 among workers. Return to work (RTW) after severe COVID-19 is a topic of increasing importance [7-9].

Return to work (RTW) and work factors associated with the post-COVID condition have been studied in small groups of workers and found that reduced work ability is associated with previous comorbidities, fatigue symptoms, and some occupational and organizational work factors [10, 28, 30, 42].

Comorbid chronic diseases (obesity, hypertension, and respiratory disorders) were associated with later return to work (RTW) among healthcare workers hospitalized for COVID-19. Dyspnea on exertion (86.8%), asthenia (86.8%), arthralgias and myalgias (71.7%), sleep disorders (64.2%), dyspnea at rest (62.3%), cough (56.6%) are among the most frequent symptoms associated with prolonged absence from work (> 3 months) described in 56 healthcare workers. In the study by Mendola et al. 58.7% of patients return to work with limitations [30].

Certain types of work and sectors of activity are also associated with RTW outcomes. For example, in a small Italian study among 427 healthcare workers, doctors had better physical and mental health status and better RTW scores than nurses and healthcare assistants [10].

Globally, between 30% and 50% of those infected with COVID-19 experience persistent symptoms of COVID (LC) that challenge return to work (RTW). Brehon et al. conducted a cohort study of 81 workers (most of whom were female (n = 52, 64%)) and from health-related occupations (n = 43, 53%) undergoing specific rehabilitation for post-COVID-19 conditions. The authors reported slight improvements in various symptoms, although only half of the participants were able to return to work.Of all patients, only 43 (53%) returned to work at program discharge, as 40 (93%) returned to modified duties [28].

Patients with prolonged COVID-19 often have to wait at least 3 months to access rehabilitation programs, which leads to worse RTW outcomes [7].

Post-COVID-19 syndrome – literature summary

A study combining individual interviews and online forum discussions was conducted in early 2021 as part of a larger mixed-method study on the needs of long-term COVID patients in Belgium. One hundred and thirty-four people participating in the study described various clinical symptoms preventing their return to work. Changing work duties improves RTW, while skeptical reactions from employers and colleagues and lack of support from the welfare system complicate return to work [42].

In 2023, in the UK, around 2 million people self-reported long-term COVID, with over 85% being of working age [18]. Data from Long Covid Support and the Trades Union Congress (TUC) on 2 January summarized that eight in 10 respondents had experienced feeling unwell after exertion (physical or mental exertion), which could mean these people would limit their activities or need from additional periods of rest or sick leave. Six out of 10 respondents had significant limitations in carrying out normal daily activities. One in 25 have been forced to take extra unpaid leave as a result of prolonged Covid. Half of those surveyed admit they have had to use their savings to support themselves financially. At the time of the survey, 214 people (7%) were unemployed as of March 2020 [18].

Aben et al. conducted a survey of employees who reported illness due to COVID-19 (N = 30,396) or flu-like symptoms not due to COVID-19 (N = 15,862) using routinely collected data from the Dutch National Health Service. RTW after COVID-19 was found to be significantly later than after flu-like symptoms (median 10 days for COVID and 6 days for flu). On average, 5.5% of employees who contracted COVID-19 were absent for more than 12 weeks. Older age, female gender, co-morbidities (including chronic, compromised immune system, diabetes and obesity) and symptoms of shortness of breath and fatigue are among the main factors for worse RTW results. Although there is a 100% RTW three months after influenza-like syndrome, the RTW rate after COVID-19 is only 92.8%. Other potential predictors (working conditions and workplace factors, economic context, resources, personal factors and lifestyle) have not been comprehensively addressed and understanding the causal relationship between these factors and the identified outcomes is difficult. The authors also emphasize that the time to RTW varies as different variants of the virus become dominant over time. For example, 12.8% of employees who contracted COVID-19 were absent from work for more than 12 weeks during the dominant period of the alpha virus, but this number decreased to 5.8% in the dominant period of the delta virus and up to 1.4% in the dominant period of the omicron virus [12].

Müller et al. conducted an observational cohort study in post-acute patients with a recognized occupational disease of COVID-19 or as a work-related accident and assessed the long-term effects of the disease on the physical and neuropsychological health, as well as the daily activities and work capacity of the affected insured persons. The authors speak of „Occupationally Acquired COVID-19“ (OAC) and recommend specific rehabilitation for patients after acute COVID-19 to restore physical and neuropsychological work capacity and to improve work capacity [13].

Davis et al. conducted an online survey of people with suspected SARS-CoV2 infection and confirmed COVID-19 disseminated through COVID-19 support groups (e.g. Body Politic, Long COVID Support Group, Long Haul COVID Fighters) and social media (e.g. Twitter, Facebook). Data were collected from September 6, 2020 to November 25, 2020. Responses from 3,762 participants with confirmed (diagnosis/antibody positive; 1,020) or suspected (diagnosis/antibody negative or not tested; 2,742) COVID-19 were evaluated, from 56 countries, with illness lasting more than 28 days and beginning before June 2020. The prevalence of 203 symptoms in 10 organ systems was calculated, and 66 symptoms were tracked over a seven-month period. An assessment of the impact on the life, work and return to baseline health of the respondents was made. For over 91% of respondents, the recovery time exceeds 35 weeks. The most common symptoms after 6 months are fatigue, post-exercise malaise and cognitive dysfunction. About 45.2% (1,700 respondents) needed a reduced work schedule compared to before the illness, and 22.3% (839 respondents) did not work during the survey due to illness [14].

Hodgson et al. in a nationally representative, multicenter, prospective cohort study determined mortality or new disability within 6 months among critically ill patients with COVID-19. A total of 212 patients from 30 hospitals were included in the study. The median age was 61 (51-70) years, and 124 (58.5%) patients were male. At month 6, 43/160 (26.9%) patients had died and 42/108 (38.9%) survivors reported a new injury. Thirteen (11.4%) survivors did not return to work due to poor health. At 6 months, 82 of 115 (71.3%) patients reported persistent symptoms. In conclusion, six months after critical illness from COVID-19, patient mortality and new-onset disability were significant. Over a third of survivors had a new disability [8].

Wulf Hanson et al. estimate (by country and territory) the number of patients affected by prolonged COVID in 2020 and 2021, the severity of their symptoms and the expected pattern of recovery. Globally, 144.7 million people (95%) had one or more of three clusters of symptoms (fatigue in 51%; cognitive problems in 60.4% and ongoing respiratory problems in 35.4%) of prolonged COVID three months after infection, with most cases occurring in patients with milder infections. Those with milder cases of acute COVID-19 had a faster estimated recovery (median duration about 4 months) than those admitted for acute infection (median duration about 9 months). One year after infection, 15.1% continued to experience symptoms of prolonged COVID. A significant number of people with prolonged COVID need rehabilitative care and support to transition back into work or education when symptoms begin to subside [26].

As reported in the Swedish study by Palstam et al. 11,955 people were subject to recurring sick leave due to COVID-19. A total of 242 people (2.0%) took intermittent sick leave due to COVID-19, and of these, 136 (56.2%) remained on sick leave until the end of follow-up. Patients (with repeated sick leave) were older and more often female. Repeated periods of sick leave may be due to persistent symptoms or the onset of new symptoms after COVID-19, or to returning to work with reduced work capacity. Sick leave and work ability are closely related to an individual‘s occupation and type of work, which are unknown characteristics in this cohort. A longer follow-up period is needed to capture long-term patterns of sick leave due to COVID-19 [43].

Sanchez-Ramirez et al. present a review of data extracted from 24 articles that reported information on a total of 5,323 adults following COVID-19 infection between 3 and 6 months after symptom onset or hospital discharge. The mean age of the patients was 55.2 ± 8.1 years, and 56% were male. Severe illness due to COVID-19 (pneumonia, serious or critical illness, need for hospitalization, intensive care unit care,

use of supplemental oxygen, etc.) was reported in approximately 36% of the cohort at baseline. CT changes (59%), abnormal pulmonary function (39%) and reduced functional capacity (36%) were reported, and the most common symptoms were fatigue (38%), dyspnea (32%), chest pain/tightness (16%), cough (13%) with expectoration (12%) or sore throat (4%). Although an average of 8 out of 10 patients returned to work or reported no work impairment, patients may experience reduced quality of life for up to 6 months after infection [16].

According to Cellai, et al. 61.5% of patients delayed their return to work at least 5 weeks after the onset of symptoms of COVID-19, the main reason being fatigue or weakness [31]. Halpin et al. described differences between patients hospitalized in a hospital and those in an intensive care unit: patients who returned to the same level of employment were 14 (for the hospitalized) and 2 (for the group admitted to the intensive care unit), respectively; part-time are 2 (for intensive care patients); sickness absence was observed more often in patients admitted to the intensive care unit than in those hospitalized in the hospital (12:3 for patients in intensive care:hospitalized); released from work are 2 (for those hospitalized) and 4 (for patients in intensive care); retired 1 (for patients in the ward) [17].

Garrigues et al. prospectively followed 120 patients (96 hospitalized and 24 admitted to the intensive care unit) after a mean of 110.9 (± 11.1) days from discharge. The most commonly reported persistent symptoms were fatigue (55%), dyspnea (42%), memory loss (34%), concentration (28%) and sleep disturbances (30.8%). Before infection with COVID-19, 56 (46.7%) were actively working and 39 patients were active in sports. Of those actively working, only 38 (69.1%) returned to work, with a reduced number of returners among ICU patients (46.7% for ICU admissions vs. 77.5% for hospitalized). Out of 39 patients – 28 (71.8%) were able to resume their physical activity. However, 18 (46%) of them remained with reduced working capacity [32].

Jacobson et al. conducted a prospective cohort study. The most common persistent symptoms of prolonged COVID are fatigue, hyposmia/dysgeusia, dyspnea, arthralgias, and myalgias. As of November 2020, 118 patients had a follow-up visit an average of 119.3 days (four months) after the initial diagnosis of COVID-19. Twenty-two (18.6%) were hospitalized for a mean of 7.5 days; of these, 11 (55%) were admitted to the intensive care unit and 6 (27%) were intubated. Hospitalized patients were older and had more comorbidities than non-hospitalized patients. At the onset of COVID-19, the most common symptoms were fatigue (85.6%), cough (74.6%), loss of taste/smell (74.6%), and fever/chills (62.7%) . Fever and chills and dyspnea were more common symptoms in hospitalized patients than in non-hospitalized patients. At month 3 post-COVID-19, 81.8% of hospitalized and 64.2% of non-hospitalized patients had residual symptoms: fatigue and dyspnea. Older age and hospitalization are associated with higher odds of post-Covid symptoms. Of those working, 11.5% missed work and 38.9% reported reduced work capacity due to health reasons. Half of all patients (including those not working) report health-related impairments in daily activities [33].

In summary, patients who recover from COVID-19 often have residual impairments, both in laboratory parameters and functional scales, indicating that recovery (especially in intensive care unit (ICU) patients) may not be without complications and to have lasting effects [16]. Patients have better outcomes following an integrative health approach that combines traditional medical treatment, non-pharmacological treatments including physical therapy, and behavioral and lifestyle changes [44, 45].

A systematic review (Gualano, Rossi, et al.) assessed the impact of persistent symptoms or impairment of COVID-19 on the working population after their return to work. The authors highlight the post-COVID-19 condition as a growing problem in occupational medicine, with consequences for workers‘ quality of life and productivity [9]. According to the American Academy of Physical Medicine and Rehabilitation, about 23,689,349 million Americans are living with a long-term condition of COVID-19, accounting for about 30% of survivors [9]. Seven of the included studies reported residual difficulty returning to work [19-,33, 36, 46], at both two- and six-month follow-ups, highlighting how residual disability was present in some of the workers even after returning to work at least several months after

recovering from COVID-19, affecting their ability to perform the same duties as before or lead to a limitation of working hours. These results highlight the impact of post-COVID-19 syndrome not only on return to work, but also on the ability to perform the same job as before, months after the underlying illness. Differences were observed between patients hospitalized and those admitted to the ICU, with a higher return-to-work rate for hospitalized patients compared to those with an ICU stay. Differences in return to work based on country also exist. The highest rate of return to work after 3 months was reported in China (100% return to work in Zhao YM's study and 90.8% in Liang L's study, respectively) [37,3 8]. In the US, return to work was 57.9% in the Robinson-Lane SG study [19] and 44.6% in Chopra V's study [20] at a two-month follow-up of the patients. In Europe, return to work is higher in France (75.6% for hospitalized patients and 46.7% for ICU patients) [32] and Finland (77.5%) [36], but it is lower in Italy (28.6% [21] at 2 months and 60.0% [46] at 6 months), and the lowest rate of return to work was found in the Dutch study (only 10% of workers returned to work after 6 months) [22].

Many studies have highlighted that presenteeism (i.e. working while sick) is common among Chinese workers [47-49]. The high rate of return to work in the US can be influenced by the health care system [50], as well as the fact that not all employees are entitled to paid sick leave (27% of 193 UN member states do not guarantee paid sick leave from the first day of illness) [51, 52].

Differences were also observed in the mean age of patients included in the studies: the two Chinese studies had the lowest mean age (47.74 for Zhao et al. and 41.3 for Liang et al.). For the rest, the average age is between 50 and 65 years [9].

Robinson-Lane et al. conducted a cross-sectional study of 2,217 adult patients in Michigan between March 16, 2020, and July 1, 2020, to assess clinical, financial, and psychological outcomes two months after recovering from COVID-19. Hospitalization and mortality rates vary by ethnicity, age, and comorbidities. A significant number of patients were rehospitalized (n = 262, 11.8%), remained in extended care facilities such as nursing homes (n = 74, 3.3%), or died (n = 288, 13%)). Some patients were unable to return to work due to health problems in the 60 days after hospitalization (n = 59, 9.8%). Black patients had the longest return-to-work delays (35.5 days on average), while Hispanic patients had the shortest delays (10.5 days on average). The majority of deaths after discharge were among white patients (n = 153, 21.5%), most of whom were discharged for palliative care (n = 103). About 64.6% (n = 86) reported moderate to severe financial effects, using all or most of their savings (n = 47, 81.0%) or were unable to cover the costs of necessary treatment (n = 31, 91.2%). Only 6% of participants sought care after discharge for any mental health problems (such as depression or anxiety). A total of 108 patients (17.9%) reported not attending follow-up physician visits in the 60 days after discharge. More than half (64.8%) of patients who did not receive follow-up care were black (n = 65, 60.2%) or Hispanic (n = 5, 4.6%), while white patients accounted for 26, 9% of the group (n = 29) [19].

Chopra et al. conducted a 60-day observational cohort study on the clinical, financial, and psychological outcomes of post-discharge patients with COVID-19 (discharged between March 16 and July 1, 2020) in Michigan. Of the 1,250 patients, 975 (78.0%) discharged alive went home, while 158 (12.6%) were transferred to a skilled nursing facility or rehabilitation facility. By 60 days after discharge, another 84 patients (6.7% of hospital survivors and 10.4% of ICU survivors) had died. Within 60 days of discharge, 189 patients (15.1% of hospital survivors) were readmitted. Of patients alive 60 days after discharge, 488 (41.8%) responded to the telephone survey. Of these, 265 reported seeing a doctor within 2 weeks [20]. Cardiopulmonary symptoms (such as cough and dyspnea) were reported by 159 patients, including 92 with new or worsening symptoms and 65 with persistent loss of taste or smell. Fifty-eight patients reported new or worsening difficulties in performing daily activities. Among 195 patients who were employed before hospitalization, 117 returned to work, while 78 could not because of ongoing health problems or job loss. Of the 117 patients who returned to work, 30 reported reduced hours or changed duties due to health reasons. Almost half of all patients (238 of 488) reported being emotionally affected by their health, and 28 sought mental health care after

discharge. Of those surveyed, 179 patients reported at least a slight financial impact from their hospitalization, with 47 reporting using most or all of their savings and 35 allocating expenses to food, utility bills, housing or medicine [20].

Monti et al. conducted a prospective follow-up study of patients admitted to intensive care units (ICU) [21]. Overall survival was 65/116 patients (56%). Of these, 39 patients were followed for an average of 61 days. Only one patient (1/39) had cognitive decline. The majority of patients reported no difficulty with walking (32/35; 82%), self-care (33/39; 85%) and usual activities (30/39; 78%). Some patients were either malnourished (15/39; 38%) or at risk of malnutrition (24/39; 62%). Dyspnea on exertion was present in 20/39 (51%) patients. About 49% (19/39) reported changes in smell and/or taste before or after hospitalization. Most patients were male (35/39; 90%) of working age (mean age 56 ± 10.5 years; six patients > 70 years). Twenty-eight (72%) were employed, two patients (5.1%) were smokers, and the most common comorbidity was hypertension (49%). Patients were on mechanical ventilation for a mean of 9 (6-14) days. The average length of stay in the intensive care unit was 10 (7-16) days, while the total hospital stay was 30 days. Before the onset of the disease, 28 patients (72%) were working. Two months after discharge, despite a good recovery, only eight patients (21%) had returned to their usual work, while one patient (2.6%) had returned to work with different tasks due to the disease. Eleven patients (28%) were unemployed or retired before the COVID-19 illness, and 19 patients (49%) were not working (during the follow-up period) for reasons related to the COVID-19 illness [21].

Another author collective – Zhao et al. conducted a retrospective multicenter cohort study [37]. Of the 55 patients (including 4 mild (7.27%), 47 moderate (85.45%) and 4 severe (7.27%) cases), 39 had residual abnormalities on chest CT scan and 14 had normal CT image. The patients were followed for a period of 64 to 93 days after discharge from the hospitals. The mean age of the patients was 47.74. Of them, 41.82% are women. Comorbidities were present in 9 patients (16.36%), while in two patients (3.64%) they were 2 or more. The most common comorbidities were hypertension (6 cases, 10.91%), diabetes mellitus (2 cases, 3.64%), and cardiovascular disease (2 cases, 3.64%). The mean body mass index of the group was 24.62 ± 3.31. Only 4 patients were smokers. After 3 months, gastrointestinal symptoms (30.91%), headache (18.18%), fatigue (16.36%), dyspnea on exertion (14.55%), as well as cough and sputum (1.81%) were observed. Six patients had olfactory and gustatory dysfunctions during the infection period, of whom two still had a reduced sense of taste during the follow-up period. Of the cases with abnormal CT findings, 12 patients (30.77%) had an abnormality in lung function. In 2 of 14 cases (12.50%) with a normal CT scan, abnormal pulmonary function was detected. The overall rate of residual pulmonary function abnormalities in the followed patients (with or without CT changes) three months after discharge was 25.45%. All 55 patients returned to their original work [37].

Liang et al. conducted a prospective observational 3-month follow-up study that evaluated symptoms, dynamic changes of severe SARS-CoV-2, IgG and IgM, lung function, and high-resolution computed tomography (HRCT) of COVID-19 survivors after discharge from the Wuhan Union Hospital, China. All 76 survivors (of whom 55 were women) were of working age (mean age 41.3 ± 13.8 years). Of them, 65 (86%) are healthcare workers. Seven (9%) survivors were admitted to the intensive care unit (ICU). The average length of hospitalization was 17 days. A total of 69 (91%) patients had returned to their original job 3 months after discharge. Most of the survivors had residual symptoms, including fever, sputum production, fatigue, diarrhea, dyspnea, cough, chest tightness on exertion, and palpitations. 42% of survivors had mild pulmonary function abnormalities at 3 months after discharge [38].

Similar results were reported by Lindahl et al., who conducted a prospective clinical observational study (between September and October 2020) in hospitalized adult patients (between March 1 and June 24) with laboratory-confirmed SARS-CoV-2 infection from March to June 2020 d. The study included demographic data, comorbidities, ten specific symptoms, and a quality of life questionnaire (RAND-36) six months after discharge. A total of 101 patients (of whom 54 men), with a mean age of 60 years and a mean

length of hospital stay of 15 days were included in the study. One or more comorbidities were found in 70 patients (69%), with the three most common being hypertension (42, 42%), asthma (19, 19%), and hyperlipidemia (19, 19%). Asthma is more common in women. Rheumatoid arthritis is found only in women, and neurological diseases – only in men. Gender differences were observed: women had shorter hospital stays (median 12 days) and lower peak supplemental oxygen flow (7 L/min), lower peak CRP values, but more often reported dyspnea, fatigue, sleep problems, and mood swings, and rated their quality of life as lower on all eight indicators from the questionnaire [36]. Five main indicators of reduced quality of life were identified: older age, female sex, higher BMI, comorbidities (sleep apnea) and need for oxygen therapy (74%), intensive care unit admission (34%) or need from mechanical ventilation (23%). Of the 63 patients (62%) who were working full-time before COVID-19, 52 (83%) returned to work full-time, four (6%) part-time and seven (11%) have not returned to work six months after discharge from hospital. Those who did not return to work had a median age of 57 years (56-73 years). Eight (8%) reported working part-time before COVID-19, three of whom returned to work part-time, three did not respond, and two did not return to work. Most patients had symptoms six months after hospital discharge. Ninety-one patients (90%) reported one or more symptoms at six months: fatigue (88%), sleep problems (76%), dyspnea (70%), and cough (61%). Symptom severity was mild in 78% and severe in 22% of patients. However, 45% reported one or more severe symptoms, with patients reporting two (7%), three (8%), four (12%), and five or more severe symptoms (6%). Only 6% of patients reported no symptoms at six months, and 4% did not respond [36].

Carenzo et al. in a single-center, prospective case series described rates of return to work in patients hospitalized in the intensive care unit. Of 101 patients with laboratory-confirmed COVID-19 disease admitted to the intensive care unit between March 1, 2020 and June 30, 2020, 25 died, 76 were discharged. Seventy-one of the discharged patients were interviewed 6 months after discharge. Forty-five (63%) were working prior to the COVID-19 (of these, 40 (89%) were full-time). Thirty-three (73%) had returned to work within 6 months, 10 (22%) were unemployed, and 2 (5%) were recently retired. Among those who returned to work, 20 (85%) reported reduced work performance. Those who did not return to work were either still on sick leave or lost their jobs as a result of COVID-19. The quality of life of those who did not return to work was worse than that of those who did [46].

Another collective of authors – van Veenendaal et al. conducted a single-center three- and six-month prospective cohort study among survivors of COVID-19 admitted to an intensive care unit between March 19 and September 30, 2020, and their family members. The average length of stay in the intensive care unit was 19.4 days, of which 16.3 days were on mechanical ventilation. About half of the patients with COVID-19 suffered from delirium during their stay in the intensive care unit. The average age of the patients was 56 years. Of the 73 (78%) surviving patients, 60 (82%) participated in the 3-month assessment questionnaire and 50 (68%) in the 6-month questionnaire. Of a total of 102 family members of survivors (partner, son/daughter, brother/sister, parents), 78 (76%) and 67 (66%) participants completed the questionnaire at 3 and 6 months, respectively. Ninety percent of patients reported persistent symptoms (fatigue, malaise, and polyneuropathy) 6 months after ICU discharge [22]. Of the working patients (30 patients), 3 patients (10%) returned to work without change, 4 had reduced working hours (13%), 3 changed professions (10%), 4 reintegrated (13%), 13 are defined as too sick to work (43%), 3 (10%) do not give an answer. Social functioning was assessed as impaired, as 90% of survivors did not reach their functional level 6 months after ICU discharge. Family members also had poorer employment status. One-third of participants had not fully returned to work at 3 and 6 months. Of the 40 family members working before their relative was admitted to the intensive care unit, 26 (65%) had returned to work fully after three months, 1 (3%) had reduced working hours, 2 (5%) had changed occupation , 5 (13%) are reintegrating, 4 (10%) are not returning to work, 1 (3%) has lost their job, 1 (3%) is not returning. At the sixth month, of 36 working participants, 23 (64%) had fully returned to work without change, 5 (14%) were working reduced hours, 1 (3%) was changing occupations, 4 (11%) were reintegrat-

ing, 3 (8%) do not give an answer. The average rate of work for family members decreased by 18.3% (at the third month) and 7.7% (at the sixth month). Of the participants, 34% rated their work status as deteriorated, and 63% reported continued deterioration of well-being due to the COVID-19-related mandatory physical distance from their relatives (the hospitalized). Study participants suffered from symptoms such as anxiety, depression, post-traumatic stress disorder (PTSD) and reduced quality of life (QoL). This phenomenon is known as post-intensive care family syndrome (PICS-F) [22].

Return to work after post-critical illness is often delayed (33% at 3 months, 55% at 6 months and 56% at 12 months) or does not occur at all, impacting overall quality of life among survivors (McPeake J et al.) [53]. Existing comorbidities are a potential risk factor for delayed return to work. The so-called „family syndrome“ may also be the cause of poorer return-to-work outcomes.

Conclusion

Globally, between 30% and 50% of those infected with COVID-19 experience prolonged symptoms of COVID (long Covid, LC) up to three months after infection. The long-term consequences are immeasurable for the affected individuals and their families, for the economy, public health, healthcare and the health insurance system. The present review showed that a significant proportion of the active working population worldwide may have physical, psychological and cognitive consequences that lead to functional impairment, temporary or permanent incapacity and/or disability, delayed return to work or return to work with limitations (reduced working hours, changed duties at the workplace, etc.) and to significant economic costs (for the victims and for the state). Recognizing the disease and its long-term effects as occupationally acquired is associated with greater worker compensatory benefits and financial security, which in turn would contribute to better RTW outcomes. Returning to work after post-critical illness is often delayed or does not occur at all, impacting the overall quality of life of survivors.

Table 1. Summarizes data from various authors regarding the work capacity of patients who survived COVID-19

Author	Number of patients	Tracking period	Patients (M/F)	Age
Mendola et al. [30]	56 health workers	18 months (from March 2020)	-	-
Long Covid Support and TUC [18]	3097 respondents	September 14 to November 1, 2022	21/100 men and 76/100 women	5% are under the age of 35, 83% are between the ages of 36 and 65 and just under 2% are over 65
Sansone D et al. [27]	247 patients (hospitalized between December 8, 2020 and April 6, 2021)	15-month follow-up	88 (35.6%) men and 159 women.	Of working age (i.e. 14-67 years, according to Italian law). The mean age of the study participants was 48.1 ± 10.5 years.
Grazzini M et al. [10]	427 healthcare workers (who were infected with COVID-19 from March 2020 to April 2021)	3 months after recovery	143 men (33.5%) and 284 women (66.5%)	Average age 45 (45.6 for men, 45.2 for women)
Brehon K et al. [28]	81 workers (43 from health-related occupations (53%)) contracted COVID-19 between March 2020 and mid-May 2021.	Released from the program before the start of January 2022.	Women (n = 52, 64%)	Mean age 48.9 (10.5) years
Kohn L et al. [42]	134 patients	Early 2021	-	-
Aben et al. [12]	30,396 with COVID and 15,862 with influenza	March 19, 2020 – March 18, 2022, with tracking until October 24, 2022.	-	-

Symptoms / Intensive care unit (ICU) admission	Return to work (RTW)	Something else	Finance
Dyspnea on exertion (86.8%), asthenia (86.8%), arthromyalgia (71.7%), sleep disorders (64.2%), dyspnea at rest (62.3%), cough (56, 6%)	absence from work (> 3 months); 58.7% return to work with limitations.	Accompanying chronic diseases (obesity, hypertension and respiratory disorders)	-
92% had long-term Covid symptoms: fatigue (96%), cognitive dysfunction (84%), shortness of breath or difficulty breathing (73%), sleep problems (65%), memory loss (63%), palpitations (60%), dizziness (57%), digestive problems (53%), muscle pain (60%), headache (60%), joint pain (58%) and chest pain (50%), mental stress and anxiety symptoms (50%), mood swings (40%) and depression (37%), tingling and tingling (44%), noise or pain in the ears (41%), cough (38%), sore throat (36%), loss of smell (34%) and taste (30%), dermatological symptoms (31%), vision problems (30%), fever or intermittent fever (25%), menstrual changes (25%), postexercise malaise (86%), significant (63%) and mild (33%) limitations while performing normal daily activities, About 60% percent of respondents had symptoms for more than a year.	One in 25 have been forced to take extra unpaid leave as a result of prolonged Covid. At the time of the survey, 214 people (7%) were unemployed as of March 2020.	14% lost their job due to illness-related reasons; 66% are subject to unfair treatment at the workplace; 16% were the target of workplace harassment; 8 per cent have been threatened with disciplinary action and 23 per cent have been questioned by their employer about symptoms of prolonged Covid. 49% believe they contracted Covid-19 at work. 32% worry about negative attitudes in the workplace.	50% admit they need to use their savings to support themselves financially; 6% took out a loan
fatigue (80.2%), shortness of breath (69.6%), lack of concentration (44.9%), headache (44.9%), myalgia (44.1%), arthralgia (43.3%) and anosmia (42.1%)	75% of patients returned to their pre-COVID-19 baseline status, although 33.2% reported some degree of disability.	women have a greater self-reported decrease in work ability. Symptoms related to prolonged COVID were more likely in older patients with preexisting comorbidities (43.7% had comorbidities).	-
33.8% reported multiple residual symptoms: pain (21%) and asthenia (14%), impaired smell and/or taste (20%), difficulty breathing (19%), brain fog (8%), gastrointestinal disorders (7%), cough (5%), headache (5%), eye disorders (5%), other (paresthesias, skin disorders, anxiety/ uncertainty, loss of appetite, melancholia, extrasystoles or tachycardia, dizziness, hair loss or upper respiratory tract irritation (12%)), 37.2% reported a change in sleep pattern (insomnia in 83.4%; excessive daytime sleepiness in 11.5%, both in 3.2%)	79.5% reported no changes in their relationships with colleagues. For 6.1% their relationship has improved and for 4.7% their relationship has worsened. 68.3% reported no changes in workload, 15% reported an increase and 7.7% a decrease in workload.	women, older workers, and healthcare assistants were more likely to report persistent symptoms. Nurses reported increased workload and poorer relationships. At 3 months post-infection, they have worse physical and mental health status	-
-	Only 43 (53%) returned to work on discharge, with 40 (93%) returning to changed duties.	Modest improvements in various symptoms after specific therapy	-
various clinical symptoms	-	Changing work duties improves RTW, while skeptical reactions from employers and colleagues and lack of support from the welfare system complicate return to work.	-
-	RTW after COVID-19 is significantly later than after flu-like symptoms (median 10 days for COVID and 6 days for flu). On average, 5.5% of employees who contracted COVID-19 were absent for more than 12 weeks. Although there is a 100% RTW three months after influenza-like syndrome, the RTW rate after COVID-19 is only 92.8%.	Older age, female gender, co-morbidities (including chronic, compromised immune system, diabetes and obesity) and symptoms of shortness of breath and fatigue are among the main factors for worse RTW results. Different variants of the virus become dominant over time, which changes the RTW results. For example, 12.8% of employees who contracted COVID-19 were absent from work for more than 12 weeks during the dominant period of the alpha virus, but this number decreased to 5.8% in the dominant period of the delta virus and up to 1.4% in the dominant period of the omicron virus.	-

Continuation of Table 1

Davis HE et al. [14]	3762 participants	6 September 2020 to 25 November 2020	Women (78.9%)	aged between 30 and 60 years (33.7% aged 40-49 years, 27.1% aged 50-59 years, 26.1% aged 30-39 years).
Hodgson CL et al. [8]	160 patients admitted to intensive care unit and followed for 6 months	March 6, 2020 to October 4, 2020 with follow-up on April 21, 2021.	124 (58.5%) patients were male	The mean age was 61 (51-70) years
Wulf Hanson S et al. [26]	-	2020 and 2021	-	-
Palstam et al. [43]	11,955 people from March 1 to August 31, 2020. The follow-up period is 4 months (122 days) from the start of sick leave.	Women (59.6%)	Average age 48 years.	-
Liao et al. [15]	303 hospitalized healthcare workers, one year after discharge (98 (32.34%) were physicians, 162 (53.47%) were nurses, and 43 (14.19%) were healthcare assistants	59 (19.47%) were male and 244 (80.53%) female.	Average age 39 years (33-48 years)	-
Sanchez-Ramirez D.C. et al. [16]	5323 adults 3 to 6 months after the onset of symptoms or discharge from the hospital	56% are men	The mean age of the patients was 55.2 ± 8.1 years	-
Cellai M et al. [31]	496 patients (of whom 26 were with long-term COVID) March 24 and May 26, 2020 with 6-month follow-up	Women (76.9%)	Median age was 47.5 (23-78) years.	-
Halpin S.J. et al. [17]	100 survivors 4 to 8 weeks after discharge (32 in ICU and 68 hospitalized)	Women 33 (48.5) in intensive care and 13 (40.6) in the ward; men 35 (51.5) in intensive care and 19 (59.4) in the ward	Median age 70.5 years (20-93) for ICU patients and 58.5 years (34-84) for hospitalized patients	-

203 symptoms in 10 organ systems and 66 symptoms were tracked over a seven-month period. The most common symptoms after 6 months are fatigue, post-exercise malaise and cognitive dysfunction.	For over 91% of respondents, the recovery time exceeds 35 weeks. About 45.2% (1,700 respondents) needed a reduced work schedule compared to before the illness, and 22.3% (839 respondents) did not work during the survey due to illness. 86.2% of working respondents feel slightly to severely unable to work.	-	-
At 6 months, 82 of 115 (71.3%) patients reported persistent symptoms.	Thirteen (11.4%) survivors did not return to work due to poor health.	At month 6, 43/160 (26.9%) patients had died and 42/108 (38.9%) survivors reported a new injury.	-
Globally, 144.7 million people (95%) had one or more of three clusters of symptoms (fatigue in 51%; cognitive problems in 60.4% and ongoing respiratory problems in 35.4%) of prolonged COVID three months after infection, with most cases occurring in patients with milder infections. One year after infection, 15.1% continued to experience symptoms of prolonged COVID.	-	Those with milder cases of acute COVID-19 had a faster estimated recovery (median duration about 4 months) than those admitted for acute infection (median duration about 9 months). A significant number of people with prolonged COVID need rehabilitative care and support to transition back into work or education when symptoms begin to subside.	-
-	11,955 people were subject to recurring sick leave due to COVID-19. A total of 242 people (2.0%) took intermittent sick leave due to COVID-19, and of these, 136 (56.2%) remained on sick leave until the end of follow-up.	Patients (with repeated sick leave) were older and more often female. Repeated periods of sick leave may be due to persistent symptoms or the onset of new symptoms after COVID-19, or to returning to work with reduced work capacity.	-
-	-	The physical and psychological functions of the survivors were significantly worse than the healthy population.	-
CT abnormalities (59%), abnormal lung function (39%) and reduced functional capacity (36%), and the most common symptoms were fatigue (38%), dyspnea (32%), chest pain/tightness (16%), cough (13%) with expectoration (12%) or sore throat (4%)	Although an average of 8 out of 10 patients returned to work or reported no work impairment, patients may experience reduced quality of life for up to 6 months after infection. A large percentage of inpatients on the ward (75.6%) returned to work compared to ICU patients (46.7%), and more work impairment was reported in inpatients (58.3%) compared to those not hospitalized (35.0%)	-	-
Respiratory symptoms were most common, reported in 23 patients (88.5%), most commonly cough, dyspnea on exertion, sinus congestion, and chest tightness. Other symptoms included fatigue (17 patients, 65%) and headache (13 patients, 50%). 9 patients (34.6%) had persistent gastrointestinal symptoms, 6 patients (23%) complained of palpitations, and 3 had persistent low-grade fever. Of note, 18 (69.2%) reported at least 4 concurrent symptoms.	16 (61.5%) patients delayed their return to work for at least 5 weeks from symptom onset, and 17 (65.3%) delayed their return to activity.	-	-
Fatigue was the most common symptom reported by 72% of participants in the ICU group and 60.3% in the ward group. The next most common symptoms were dyspnea (65.6% in the ICU group and 42.6% in the ward group) and psychological distress (46.9% in the ICU group and 23.5% in the ward group) .	Returned to the same level of employment patients 14 (for the hospitalized) and 2 (for the group admitted to the intensive care unit); part-time 2 (for intensive care patients); absence due to illness 3 (for those hospitalized) and 12 (for patients in intensive care); released from work 2 (for those hospitalized) and 4 (for patients in intensive care); retired 1 (for ward patients)	-	-

Continuation of Table 1

Garrigues E et al. [32]	120 patients (96 hospitalized and 24 in intensive care) after a mean of 110.9 days March 15 and April 14, 2020	75 men	-	-
Jacobson KB et al. [33]	118 patients (22 hospitalized and 96 not hospitalized)	63 men	Average age 43.3 years.	-
Robinson-Lane et al. [19]	2217 adult patients between 16 March 2020 and 1 July 2020	-	-	-
Chopra et al. [20]	488 patients discharged between March 16 and July 1, 2020.	-	-	-
Monti et al. [21]	65 ICU patients, 39 followed for 2 months	Most patients were male (35/39; 90%)	Of working age (mean age 56 ± 10.5 years; six patients > 70 years).	-
Zhao et al. [37]	55 patients followed for a period of 64 to 93 days after hospital discharge	41.82% are women	The mean age of the patients was 47.74	-
Liang et al. [38]	76 survivors at three-month follow-up; 65 (86%) are healthcare workers	55 women	Of working age (mean age 41.3 ± 13.8 years)	-
Lindahl et al. [36]	101 patients hospitalized between March 1 and June 24 and followed up in September and October 2020.	54 men	Average age 60 years	-

The most commonly reported persistent symptoms were fatigue (55%), dyspnea (42%), memory loss (34%), concentration and sleep disturbances (28% and 30.8%, respectively).	38/56 (67.9%) returned to work, respectively 31/41 (75.6%) for hospitalized patients and 7/15 (46.7%) for ICU patients.	-	-
The most common symptoms 3-4 months after COVID are fatigue and dyspnea.	80/117 (67.3%) returned to work, respectively 16/22 (72.7%) for the hospitalized and 64/95 (67.4%) for the non-hospitalized; 9/78 (11.5%) lost their job due to illness (2/15 (13.3%) for hospitalized and 7/63 (11.1%) for non-hospitalized); work disorders due to the disease in 28/72 (38.9%) (7/12 (58.3%) for hospitalized and 21/60 (35.0%) for non-hospitalized);	-	-
-	59 patients (9.8%) did not return to work	-	64.6% (n = 86) reported moderate to severe financial effects, using all or most of their savings (n = 47, 81.0%) or being unable to cover necessities (n = 31, 91, 2%).
Cardiopulmonary symptoms (such as cough and dyspnea) were reported by 159 patients, including 92 with new or worsening symptoms and 65 with persistent loss of taste or smell. Fifty-eight patients reported new or worsening difficulties in performing daily activities.	Of the 195 patients, 117 returned to work, while 78 could not due to ongoing health problems or job loss. Of the 117 patients who returned to work, 30 reported reduced hours or changed duties due to health reasons.	-	179 patients reported at least a slight financial impact from their hospitalization, with 47 reporting using most or all of their savings and 35 rationing food, heat, housing, or medication due to expenses
-	28 patients (72%) worked. Two months after discharge, despite a good recovery, only eight patients (21%) had returned to their usual work, while one patient (2.6%) had returned to work with different tasks due to the disease. Eleven patients (28%) were unemployed or retired before the COVID-19 illness, and 19 patients (49%) were not working (during the follow-up period) for reasons related to the COVID-19 illness.	-	-
After 3 months, gastrointestinal symptoms (30.91%), headache (18.18%), fatigue (16.36%), dyspnea on exertion (14.55%), as well as cough and sputum (1.81%) were observed. The overall rate of residual pulmonary function abnormalities in the followed patients (with or without CT changes) three months after discharge was 25.45%	All 55 patients returned to their original work.	-	-
Most of the survivors had residual symptoms, including fever, sputum production, fatigue, diarrhea, dyspnea, cough, chest tightness on exertion, and palpitations. 42% of survivors had mild pulmonary function abnormalities at 3 months after discharge.	A total of 69 (91%) patients had returned to their original job 3 months after discharge.	-	-
Most patients had symptoms six months after hospital discharge. Ninety-one patients (90%) reported one or more symptoms at six months: fatigue (84/95, 88%), sleep problems (73/96, 76%), dyspnea in 66 patients (70%), and cough in 57 (61%) patients. Symptom severity was mild in 78% and severe in 22% of patients. However, 43 patients (45%) reported one or more severe symptoms, with seven patients (7%) reporting two, eight patients (8%) three, 11 (12%) four, and six (6%) report five or more severe symptoms. Only six patients (6%) reported no symptoms at six months, and four (4%) did not respond.	Of the 63 patients (62%) who were working full-time before COVID-19, 52 (83%) returned to work full-time, four (6%) part-time and seven (11%) have not returned to work six months after discharge from hospital. Those who did not return to work had a median age of 57 years (56-73 years). Eight (8%) reported working part-time before COVID-19, three of whom returned to work part-time, three did not respond, and two did not return to work.	One or more comorbidities were found in 70 patients (69%), with the three most common being hypertension (42, 42%), asthma (19, 19%), and hyperlipidemia (19, 19%). Rheumatoid arthritis is found only in women, and neurological diseases – only in men.	-

Continuation of Table 1

Carenzo et al. [46]	71 ICU patients between 1 March 2020 and 30 June 2020 were followed up 6 months after discharge	-	-	-
Van Veenendaal et al. [22]	Three- and six-month follow-up of patients admitted to the intensive care unit between March 19 and September 30, 2020, and their family members: Of the 73 (78%) surviving patients, 60 (82%) participated in the 3-month questionnaire, and 50 (68 %) in the 6-month questionnaire. Of a total of 102 survivor family members, 78 (76%) and 67 (66%) participants completed the questionnaire at 3 and 6 months, respectively.	-	The average age of the patients was 56 years.	-

-	Forty-five (63%) were working prior to the COVID-19 illness (of these, 40 (89%) were full-time). Thirty-three (73%) had returned to work within 6 months, 10 (22%) were unemployed, and 2 (5%) were recently retired. Among those who returned to work, 20 (85%) reported reduced work performance. Those who did not return to work were either still on sick leave or lost their jobs as a result of COVID-19.	The quality of life of those who did not return to work was worse than that of those who did.	-
90% reported persistent symptoms (fatigue, malaise, and polyneuropathy) 6 months after ICU discharge. Study participants suffered from symptoms such as anxiety, depression, post-traumatic stress disorder (PTSD) and reduced quality of life (QoL).	Of the working patients (30 patients), 3 patients (10%) returned to work without change, 4 had reduced working hours (13%), 3 changed professions (10%), 4 reintegrated (13%), 13 are defined as too sick to work (43%), 3 (10%) do not give an answer. One-third of participants had not fully returned to work at 3 and 6 months. Of the 40 family members working before their loved one was admitted to the intensive care unit, 26 (65%) had returned to work fully after three months, 1 (3%) had reduced working hours, 2 (5%) had changed occupation, 5 (13%) are reintegrating, 4 (10%) are not returning to work, 1 (3%) has lost their job, 1 (3%) is not returning. At the sixth month, of 36 working participants, 23 (64%) had fully returned to work without change, 5 (14%) were working reduced hours, 1 (3%) was changing occupations, 4 (11%) were reintegrating, 3 (8%) do not give an answer. The average rate of work for family members decreased by 18.3% (at the third month) and 7.7% (at the sixth month). Of the participants, 34% rated their work status as deteriorated, and 63% reported continued deterioration of well-being due to the COVID-19-related mandatory physical distance from their relatives (the hospitalized).	Social achievement was assessed as impaired, as 90% of survivors were not analyzed at the working level after 6 months of ICU discharge. Family members also had a worse working status.	-

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