

Editorial in Occupational and Public Health

Post-COVID-19 Syndrome and new challenges posed by climate change require an interdisciplinary approach: The role of occupational health services

Francesco CHIRICO^{1*}, Behdin NOWROUZI-KIA²

Affiliations:

¹ Post-Graduate School of Occupational Health, Università Cattolica del Sacro Cuore, Rome, Italy. Health Service Department, Italian State Police, Ministry of the Interior, Milan, Italy. Email: francesco.chirico@unicatt.it ORCID: 0000-0002-8737-4368.

² Department of Occupational Science and Occupational Therapy, Temerty Faculty of Medicine, University of Toronto, Toronto, Ontario, Canada E-mail: behdin.nowrouzi.kia@utoronto.ca ORCID: 0000-0000-0002-5586-4282

***Corresponding Author:**

Prof Francesco Chirico, Università Cattolica del Sacro Cuore, Roma, Italy. E-mail: francesco.chirico@unicatt.it

Key words: COVID-19; Long-COVID-19; Occupational therapy; Occupational health; Occupational health services; Post-COVID-19 symptoms.

Cite this paper as: Chirico F, Nowrouzi-Kia B. Post-COVID-19 syndrome and new challenges posed by climate change require an interdisciplinary approach: The role of occupational health services. *J Health Soc Sci.* 2022;7(2):132–136. Doi: 10.19204/2022/PSTC1

Received: 10 June 2022

Accepted: 15 June 2022

Published: 15 June 2022

In 2009, a *Lancet* commission declaring climate change as the “biggest global health threat of the 21st century” [1, p.1693] recommended that the health consequences of climate change should give priority on the agenda of every academic journal, scientific and professional conference, and university curriculum. Even before the pandemic, however, there was scant evidence to suggest that occupational disciplines had risen to this challenge, even though occupation is a well-known social determinant of health, which may be amplified by social and economic inequity, low health literacy, environmental degradation and climate change [2,3].

The current COVID-19 pandemic, is generating many challenges at any levels in our societies. For this reason, a comprehensive strategy (“syndemic approach”) has been indicated to address the ongoing COVID-19 pandemic, as it may interact with global inequity, other non-communicable diseases and climate change. Increasing prevention and resilience skills in our healthcare systems and society have been suggested as measures to protect the most vulnerable populations [4].

Millions of people will survive the SARS-CoV-2 infection, and, as a consequence, the number of individuals suffering from COVID-19 sequelae will dramatically increase over time [5]. Symptoms associated with SARS-CoV-2 infection are heterogeneous and may affect different systems such as respiratory (general fatigue, cough, sore throat, rhinorrhea, dyspnea), musculoskeletal (myalgias, arthralgias), gastrointestinal (diarrhoea, abdominal pain, vomiting), psychological (post-traumatic stress disorder, anxiety, depression, burnout syndrome, mood disorders, insomnia and sleep problems), neurocognitive (brain fog, cognitive impairment, dizziness), neurological (headaches, ageusia, anosmia) and autonomic (chest pain, tachycardia, palpitations). Many survivors of severe COVID-19 continue to complain of cardiological symptoms for long periods, even after their discharge from hospital [5–13].

A meta-analysis showed that post-COVID-19 symptoms are present in more than 60% of patients infected by SARS-CoV-2. Fatigue and dyspnea were the most prevalent post-COVID-19 symptoms, particularly 60 and ≥ 90 days after the infection, but other post-COVID-19 symptoms also included cough (20-25%), anosmia (10-20%), ageusia (15-20%) or joint pain (15-20%) [14].

Based on relapsing/remitting nature of post-COVID symptoms, Fernández-de-Las-Peñas and colleagues have proposed the following integrative classification: potentially infection related-symptoms (up to 4-5 weeks), acute post-COVID symptoms (from week 5 to week 12), long post-COVID symptoms (from week 12 to week 24), and persistent post-COVID symptoms (lasting more than 24 weeks) [13].

The expected difference in the prevalence of post-COVID-19 symptoms between hospitalized and non-hospitalized patients has not been confirmed [14], and post-COVID-19 syndrome has been even described in patients with mild infection, younger than 65 years and with no preexisting comorbidities [11,13,15]. For this reason, people with long-COVID or “long-haulers” of working age are likely to increasingly present health problems and impaired work ability when returning to work after COVID-19 infection. Therefore, their fitness for work could be temporarily or permanently compromised, and some of them could be result in unfitness for their actual job.

In European Union countries, occupational health physicians of private and public sectors are appointed by employers to carry out evidence-based health surveillance programs to protect and prevent occupational risks, which should be normally organized within occupational health services (OHSs). Occupational health surveillance is mandatory when certain workplace hazards are present. It has the advantage of detecting adverse health effects resulting from occupational exposures as early as possible by avoiding the onset of occupational and work-related diseases, and the advantage to inform the effectiveness of preventive measures resulting from the risk assessment and management process [16–20].

Workplace health promotion (WHP) programs, on the contrary, are voluntary for employers and employees and constitute an important pillar of the holistic workplace health management strategy [21–23]. WHP has the purpose to promote higher levels of workers’ global wellbeing, according to the “Total Worker Health” concept [24–26].

However, due to their intrinsic characteristics, either occupational health or WHP programs could fail to protect the health of many workers affected by post-COVID 19 symptoms.

OHSs are multidisciplinary teams composed by occupational physicians and occupational therapists, psychologists, nurses, hygienists, ergonomists, and safety managers. Occupational or physical therapists should be included in OHSs set up to address post-COVID-19 disorders among workers, as specific rehabilitation programs could be developed on the basis of workers’ functional impairment.

Occupational therapists, indeed, may be particularly useful when workers return to work, because they perform functional capacity evaluations, and provide workplace mental health interventions to improve work performance and productivity. By collaborating with occupational physicians and psychologists, OHS and WHP programs could be joined to protect workers affected by COVID-19 syndrome and enhance the global well being of the workers.

Despite the growing clinical relevance of post-COVID-19 syndrome, there is minimal information available on the organizational response of health services to this condition. We believe that an interdisciplinary approach including primary care providers and occupational health and safety professionals, with the contribution of specialists in cardiology, neurology, psychiatry, or respiratory diseases may benefit companies and society

A strict cooperation between occupational and public health stakeholders in the framework of multidisciplinary OHSs, furthermore, should be developed during and even in the post-COVID-19 era [24–26]. OHSs may assist workers affected by COVID-19 infection or post-COVID-19 symptoms by integrating counselling, testing, health surveillance, and medical assistance at individual and group levels, according to a more comprehensive approach in line with the challenges that climate change poses to us, including global warming and extreme weather, and vectorborne diseases in

outdoor workers, and new emerging issues concerning migrant workers and the ageing of the workplace, as well as new technologies and psychosocial risk factors deriving from new working organizations (ie., working from home) [27–30].

Healthcare systems across the world are struggling to meet people's health needs, due to global COVID-19 crisis, shortage of physicians, budget constraints, and subsequently, high workload, turnover intention and burnout levels among healthcare workers [3]. For this reason, OHSs with multidisciplinary teams of experts collaborating with local healthcare systems (primary care providers, hospitals, and local health services) could address the needs of workers affected by post-COVID-19 symptoms and drive the best holistic strategies for responding to the new global health challenges posed not only by COVID-19, but also by new workplace hazards requiring a complex and overall approach for prevention, protection, and return to work of both healthy and disabled workers [31,32].

For instance, it was proposed that an integrated and multidisciplinary model with employee participation in prevention activities and occupational health nurses assuming leadership role in health and safety management of their organizations [33], may be effective to meet these needs. New interdisciplinary approaches would allow the government to address shortage of healthcare professionals and save money for health expenditure.

People with disabilities make up an estimated one billion, or 15 percent, of the world's population. About 80 percent are of working age. However, many of them face barriers to education, access to health care and are more likely to be unemployed [34]. Disability management is an indispensable tool to support workers' integration and retention. A disability management approach that employs a biopsychosocial approach should be combined with new technologies such as digitalization for skilling or re-skilling of workers; and OHSs may also use a patient-centered approach to bolsters workers' health and well-being.

OHs are, however, are still scarce and unevenly distributed across the world, as they may be affected by socio-economic inequities. COVID-19 has increased health inequities that have existed in our society for decades. Level of education, poverty, poor housing conditions, low household income, speaking in a language other than the national language in a country, and living in overcrowded households were found to be risk factors of COVID-19 incidence/infection, death, and confirmed diagnosis, and many essential workers are at high risk for COVID-19 infection as they have one or more of these risk factors [35].

COVID-19, economic crisis and new global health challenges caused by climate change could require new adjustments in healthcare systems of both high and medium-low income countries. COVID-19 crisis has affected all aspects of everyday life and work, and heavily impacted the global economy. However, the COVID-19 lesson could even indicate policymakers the right strategies to address the current global climate emergency, by tackling inequity, costs and solidarity through a global and coordinated strategy [36,37].

Responding to COVID-19 and future global challenges is not only necessary, but also timely [38]. Therefore, further research and guidelines from policymakers are warranted, even to reduce gaps and heterogeneity increasingly in assistance to workers affected by post COVID-19 syndrome.

Author Contributions: Writing—original draft preparation: FC. Writing—review and editing: BN-K. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable

Informed Consent Statement: Not applicable

Acknowledgments: None

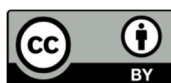
Conflicts of Interest: The authors declare no conflict of interest

Publisher's Note: Edizioni FS stays neutral with regard to jurisdictional claims in published maps and institutional affiliation.

References

1. Costello A, Abbas M, Allen A, Ball S, Bell S, Bellamy R et al. Managing the health effects of climate change. *Lancet*. 2009;373, 1693–1733. [https://doi.org/10.1016/S0140-6736\(09\)60935-1](https://doi.org/10.1016/S0140-6736(09)60935-1).
2. Whalley Hammell K. Building back better: Imagining an occupational therapy for a post-COVID-19 world. *Aust Occup Ther J*. 2021 Oct;68(5):444–453. doi: 10.1111/1440-1630.12760. Epub 2021 Jul 22.
3. Chirico F, Leiter M. Tackling stress, burnout, suicide, and preventing the “Great resignation” phenomenon among healthcare workers (during and after the COVID-19 pandemic) for maintaining the sustainability of healthcare systems and reaching the 2030 Sustainable Development Goals. *J Health Soc Sci*. 2022;7(1):9–13. Doi: 10.19204/2022/TCKL1.
4. Di Ciaula A, Krawczyk M, Filipiak KJ, Geier A, Bonfrate L, Portincasa P. Noncommunicable diseases, climate change and iniquities: What COVID-19 has taught us about syndemic. *Eur J Clin Invest*. 2021 Dec;51(12):e13682. doi: 10.1111/eci.13682. Epub 2021 Sep 29.
5. Rubin R. As Their Numbers Grow, COVID-19 “Long Haulers” Stump Experts. *JAMA*. 2020 Oct 13;324(14):1381–1383. Doi: 10.1001/jama.2020.17709.
6. Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, et al. A Novel Coronavirus from Patients with Pneumonia in China, 2019. *N Engl J Med*. 2020 Feb 20;382(8):727–733. Doi: 10.1056/NEJMoa2001017. Epub 2020 Jan 24.
7. Vanichkachorn G, Newcomb R, Cowl CT, Murad MH, Breeher L, Miller S, et al. Post-COVID-19 Syndrome (Long Haul Syndrome): Description of a Multidisciplinary Clinic at Mayo Clinic and Characteristics of the Initial Patient Cohort. *Mayo Clin Proc*. 2021 Jul;96(7):1782–1791. Doi: 10.1016/j.mayocp.2021.04.024. Epub 2021 May 11.
8. Szarpak L, Pruc M, Koda M, Chirico F. Heart inflammation risk after COVID-19 vaccine. *Cardiol J*. 2021 Dec 13. Doi: 10.5603/CJ.a2021.0161. Epub ahead of print.
9. Szarpak L, Pruc M, Filipiak KJ, Popieluch J, Bielski A, Jaguszewski MJ, et al. Myocarditis: A complication of COVID-19 and LONG-COVID-19 syndrome as a serious threat in modern cardiology. *Cardiology J*. Nov 2021. Doi: 10.5603/CJ.a2021.0155.
10. Nucera G, Chirico F, Rafeig Z, Gilis-Malinowska N, Gasecka A, Litvinova N, et al. Need to update cardiological guidelines to prevent COVID-19 related myocardial infarction and ischemic stroke, *Cardiol J*. October 2021. Doi: 10.5603/CJ.a2021.0120.
11. Nucera G, Chirico F, Raffaelli V, Marino P. Current challenges in COVID-19 diagnosis: a narrative review and implications for clinical practice. *Ital J Med*. 2021;15:129–134.
12. Szarpak L, Chirico F, Pruc M, Szarpak L, Jerzy Dzieciatkowski T, Rafeig Z. Mucormycosis- a serious threat in the COVID-19 pandemic? *J Infect*. 2021. Doi: 10.1016/j.jinf.2021.05.015.
13. Fernández-de-Las-Peñas C, Palacios-Ceña D, Gómez-Mayordomo V, Cuadrado ML, Florencio LL. Defining Post-COVID Symptoms (Post-Acute COVID, Long COVID, Persistent Post-COVID): An Integrative Classification. *Int J Environ Res Public Health*. 2021 Mar 5;18(5):2621. Doi: 10.3390/ijerph18052621.
14. Fernández-de-Las-Peñas C, Palacios-Ceña D, Gómez-Mayordomo V, Florencio LL, Cuadrado ML, Plaza-Manzano G, et al. Prevalence of post-COVID-19 symptoms in hospitalized and non-hospitalized COVID-19 survivors: A systematic review and meta-analysis. *Eur J Intern Med*. 2021 Oct;92:55–70. Doi: 10.1016/j.ejim.2021.06.009. Epub 2021 Jun 16.
15. Chirico F, Sagan D, Markiewicz A, Popieluch J, Pruc M, Bielski K, et al. SARS-CoV-2 Virus mutation and loss of treatment and preventive measures as we know it now. *Disaster Emerg Med J*. 2021;6(4). Doi: 10.5603/DEMJ.a2021.0025.
16. Chirico F. The role of Health Surveillance for the SARS-CoV-2 Risk Assessment in the Schools. *J Occup Environ Med*. February 2021 (ahead-of-print). 2021;63(4):e255–e266. Doi: 10.1097/JOM.0000000000002170.
17. Chirico F, Taino G, Se necesita una evaluación adecuada del riesgo de SARS-CoV-2 para la evaluación médico-legal de la infección por COVID-19 [A proper SARS-CoV-2 risk assessment is needed for medico-legal assessment of the COVID-19 infection]. *Spanish J Legal Med*. 2021;47(3):130–131. Doi: <https://doi.org/10.1016/j.reml.2021.01.004>.
18. Chirico F, Magnavita N. The significant role of health surveillance in the occupational heat stress assessment. *Int J Biometeorol*. 2019;63(2):193–194. <https://doi.org/10.1007/s00484-018-1651>.
19. Chirico F, Sacco A. Enhancing the role of occupational health services in the battle against Corona Virus Disease 2019. *Ann Ig*. 2022;34(5). Doi: 10.7416/ai.2022.2511.
20. Chirico F, Magnavita N. The Crucial Role of Occupational Health Surveillance for Health-care Workers During the COVID-19 Pandemic. *Workplace Health Saf*. 2021;69(1):5–6. Doi:10.1177/2165079920950161.

21. Chirico F, Magnavita N. The Spiritual Dimension of Health for More Spirituality at Workplace. *Indian J Occup Environ Med.* 2019;23(2):99. Doi: 10.4103/ijoem.IJOEM_209_18.
22. Acquadro Maran D, Capitanelli I, Cortese CG, Ilesanmi OS, Gianino MM, Chirico F. Animal-Assisted Intervention and HealthCare Workers Psychological Health: A Systematic Review of the Literature. *Animals.* 2022;12:383. <https://doi.org/10.3390/ani12030383>.
23. Chirico F, Sharma M, Zaffina S, Magnavita N. Spirituality and Prayer on Teacher Stress and Burnout in an Italian Cohort: A Pilot, Before-After Controlled Study. *Front Psychol.* 2020;10:2933. Published 2020 Jan 21. Doi:10.3389/fpsyg.2019.02933.
24. Chirico F, Nucera G, Szarpak L, Zaffina S. The cooperation between occupational and public health stakeholders has a decisive role in the battle against the COVID-19 pandemic. *Disaster Med Public Health Preparedness.* 2021;1–4. Doi. 10.1017/dmp.2021.375.
25. Chirico F, Sacco A, Ferrari G. “Total Worker Health” strategy to tackle the COVID-19 pandemic and future challenges in the workplace. *J Health Soc. Sci.* 2021;6(4):452–457. Doi: 10.19204/2021/ttlw1.
26. Chirico F, Zaffina S, Ferrari G. Call for scholarly networking between occupational and public health stakeholders to address the COVID-19 pandemic and new global health challenges in the post-COVID-19 era: The case of scientific collaboration between SIPISS, AIPMEL and the Summer School on Total Worker Health. *J Health Soc Sci.* 2021;6(3):309–312. Doi: 10.19204/2021/cllf1.
27. Magnavita N, Chirico F. New and emerging risk factors in Occupational Health. *Appl Sci.* 2020;10(4):8906. Doi: 10.3390/app10248906.
28. Chirico F, Magnavita N. New and Old Indices for Evaluating Heat Stress in an Indoor Environment: Some Considerations. Comment on Kownacki, L.; Gao, C.; Kuklane, K.; Wierzbicka, A. Heat Stress in Indoor Environments of Scandinavian Urban Areas: A Literature Review. *Int J Environ Res Public Health* 2019, 16 (4), 560. doi:10.3390/ijerph16040560. *Int J Environ Res Public Health.* 2019;16(8):1444. Published 2019 Apr 23. Doi:10.3390/ijerph16081444.
29. Chirico F, Magnavita N. Letter to the editor (January 1, 2019) concerning the paper "Impact of air pollution on depression and suicide". *Int J Occup Med Environ Health.* 2019 Jun 14;32(3):413–414. Doi: 10.13075/ijomh.1896.01417. Epub 2019 May 21.
30. Magnavita N, Capitanelli I, Ilesanmi OS, Chirico F. Occupational Lyme Disease: A systematic review and meta-analysis. *Diagnostics.* 2022;12(2):296. Doi: 10.3390/diagnostics12020296.
31. Chirico F, Magnavita N. West Nile virus infection in Europe: need for an integration of occupational health practice and public health activities. *Ann Ist Super Sanita.* 2019;55(1):3–5.
32. Chirico F, Magnavita N. The West Nile Virus epidemic-occupational insight. *Lancet.* 2019 Mar 30;393(10178):1298.
33. Marinescu LG. Integrated approach for managing health risks at work--the role of occupational health nurses. *AAOHN J.* 2007 Feb;55(2):75–87. Doi: 10.1177/216507990705500205.
34. ILO. New ILO database highlights labour market challenges of persons with disabilities. 13 June 2022. ilostat.ilo.org/new-ilo-database-highlights-labour-market-challenges-of-persons-with-disabilities/
35. Khanijahani A, Iezadi S, Gholipour K, Azami-Aghdash S, Naghibi D. A systematic review of racial/ethnic and socioeconomic disparities in COVID-19. *Int J Equity Health.* 2021 Nov 24;20(1):248. Doi: 10.1186/s12939-021-01582-4.
36. Chirico F. Spirituality to cope with COVID-19 pandemic, climate change and future global challenges. *J Health Soc Sci.* 2021;6(2):151–158. Doi:10.19204/2021/sprt2.
37. Manzanedo RD, Manning P. COVID-19: Lessons for the climate change emergency. *Sci Total Environ.* 2020 Nov 10;742:140563. Doi: 10.1016/j.scitotenv.2020.140563. Epub 2020 Jun 27.
38. Chirico F. Comments on “Climate change and Public Health: A Small Frame Obscures the Picture”. *New Solut.* 2018 May;28(1):5–7. Doi: 10.1177/1048291117752463.



© 2022 by the authors. This is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).