

The Digital Economy and Hybrid Work Call for a Review of Compensation Criteria for Musculoskeletal Disorders

YVES ROQUELAURE¹, JULIE BODIN^{1,*}, FLORENCE CROS², ALEXIS DESCATHA^{1,3}, MARC FADEL¹

¹Univ Angers, CHU Angers, Univ Rennes, Inserm, EHESP, Irset (Institut de Recherche en Santé, Environnement et Travail)—UMR_S 1085, IRSET-ESTER, SFR ICAT, F-49000, Angers, France

²GRePS UR 4163, Université Lumière Lyon 2, Lyon, France

³Occupational Medicine, Epidemiology and Prevention, Donald and Barbara Zucker School of Medicine, Hofstra/Northwell, USA

KEYWORDS: Hybrid Work; New Way of Working; Musculoskeletal Disorders; Occupational Disease; Compensation

SUMMARY

Work-related musculoskeletal disorders (WRMSD) pose a significant occupational health challenge in Europe. The digitization of the economy substantially reshaped the nature and organization of work. The proliferation of hybrid working, characterized by a combination of office-based and remote work, has been accelerated by the COVID-19 pandemic. This review covers hybrid forms of work, their impact on WRMSDs, and the potential implications for WRMSD compensation. Approximately 30-40% of the European workforce could potentially transition to hybrid forms of work. Hybrid work arrangements can result in prolonged static postures of the trunk, neck, and upper limbs without adequate breaks, thereby increasing the risk of neck and lower back pain. As teleworking and hybrid working become more prevalent, an increase in non-specific WRMSDs is anticipated among the working population. In many countries, claims for WRMSDs necessitate a formal diagnosis by a healthcare professional. However, cases of non-specific WRMSDs, such as cervicalgia or chronic shoulder pain, – commonly observed in sedentary workers engaged in predominantly low-intensity, prolonged static work amid visually and cognitively demanding tasks – often do not meet the criteria for compensation as occupational diseases. The compensation system and/or the criteria for compensation must be adapted to accommodate the rise of telework, necessitating evolving criteria for compensation that address both medical and risk exposure considerations.

Work-related musculoskeletal disorders (WRMSDs) are one of the two major occupational health issues in Europe [1], and a major cause of compensation claims in most countries. They are associated with periarticular soft tissue overuse during repetitive and/or forceful work in the agriculture, industry and service sectors. Nevertheless, new forms of work, such as hybrid work, modify exposure to biomechanical, organizational, and psychosocial risk

factors and influence the risk of incident and/or chronic WRMSDs.

The digitalization of the economy has significantly transformed the nature and structure of work, such as working hours, locations, and the utilization of information and communication technologies (ICTs) (e.g., telework, platform work) (EU-OSHA 2018). The adoption of telework and hybrid work, characterized by alternating office-based and remote

work, experienced a rapid increase due to the sudden onset of the COVID-19 pandemic. Multiple Living, working and COVID-19 e-surveys conducted by Eurofound between 2020 and 2022 revealed that one in three workers engaged in full-time telework, while 14% operated under a hybrid model in 2020. Subsequent years witnessed a decline in full-time telework prevalence, yet the proportion of hybrid workers surged, with nearly one in five workers embracing this model by spring 2022. By 2022, hybrid working had emerged as the second most prevalent work arrangement in the EU [2]. On average, men with hybrid work schedule teleworked 20% of their working hours while women teleworked 25% [2]. While telework remains impractical for many workers, hybrid forms of work are likely to become standard for a considerable proportion of European workers in the foreseeable future [3]: between 30 to 40% of the European workforce could potentially transition to hybrid work models [4, 5]. Service sectors (information and communication, public administration...) are more predisposed to adopting telework or hybrid work setups, whereas numerous industrial and service positions (e.g., healthcare workers) are not conducive to telework [2, 4]. Disparities in the implementation of hybrid work also exist among occupational groups, to the benefit of high-income, highly qualified professional, technical experts and senior administrative roles [2, 4, 6]. Moreover, the adoption of hybrid work varies depending on the organizational habits and practices, influenced by the size and sector of activity of different organizations. In most cases of hybrid work, tasks that are amenable to teleworking, such as administrative, commercial, technical, data processing, design, or collaborative work, are involved [2, 3, 5].

WRMSDs represent a significant source of discomfort and pain across various sectors and occupations, often resulting in disability, prolonged sick leave, and even job loss in severe chronic cases [7]. WRMSDs are inherently multifactorial [1], involving not only personal and medical factors but also various work-related biomechanical, organizational, and psychosocial factors. Biomechanical factors such as physical workload, repetitive movements, force intensity, awkward postures, exposure to hand- and whole-body vibrations, and localized pressure are

among the primary contributors to the development of WRMSDs [1, 7-9]. Additionally, numerous studies have highlighted how psychosocial risk factors in the workplace can impact the onset of WRMSDs, either by amplifying biomechanical exposure or by triggering stress mechanisms [1, 7]. The interaction between biomechanical exposures and psychosocial risk factor can serve as both etiological factors, influencing the onset of pain or significant functional impairment, and prognostic factors for chronicity or long-term disability [7]. The work situations most at risk of WRMSDs typically involve repetitive and/or forceful movements, which can lead to “periarticular soft-tissue overuse” and consequentially result in non-specific muscular pain and specific disorders such as tendinopathies and nerve entrapment. These risky work situations are commonly observed in workers across the agriculture, industry, and services sectors [1].

Telework and hybrid work arrangements increase the duration of time spent in a seated posture. It is probable that suitable equipment, whether pertaining to workspace setup or ergonomically designed tools, may not be readily available at home to facilitate prolonged screen work. Telework and hybrid work, which entail visually and cognitively demanding tasks, often lead to prolonged static postures without breaks, resulting in sustained activation of type I muscular motor units in the neck, shoulders, and back. This prolonged activation can lead to dysfunction of motor units, activation of nociceptive pathways, and centralization of pain, ultimately triggering shoulder, neck, dorsal, and lumbar pain [10].

A review of systematic review on telework and hybrid work, and their impact on WRMSDs has been conducted using the PubMed database (2001-2024) (Table 1) Five recent systematic reviews and meta analyses (published between 2020 and 2023) have been identified: [11-15]. Except one, all reported an increase of the risk of MSDs in teleworkers/hybrid workers (Table 1). This concerned mainly non-specific low back pain [13], cervical pain, and non-specific shoulder pain, and to a lower extent thoracic pain and lower limb pain.

Even if epidemiological evidence on the effects of telework on MSDs is still scant, there appears to be

Table 1. Recent systematic reviews on impact of telework/hybrid work on work-related musculoskeletal disorders.

Authors (year)	N Studies	Main conclusion
Oakman et al. (2020)	2 CS ¹	Lower or equal level of pain in teleworkers vs non teleworkers
Dos Santos et al. (2021)	8 CS ¹	Increased prevalence of nonspecific low back and neck pain
Papalia et al. (2023)	8 (3CS ¹ , 1RS ¹ , 2PP ¹ , 2PS ¹)	Increased prevalence of nonspecific low back pain
Fadel et al. (2023)	25 (22CS ¹ , 1PP ¹ , 1PS ¹ , 1IS ¹)	Increased prevalence or intensity of nonspecific low back, neck and shoulder pain in most studies
Gomez et al. (2023)	6 (5CS ¹ , 1CC ¹)	Highest prevalence for nonspecific neck pain, low back pain and shoulder pain

(1) CS: cross sectional study, CC: case control study; RS: retrospective study, PP: pre/post study, PS: prospective study; IS: intervention study.

an elevated risk of neck pain, shoulder pain and low back pain, which are influenced by organizational and biomechanical factors [12-17]. Some studies suggest that teleworking more than two to three days per week may be associated with an increased risk of WRMSD [18].

Compensation criteria vary among EU member states due to each country having its unique legal and regulatory framework concerning occupational health and safety, workers' compensation, and social insurance. WRMSDs are the most commonly recognised occupational diseases in France, Italy, and Spain. However, the lists of diseases eligible for recognition as occupational diseases, as well as recognition practices and notification systems, vary significantly from one Member State to another [9]. In most compensation systems, medical criteria pertain to specific disorders, defined by objective diagnostic criteria, such as rotator cuff tendinopathy, lateral epicondylitis, or carpal tunnel syndrome, thereby excluding nonspecific complaints like regional pain [19]. Compensation claims typically necessitate a formal diagnosis from a medical professional, supported by medical evidence such as imaging studies, medical records, and expert opinions. Establishing a direct link between work activities and the development of the musculoskeletal disorder is crucial. This requires demonstrating that the disorder was either caused by or significantly aggravated by the conditions of employment. Compensation eligibility typically considers biomechanical overloads, including repetitive movements, awkward postures, forceful exertions, or exposure to vibrations. Compensation amounts may vary depending on whether the

musculoskeletal disorder results in temporary disability (where the worker can recover and return to work) or permanent disability [20].

It is important to note that WRMSDs experienced by teleworkers/hybrid workers primarily manifest as non-specific shoulder, cervical, or low-back pain, which typically fall outside the scope of traditional compensation systems. While these multifactorial disorders can be evaluated through subjective methods such as questioning and functional scales, neurophysiological or imaging examinations contribute little or nothing to their diagnosis. Moreover, telework situations are predominantly characterized by sedentary computer work, which does not align with the "classic definition of biomechanical overload" [20].

In conclusion, the proliferation of non-specific WRMSDs is anticipated in the workforce due to the expansion of telework or hybrid work arrangements. However, in most countries, cases of non-specific WRMSDs, such as cervicgia or chronic shoulder pain - commonly observed in sedentary workers engaging in predominantly low-intensity, prolonged static work during visually and cognitively demanding tasks - do not meet the criteria for compensation as occupational diseases. Therefore, adjustments to the compensation system and/or criteria are necessary to accommodate the rise of telework, with evolving standards for compensation, encompassing both medical and risk exposure criteria.

FUNDING: This study was funded by a national grant from the ANSES (French Agency for Food, Environmental and

Occupational Health & Safety) which had no role in the methodology, results or writing of the paper (“Convention de recherche et développement” Anses/Inserm 2021- CRD10).

INSTITUTIONAL REVIEW BOARD STATEMENT: Not applicable.

INFORMED CONSENT STATEMENT: Not applicable.

DECLARATION OF INTEREST: The authors declare no conflict of interest.

AUTHOR CONTRIBUTION STATEMENT: YR wrote the manuscript. All authors contributed to critically reviewing the manuscript, and approving the final manuscript.

DECLARATION ON THE USE OF AI: None.

REFERENCES

1. EU-OSHA. Work-Related Musculoskeletal Disorders: Why Are They Still so Prevalent? Evidence from a Literature Review. European Agency for Safety and Health at Work (EU-OSHA); 2020. <https://osha.europa.eu/en/publications/work-related-musculoskeletal-disorders-why-are-they-still-so-prevalent-evidence/view>
2. Eurofound. Fifth Round of the Living, Working and COVID-19 e-Survey: Living in a New Era of Uncertainty. Publications Office of the European Union; 2022. Accessed July 7, 2022. <https://www.eurofound.europa.eu/fr/publications/2022/fifth-round-of-covid-19-e-survey-living-in-the-new-era-of-uncertainty>
3. Eurofound. The Future of Telework and Hybrid Work. Publications Office of the European Union; 2023. <https://www.eurofound.europa.eu/publications/report/2023/the-future-of-telework-and-hybrid-work>
4. Sostero M. Teleworkability and the COVID-19 Crisis: A New Digital Divide? European Commission; 2020. <https://ec.europa.eu/jrc/sites/jrcsh/files/jrc121193.pdf>
5. Eurofound. The Rise in Telework: Impact on Working Conditions and Regulations. Publication Office of the European Union, Luxembourg; 2022. <https://www.eurofound.europa.eu/publications/report/2022/the-rise-in-telework-impact-on-working-conditions-and-regulations>
6. EU-OSHA. OSH Pulse - Occupational Safety and Health in Post-Pandemic Workplaces Flash Eurobarometer Report. European Agency for Safety and Health at Work (EU-OSHA); 2022. <https://osha.europa.eu/en/publications/osh-pulse-occupational-safety-and-health-post-pandemic-workplaces>
7. Roquelaure Y. Musculoskeletal Disorders and Psychosocial Factors at Work. European Trade Union Institute (ETUI); 2018:82. <https://www.etui.org/sites/default/files/EN-Report-142-MSD-Roquelaure-WEB.pdf>
8. van der Molen HF, Foresti C, Daams JG, Frings-Dresen MHW, Kuijer PPFM. Work-related risk factors for specific shoulder disorders: a systematic review and meta-analysis. *Occup Environ Med*. Published online July 29, 2017. Doi: 10.1136/oemed-2017-104339
9. EU-OSHA. Work-Related Musculoskeletal Disorders: Prevalence, Costs and Demographics in the EU. European Agency for Safety and Health at Work (EU-OSHA); 2019. <https://osha.europa.eu/fr/publications/msds-facts-and-figures-overview-prevalence-costs-and-demographics-msds-europe/view>
10. Johansson H, Arendt-Nielsen L, Bergenheim M, et al. Epilogue: an integrated model for chronic work-related myalgia “Brussels Model.” Published online 2003. Accessed April 7, 2017. [http://vbn.aau.dk/en/publications/epilogue\(39712b90-002c-11da-b4d5-000ea68e967b\).html](http://vbn.aau.dk/en/publications/epilogue(39712b90-002c-11da-b4d5-000ea68e967b).html)
11. Oakman J, Kinsman N, Stuckey R, Graham M, Weale V. A rapid review of mental and physical health effects of working at home: how do we optimise health? *BMC Public Health*. 2020;20(1):1825. doi:10.1186/s12889-020-09875-z
12. dos Santos IN, Pernambuco ML, da Silva AMB, de Andrade Ruela G, de Oliveira AS. Association between musculoskeletal pain and telework in the context of the COVID-19 pandemic: an integrative review /Associação entre dor musculoesquelética e teletrabalho no contexto da pandemia de COVID-19: uma revisão integrativa. *Revista Brasileira de Medicina do Trabalho*. 2021;19(3):342-351.
13. Papalia GF, Petrucci G, Russo F, et al. COVID-19 Pandemic Increases the Impact of Low Back Pain: A Systematic Review and Metanalysis. *Int J Environ Res Public Health*. 2022;19(8):4599. Doi: 10.3390/ijerph19084599
14. Gomez IN, Gonzalez-Suarez C, Sosa KE, Tapang ML. Work-from-home-related musculoskeletal pain during the COVID-19 pandemic: A rapid review protocol. *Int J Osteopath Med*. Published online April 4, 2022. Doi: 10.1016/j.ijosm.2022.04.005
15. Fadel M, Bodin J, Cros F, Descatha A, Roquelaure Y. Teleworking and Musculoskeletal Disorders: A Systematic Review. *Int J Environ Res Public Health*. 2023;20(6):4973. Doi: 10.3390/ijerph20064973
16. Marques de Macedo TA, dos Santos Cabral EL, Silva Castro WR, et al. Ergonomics and telework: A systematic review. *Work*. 2020;66(4):777-788. Doi: 10.3233/WOR-203224
17. Milaković M, Koren H, Bradvica-Kelava K, et al. Telework-related risk factors for musculoskeletal disorders. *Front Public Health*. 2023;11:1155745. Doi: 10.3389/fpubh.2023.1155745

18. Matsugaki R, Muramatsu K, Tateishi S, et al. Association Between Telecommuting Environment and Low Back Pain Among Japanese Telecommuting Workers: A Cross-Sectional Study. *J Occup Environ Med.* 2021;63(12):e944-e948. Doi: 10.1097/JOM.0000000000002412
19. ILO. Diagnostic and exposure criteria for occupational diseases – Guidance notes for diagnosis and prevention of the diseases in the ILO List of Occupational Diseases (revised 2010). Published online 2022. https://www.ilo.org/global/topics/safety-and-health-at-work/resources-library/publications/WCMS_836362
20. Eurogip. Musculoskeletal disorders: What recognition as occupational diseases? A study on 10 European countries Paris: EUROGIP - Ref. Eurogip-120/E - 2016 - 21 x 29,7 cm - 70 pages - 979-10-91290-79-1. Published online 2016. https://www.eurogip.fr/images/pdf/Eurogip120E_ReportMSDs.pdf