

## MUSCULOSKELETAL DISORDERS IN WORKERS WITH MULTIPLE SCLEROSIS: A TASK-ORIENTED VIEW

This discussion paper was developed as part of the collaboration agreement signed by the Italian National Institute for Insurance against Accidents at Work (INAIL) and the European Agency for Safety and Health at Work (EU-OSHA) related to the provision of research services in the area of musculoskeletal disorder (MSD) prevention. It presents the findings of research developed by the INAIL Department of Occupational and Environmental Medicine, Epidemiology and Hygiene in partnership with the Italian Multiple Sclerosis Foundation (FISM).

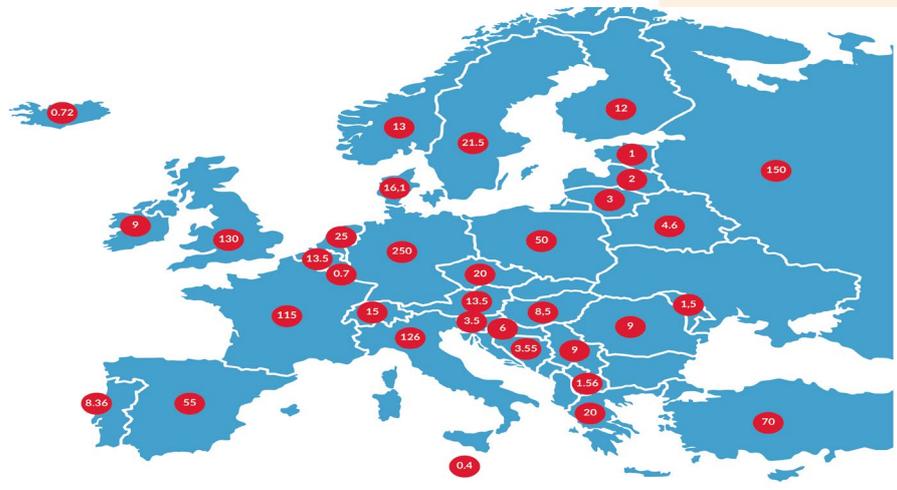
Multiple sclerosis (MS) is an inflammatory demyelinating chronic disease of the central nervous system (CNS). MSDs and their causes are not well understood in MS. Asymmetric posture, walking impairment, muscle weakness, sensitive dysfunction and spasticity are believed to play a role in their onset. In this context, the most common type of pain is lower back pain that ranges from 10 to 21.4 %. These MSDs can affect the quality of life of persons with MS (PwMS), and in particular their working activities. In this paper we present proposals aimed at improving safety and health conditions during working activities by delivering an ad hoc multidisciplinary intervention focused on occupational therapy in particular. In the paper, the intervention's effect is taken into account by evaluating improvements using patient reported outcomes (PROs) to detect the effect of multidisciplinary interventions in working activities. Moreover, this paper aims to improve knowledge on MSDs in MS (and the effect on working activities) and to contribute to empowerment training, especially addressed to occupational safety and health (OSH) professionals. This will result in improving risk assessment and management, as well as the health surveillance process, by focusing on continuous enhancement in the protection of the health and safety of workers with MS, from the perspective of their successful job integration/reintegration and maintenance of employment.

### Multiple sclerosis: an overview

MS is a chronic disease of the CNS that affects almost 3 million people worldwide (Multiple Sclerosis International Federation (MSIF), 2013).

Data reported in the European MS Barometer 2020 show that 1.2 million people overall have MS in the 35 European countries considered, including the Russian Federation (European Multiple Sclerosis Platform, 2021). Figure 1 shows the number of people with MS in European countries.

Figure 1: Number of people with MS in Europe (absolute values x 1,000)

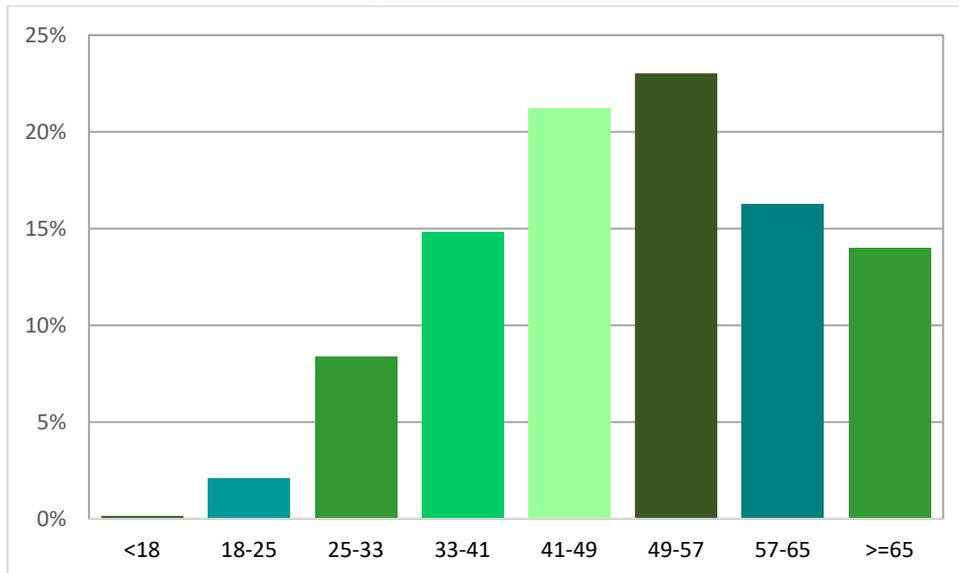


Source: Italian Multiple Sclerosis Society (AISM), 2021.

In Italy, approximately 130,000 people live with MS, and more than 3,600 are diagnosed every year (AISM, 2021).

The FISM, in collaboration with the University of Bari, promoted in 2015 the Italian Multiple Sclerosis Register project. The main objective consists of creating a multicentre organisational structure for the systematic gathering, on a voluntary basis, of PwMS clinical data at national level. This can be considered a scientific research tool that allows the progress of knowledge on the natural history of the disease and its development over time as well as the gathering of epidemiological, social and welfare data, useful for the development of specific studies and health planning actions. Up to 31 May 2021, the abovementioned register, created with the involvement of a network of over 130 specialist centres, counts 72,283 patients, broken down by age as represented in Figure 2.

**Figure 2: Patients included in the Italian Multiple Sclerosis Registry by age groups (base = 72,283)**



Source: The Italian Multiple Sclerosis Register (<https://registroitalianosm.it/en/index.php?page=report>)

MS is usually diagnosed in people aged 20-50 years and causes a broad and diverse range of symptoms that progressively impair patients' mobility, cognitive abilities, and sensory and autonomic systems (Doshi and Chataway, 2016). Although available treatments reduce symptoms and can slow down progression of the disease, most patients experience different degrees of disability with time, which is why MS is the most common non-traumatic cause of disability in young and adult populations in most high- and middle-income countries (Bevan and Steadman, 2015; Giovannoni et al., 2016).

Depending on presentation and initial course, MS is classified at onset as either one of two main subtypes:

1. Approximately 85 % of patients are diagnosed with relapsing-remitting form (RRMS). It is characterised by episodes of significant worsening of symptoms (relapses), followed by full or partial recovery, and then periods of remission. RRMS is more common among women and young adults (average age 30) (Brownlee et al., 2017).
2. Approximately 15 % of patients are diagnosed with primary progressive form (PPMS), in which disability continuously progresses and relapses may or may not be present. PPMS is usually diagnosed in older patients than RRMS (average age 40) and with no differences based on gender (Brownlee et al., 2017).

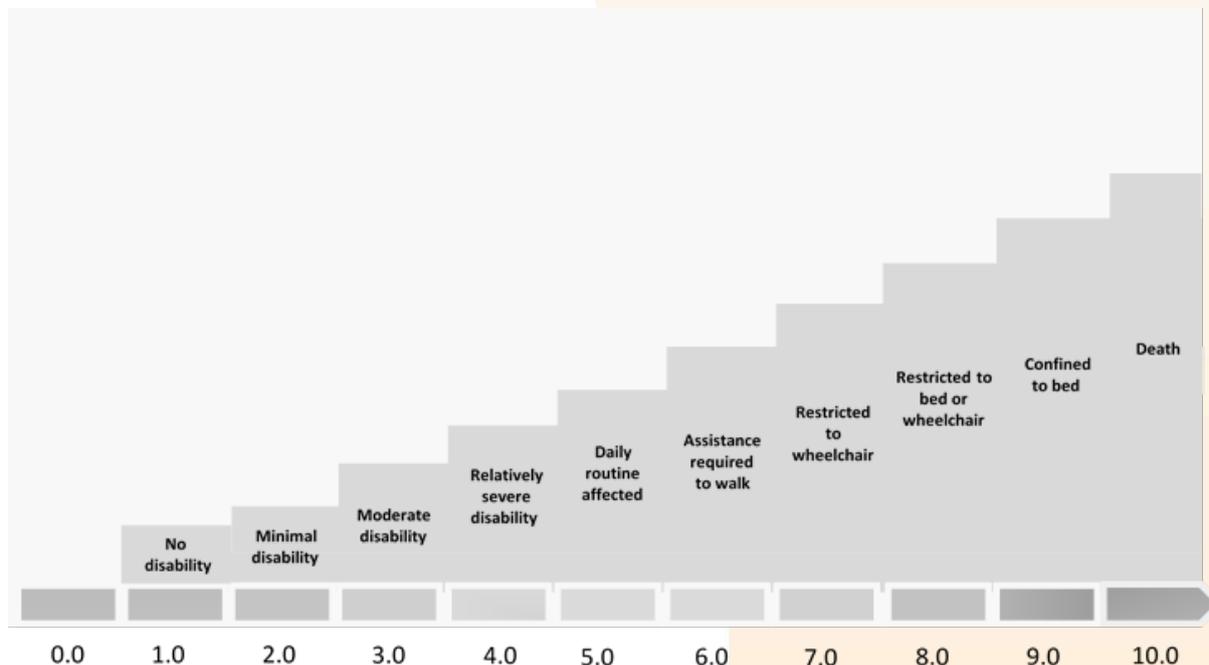
Due to the damage sustained by the CNS, many people initially diagnosed with RRMS develop a secondary progressive form (SPMS) some years after onset (15-20 years in most untreated RRMS patients). SPMS is characterised by a continuous progression of disability and very limited or no recovery (Giovannoni et al., 2016; Schwartz et al., 2013).

## Musculoskeletal disorders in multiple sclerosis

In the general population, MSDs are a very common condition. The prevalence of backpain in adults ranges from 5 to 22 % (Dagenais et al., 2008), limiting working and daily activities. Moreover, osteoarthritis can be considered the most common disease in adults, causing a restriction of daily living activities. Pain caused by MS can be musculoskeletal, paroxysmal or chronically neurogenic in nature (Solaro et al., 2004). MSDs in MS are induced, in particular, by an abnormal pattern of ambulation, abnormal upper limb movements and spasticity. In this context, two different definitions of pain are used in MS: neuropathic and nociceptive pains. The origin of nociceptive pain in MS has been suggested as being due to asymmetric posture, spasticity and walking impairments (Borgel et al., 2009; Broia et al., 2014). According to literature, the prevalence of back pain in MS ranges from 10 to 16 % (O'Connor et al., 2008) and the most common cause is low back pain with a prevalence of 21.4 (Martinelli Boneschi et al., 2008).

In a recent study, Massot et al. (2016) designed a retrospective study in a large medical centre in France with the aim to determine prevalence of MSDs in a group of 200 PwMS using an Expanded Disability Status Scale (EDSS – see Figure 3) from 4 to 7. The EDSS range from 4 to 7 comprises patients with significant disability but self-sufficient and up and about some 12 hours a day and able to walk without aid or rest for 500m (EDSS = 4) to patients unable to walk beyond approximately 5m even with aid and essentially restricted to wheelchair (Kurtzke, 1983). This EDSS range is extremely relevant for the occurrence of MSDs and includes a large proportion of employed patients with MS (Ponzio et al., 2015). Results of the study by Massot et al. (2016) showed that the most common MSDs were knee osteoarthritis that account for 7.9 %, toe claws (6.8 %), knee recurvatum (6.3 %) and rotator cuff tendinitis (5.8 %). Moreover, low back pain accounted for 41.6 % of the total sample considered in the study.

Figure 3: Schematic representation of EDSS



Source: Perez et al., 2021.

In this frame, we can assume from the literature that PwMS with walking and upper limb impairments could be a population at risk for osteoarthritis and tendinitis, and it could be important to prevent these complications. Indeed, these patients use one or more walking aids, according to their level of disability, and the increasing use of walking aids during disease progression could improve cases with osteoarthritis and tendinitis. In addition, we can assume that at a higher level of disability, the use of a wheelchair could lower the rate of tendinitis on lower limbs and increase the level of MSDs, such as cuff tendinitis. Another factor that we have to take into account is the correlation of MSDs and neuropathic pain. Several studies showed an increase of neuropathic pain in MSDs presenting as osteoarthritis (Dimitroulas et al., 2014). Lastly, it is well known that human posture depends on integration and organisation of spatial references, basically the integration of vestibular, proprioceptive and vision functional systems. In MS, demyelinating lesions could affect these three systems (Brichetto et al., 2015), leading to altered posture. Moreover, vision is often impaired, affecting stereoscopic vision and the integration of neck posture and the oculomotor system (Caneiro et al., 2010).

In conclusion, while MSDs have an important impact on working ability in the adult healthy population, this is particularly relevant for people with disability and in the case of MS, where working ability is influenced by the particular requirements regarding physical and mental ability specific to each type of employment activity (Wickström et al., 2017).

## Multiple sclerosis and employment

As prevalence rates are higher among people aged 35-64, who are at the peak of their adult life and productivity, MS has a devastating impact on patients' quality of life and ability to work (Bevan and Steadman, 2015; Giovannoni et al., 2016); in particular, the most important social consequence of MS is reduced employability due to the individual's compromised ability to perform occupational tasks.

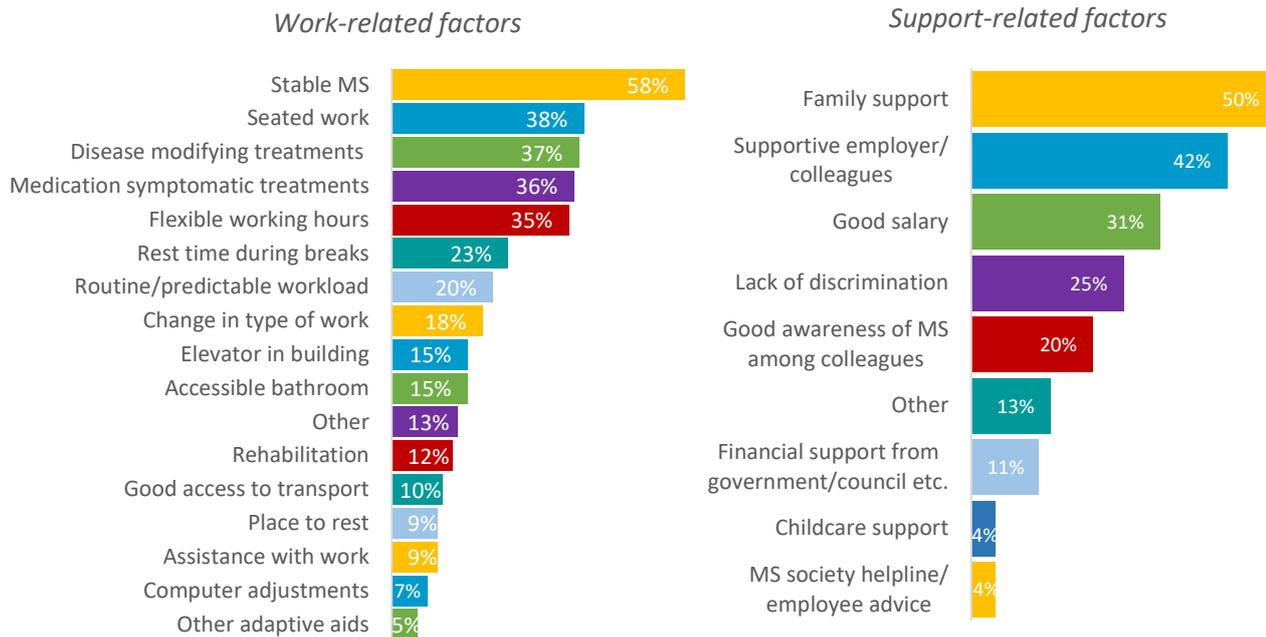
Several studies have examined the relationship between MS and employment status, assessing the impact of MS on employment rate. For workers with this type of disability, there is often a need to adapt the work conditions to their health status (Fantoni-Quinton et al., 2016; Kobelt et al., 2006; Messmer Uccelli et al., 2009; Simmons et al., 2010).

In a survey conducted in 2010 (MSIF, 2010) on a worldwide scale it was found that approximately 83 % of PwMS leave work prematurely due to the disease and that 47% of these individuals leave work within 3 years of diagnosis. The majority of respondents (85 %) reported the symptom 'fatigue' as the main cause of their inability to stay at work, followed by mobility disorders in general (72 %).

International evidence shows that unemployment rates among PwMS are much higher than in the general population, and they increase with the progression of disability (Julian et al., 2008, Kobelt et al., 2017). Based on the literature review, the unemployment rate of MS workers depends on different aspects (that is, the severity and duration of disease, type of working activities, educational level). Findings show a mean unemployment rate of about 60 % (Kobelt et al., 2006; Schiavolin et al., 2013) with a range from 24 to 80 % (Bøe Lunde et al., 2014; Findling et al., 2015; Glanz et al., 2012; Honarmand et al., 2011; Messmer Uccelli et al., 2009). The progressive disease course, increasing age, physical disability, higher levels of pain and fatigue, depression, anxiety and cognitive disorders are the factors that were most frequently associated with difficulties in performing working tasks.

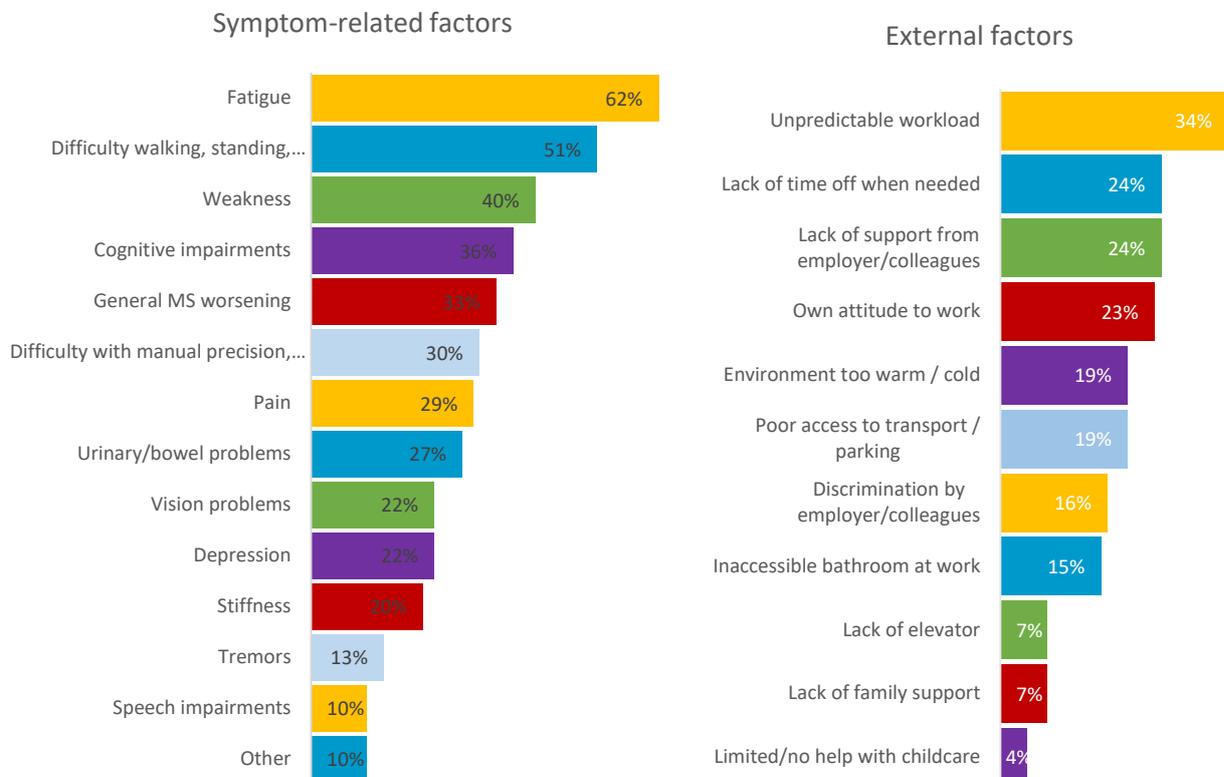
Finding and retaining employment is a major challenge for PwMS who report that a broad range of work-related, support-related and symptoms-related factors play a significant role in that respect (Figures 4 and 5) (MSIF, 2016).

Figure 4: Factors that have helped people with MS stay in employment



Source: MSIF, 2016.

Figure 5: Factors that prevented people with MS from staying in employment



Source: MSIF, 2016.

Data collected by the AISM in 2017 on employment of PwMS resonate with international evidence: approximately 33 % of all Italian PwMS reported having left their employment due to the disease, and 50 % indicated that limitations caused by MS prevented them from doing the job they wanted or were qualified to do (AISM, 2017).

The Covid-19 pandemic exacerbated the difficulties of Italian PwMS, not only because of the discontinuity in health and social care services it caused (Manacorda et al., 2021), but also from an employment point of view.

## Measuring domains relevant for working ability in multiple sclerosis

Fatigue, mobility and cognitive problems are the primary factors preventing people with MS from remaining in employment. These symptoms have different impact on their work, depending on the requirements and the possibility of adapting the workplace, the possibility for sedentary work and flexible working hours, and influence on the work content (MSIF, 2016). These conditions could consequently increase problems and difficulties in issuing a fitness for work judgement without limitations or prescriptions.

The EDSS is one of the main predictors for reduced work ability. However, the long-established EDSS but also the Multiple Sclerosis Functional Composite are inadequate to capture the change in the functional domains in MS patients needed to capture disease progression and the impact of impairment on activities of daily living and working ability (Cohen et al., 2012). To assess changes in different functional domains, the AISM in 2013 funded a project titled PROMOPRO-MS, with the aim to validate a functional profile of MS, based on variables and related measures, useful for quantifying MS progression and to develop a core outcome set in MS. The domains and related measures identified were a combination of clinician-assessed outcomes and PROs. In particular, the PROMOPRO-MS outcome set included measures related to fatigue, mobility, upper limb dexterity, cognition, anxiety and depression. Different studies showed the efficacy of the core outcome set in detecting changes and a progression in the disease (Brichetto et al., 2020; Fiorini et al., 2015). The proposed set of measures could be used not only to detect disease progression but also to identify the impact of an intervention in MS. In particular, it is mandatory to be able to assess mobility and upper limb dexterity that are often impaired in MS, leading to reduced working ability. In this context, the PROMOPRO-MS outcome set utilises a PRO devoted to assessing walking ability called Multiple Sclerosis Walking Scale (MSWS-12). Results of the study published for the use of MSWS-12 in Italian subjects with MS provide evidence that the MSWS-12/IT (Solaro et al., 2015) is reliable and valid. In addition, more than 90 % of subjects reported that this instrument is simple to understand and complete, thus making it a useful tool in clinical practice. In the domain of upper limb dexterity, the PROMOPRO-MS study identified the AbilHand PRO measures as the golden standard. In a study funded by the AISM, Grange et al. (2021) validated a short version of the AbilHand, the ABILHAND-26, that could represent a valid assessment for self-perceived ability to perform manual activity, especially for PwMS with moderate-to-high level of disability.

## Multidisciplinary intervention and the role of occupational therapy

As stated before, MS is characterised by heterogeneous symptoms that could affect individuals in different functional domains. MSDs are one aspect of a complex disease that needs a multidisciplinary approach. A multidisciplinary care team can be defined as a partnership among healthcare workers of different disciplines inside and outside the health sector, as well as in care centres and the community, with the goal of providing continuous, comprehensive and efficient health services. In this context, a multidisciplinary rehabilitation team approach is needed to counteract MS symptoms, and in particular MSDs, and to preserve as much as possible daily living and working activities. The concept of multidisciplinary rehabilitation can be defined as assisting individuals who experience disability to achieve and maintain optimal functioning in interaction with their environments. It is considered a highly individualised education and adaptation process to achieve maximum activity and participation (Feys et al., 2016).

The team is usually composed of occupational therapists, physiotherapists, neuropsychologists, physicians, nurses and social workers.

Occupational therapists and other qualified staff can undertake both task and environmental analysis, allowing tasks to be broken down into manageable steps and ensuring the demands of the job are minimised. Most importantly, this team can also work to develop 'real-life' vocational rehabilitation interventions that address the specific problems experienced in the workplace, for example, by moving someone's desk nearer to the bathroom, avoiding distracting environments, and requesting that all tasks are emailed and therefore not dependent on memory.

In this context and taking into account that MSDs could be induced, in particular, by an abnormal pattern of ambulation, abnormal upper limb movements and spasticity, the approach of a multidisciplinary team is fundamental in order to compensate for, modify and/or improve the abovementioned symptoms. Based on the literature (Doogan and Playford, 2014) and the AISM PROMOPRO-MS database, a different approach could be identified so as to impact working ability in MS. Table 1 summarises the approaches with a view on the healthcare professional involved and the relevance for MSDs.

**Table 1:** The table summarises the multidisciplinary team approaches, the relevant healthcare professional involved and the relevance for MSDs needed to compensate for, modify and/or ameliorate symptoms that could affect working activities in MS

Improving performance	Healthcare professional involved	Relevant for musculoskeletal disorders
Fatigue management	Occupational Therapist	YES
Physiotherapy to manage tone or mobility difficulties	Physical Therapist	YES
Cognitive rehabilitation/retraining	Psychologist	NO
Psychological adjustment to diagnosis	Psychologist	NO
Psychotherapy for anxiety and depression and improving self-esteem, self-efficacy and confidence	Psychologist	NO
<b>Compensating for performance difficulties</b>		
Ensuring toilet access	Occupational Therapist	YES
Minimising distractions	Psychologist/Occupational Therapist	NO
Making 'to do' lists	Occupational Therapist	NO
Using voice-activated software	Occupational Therapist/Speech Therapist	NO
Taking regular agreed upon rest breaks	Occupational Therapist	YES
Using memory aids e.g. diary, calendar, mobile/computer apps	Psychologist/Occupational Therapist	NO
<b>Modifying performance demands</b>		
Considering redeployment	Social Worker	YES
Working part time	Social Worker	YES
Working from home	Social Worker	YES

Source: PROMOPRO-MS database – Brichetto et al., 2020.

A multidisciplinary team can work with the PwMS to manage performance in the workplace in an integrated approach that involves the occupational physician (OP) and the other professionals of the company's prevention system. Hence, there is relevance for an integrated approach aimed at the assessment and management of risks in the workplace with the inclusion in the team of the company's prevention professionals, in particular the OP.

## Improving the job retention strategies for multiple sclerosis workers

Considering that the diagnosis of MS takes place between 20 and 50 years of age, when people are economically more active or are entering or already inserted in the world of work, in addition to the job placement, a significant problem arises regarding the maintenance of the workplace. Above all, this occurs in relation to the very variable clinical course of MS and to the symptoms or symptom complex that could affect the continuity of work performance.

Since 2004, EU-OSHA affirms: *'People with disabilities should receive equal treatment at work. This includes equality regarding health and safety at work. Health and safety should not be used as an excuse for not employing or not continuing to employ disabled people. In addition, a workplace that is accessible and safe for people with disabilities is also safer and more accessible for all employees, clients and visitors. People with disabilities are covered by both European anti-discrimination legislation and occupational health and safety legislation. This legislation, which the Member States implement in national legislation and arrangements, should be applied to facilitate the employment of people with disabilities, not to exclude them'*. On this basis, the Agency calls for an integrated approach to health and safety in the workplace, taking into account the anti-discrimination aspect (EU-OSHA, 2004, p. 1).

Therefore, the approach to job placement/maintenance of people with chronic degenerative diseases and, in the specific case of MS, must be implemented according to what is dictated by both the current legislation for the protection of health and safety – in Italy, specifically established by Legislative Decree 81/2008 – and the anti-discrimination one. The latter is regulated by Legislative Decree 216/2003 and Law 18/2009, respectively, implementing Council Directive 2000/78 / EC of 27 November 2000 establishing a general framework for equal treatment in employment and occupation and ratification and execution of the United Nations (UN) Convention on the Rights of Persons With Disabilities.

The issue turns out to be complex and delicate –amplified even more by issues also related to the protection of privacy. In this context, the various professionals of a company's prevention system – each within their own field of competence – play a relevant role in the best management of critical issues, in the implementation of prevention strategies and, in particular, in contributing to identifying 'reasonable accommodation' of PwMS needs in the workplace.

Reasonable accommodations are modifications or adaptations that allow people with disabilities to get or keep a job, also with the aim of improving working life as a whole, in compliance with the abovementioned Council Directive and UN Convention.

Extensive information on reasonable accommodations is available in the Job Accommodation Network (JAN) (Persechino et al., 2014). This is an online workplace accommodation toolkit that provides technical assistance to both employees and employers in order to create a more disability-inclusive and compliant workplace. It contains policies and practice samples, templates and checklists as well as emerging approaches that companies can try out and customise for their workplace needs.

Taking into consideration that there are several and often complex aspects involved in identifying reasonable accommodations in the MS context, in-depth information on some working context characteristics is appropriate (Table 2).

**Table 2:** Examples of areas to investigate as proposed by JAN

Areas to investigate
1. What limitations is the employee experiencing?
2. How do these limitations affect the employee and the employee's job performance?
3. What specific job tasks are problematic as a result of these limitations?
4. What accommodations are available to reduce or eliminate these problems? Are all possible resources being used to determine possible accommodations?
5. Has the employee been consulted regarding possible accommodations?
6. Once accommodations are in place, would it be useful to meet with the employee to evaluate the effectiveness of the accommodations and to determine whether additional accommodations are needed?
7. Do supervisory personnel and employees need training?

Source: JAN, 2019, p. 4.

Below are some examples of accommodations available as part of the work-related functions proposed by JAN, aimed at reducing/eliminating problems for employees with MS; however, other accommodation solutions may exist.

**Table 3:** Examples of solutions/interventions by work-related functions

Work-related functions	Solution or proposed intervention
Parking	▪ Accessible Parking Space
	▪ Flexible Schedule
	▪ Telework, Work from Home, Working Remotely
	▪ Wheelchairs
Worksite Access	▪ Accessible Toilets and Toilet Seats
	▪ Adjustable Workstations for Industrial Settings
	▪ Adjustable Workstations for Office Settings
	▪ Alternative Locks
	▪ Anti-fatigue Matting
	▪ Braille and/or ADA Signage
	▪ Building Accessibility Products
	▪ Doorknob Grips and Handles
	▪ Flexible Schedule
	▪ Portable Ramps
	▪ Ramps
	▪ Scooters
	▪ Service Animal
	▪ Support Animal
▪ Telework, Work from Home, Working Remotely	
▪ Wearable Anti-fatigue Matting	

Work-related functions	Solution or proposed intervention
	<ul style="list-style-type: none"> <li>▪ Wheelchair Lifts</li> <li>▪ Wheelchairs</li> <li>▪ Worksite Redesign / Modified Workspace</li> </ul>
Work Station Access	<ul style="list-style-type: none"> <li>▪ Adjustable and Ergonomic School Desks and Equipment</li> <li>▪ Adjustable Desktop Workstations for Office Settings</li> <li>▪ Adjustable Workstations for Industrial Settings</li> <li>▪ Anti-fatigue Matting</li> <li>▪ Articulating Keyboard Trays</li> <li>▪ Assist Lift Cushions</li> <li>▪ Chair Mats</li> <li>▪ Chairs for Little People</li> <li>▪ Chairs for Tall People</li> <li>▪ Dual Monitors</li> <li>▪ Elevating Lift and Office Chairs</li> <li>▪ Ergonomic and Adjustable Office Chairs</li> <li>▪ Ergonomic Equipment</li> <li>▪ Expanded Keyboards</li> <li>▪ Forearm Supports</li> <li>▪ Forward Leaning Chairs</li> <li>▪ Large-rated Chairs</li> <li>▪ Monitor Mirrors</li> <li>▪ Monitor Risers</li> <li>▪ Mousing Surfaces</li> <li>▪ Stand-lean Stools</li> <li>▪ Supine Workstations</li> <li>▪ Work Platforms</li> <li>▪ Zero Gravity (reclining) Chairs</li> </ul>
Temperature (Sensitivity to Cold)	<ul style="list-style-type: none"> <li>▪ Air Deflectors</li> <li>▪ Cold Resistant Gloves</li> <li>▪ Flexible Schedule</li> <li>▪ Foot Warmers</li> <li>▪ Heated Clothing</li> <li>▪ Heated Ergonomic and Computer Products</li> <li>▪ Heated Gloves</li> <li>▪ Modified Break Schedule</li> <li>▪ Telework, Work from Home, Working Remotely</li> <li>▪ Vent Covers</li> <li>▪ Workstation Space Heaters</li> </ul>
Temperature (Sensitivity to Heat)	<ul style="list-style-type: none"> <li>▪ Air Deflectors</li> <li>▪ Cooling Clothing</li> <li>▪ Fans</li> <li>▪ Flexible Schedule</li> </ul>

Work-related functions	Solution or proposed intervention
	<ul style="list-style-type: none"> <li>▪ Modified Break Schedule</li> </ul>
	<ul style="list-style-type: none"> <li>▪ Personal Visors</li> </ul>
	<ul style="list-style-type: none"> <li>▪ Telework, Work from Home, Working Remotely</li> </ul>
	<ul style="list-style-type: none"> <li>▪ Vent Covers</li> </ul>
	<ul style="list-style-type: none"> <li>▪ Workstation Space Heaters</li> </ul>

Source: JAN, 2019 (modified).

Hence, it is relevant to carry out a careful 'risk assessment' related to 'workers exposed to specific risks', in compliance with the requirements of the Framework Directive on OSH and the Italian Legislative Decree 81/08. This will favour, also in line with the provisions of the specific EU-OSHA report (Crawford et al., 2021), the identification and adoption of reasonable accommodations that would allow workers to continue working and the company to preserve efficiency and productivity.

So far, no data is available on the types of risks that workers with MS are actually exposed to.

Data transmitted – by the first quarter of 2019 – through a specific IT platform set up at INAIL and relating to 2018 showed that in Italy a total of 14,786,812 workers are subject to mandatory health surveillance, in accordance with Legislative Decree 81/2008, versus 23,215,000 workers employed in the same period. This apparent discrepancy is because not all workers fall within the scope of the standard or are exposed to risks for which health surveillance is required.

In Table 4, risks for which Italian workers are visited are shown.

**Table 4:** Types of risks in the workplace and exposed workers

Risk description	Total workers under health surveillance	% of workers under health surveillance on total workers visited by type of risk
Manual handling of loads (MHLs)	6,362,558	43.0%
Upper limb biomechanical overload	2,520,141	17.0%
Chemical agents	2,579,109	17.4%
Asbestos	21,990	0.1%
Biological agents	2,581,665	17.5%
Display Units (VDUs)	4,497,422	30.4%
Whole body vibrations	1,045,898	7.1%
Hand-arm vibrations	1,068,450	7.2%
Noise	2,707,460	18.3%
Artificial optical radiation	201,781	1.4%
Natural ultraviolet radiation	256,234	1.7%
Severe microclimate	1,137,538	7.7%
Hyperbaric atmospheres	3,726	0.0%
Night work >80 days / year	1,264,811	8.6%
Other risks highlighted by Risk Assessment	4,030,076	27.3%
Postural risks	3,103,207	21.0%

Risk description	Total workers under health surveillance	% of workers under health surveillance on total workers visited by type of risk
Carcinogens	130,922	0.9%
Mutagens	23,399	0.2%
Electromagnetic fields	108,234	0.7%
Infrasound/Ultrasound	3,712	0.0%
Silica	30,122	0.2%
<b>Total</b>	<b>33,678,455</b>	

NB: The same worker can be exposed to several occupational risks.

Source: INAIL (unpublished data extracted from the dashboard of OPs' mandatory communications pursuant to Article 40 of Legislative Decree 81/2008). Year 2018 (last available).

In particular, regarding the risks present during work that can cause/worsen MSDs, about 43 % of Italian workers are visited by the OP for manual handling of loads (MHLs), 30 % for visual display unit (VDU) risk, 21 % for postural risk and 17 % for biomechanical overload of the upper limbs. It should be noted that there might also be multiple exposures at the same time for the same worker.

In regards to the above, a survey was conducted through a convenience sampling approach of 403 OPs living and working in Italy (Persechino et al., 2019), using a self-administered questionnaire.

The questionnaire was structured, using indicators based on a careful review of the literature focused on the work issue in MS patients (Raggi et al., 2015; Rosti-Otajärvi et al., 2017; Schiavolin et al., 2013). Information regarding the health surveillance system and the evaluation of fitness for work in MS workers and the training and updating needs on MS were also gathered.

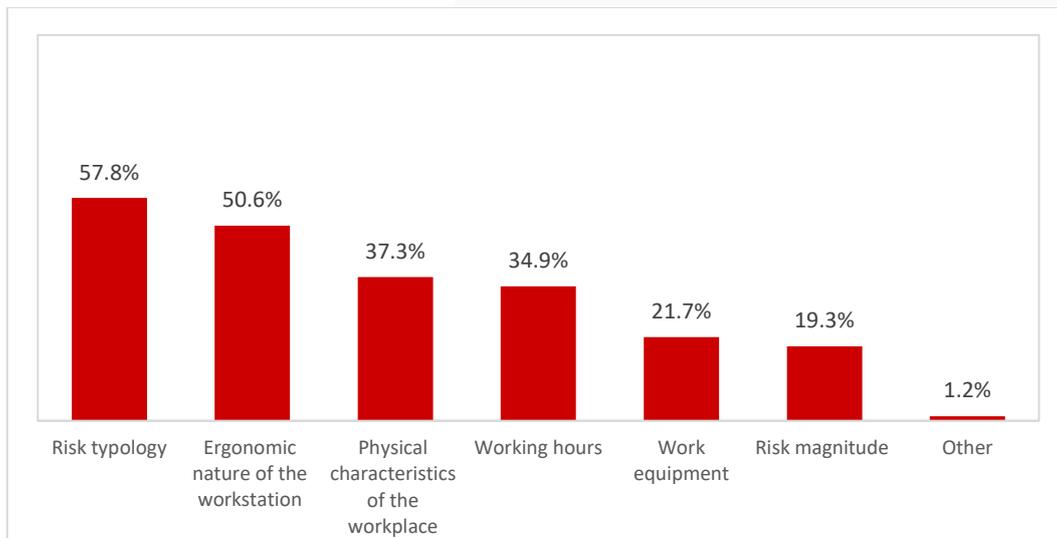
Of those surveyed, 271 OPs (67.8 % of sample) have managed workers with MS during their professional activities, mostly as included in the health surveillance programme, pursuant to Legislative Decree 81/08.

Regarding the health surveillance area in particular, when an OP releases a fitness for work judgement with limitations or prescriptions, the employer usually provides the worker with special accommodations (for example, to change the working tasks/activities) to ensure a complete and satisfactory fit between the health conditions of workers and the characteristics of working tasks/activities. The survey also demonstrated that more than half of the sample highlighted the presence of certain difficulties in issuing a fitness for work judgement without limitations or prescriptions. These difficulties are mainly due to the ergonomic nature of the workstation (24.5 %) or to physical characteristics of the workplace (17.4 %), to the typology (22.5 %) and magnitude of occupational risk factors that MS workers are exposed to (8.0 %), and the duration of working time (17.4 %). Only 63 OPs (24.1 %) needed to carry out diagnostic insights related to MS to issue the fitness for work judgement. Of the OPs interviewed, 30.8 % said that MS workers included in the health surveillance programme were mainly exposed to VDUs and 19.0 % (N=98 OPs) to MHLs.

A deeper analysis carried out on the abovementioned sub-sample (N=98 OPs) highlighted that about half of the OPs who have managed MS workers exposed to MHLs risk had a request in addition to the already mandatory one for a further medical examination by the PwMS.

Of those interviewed, 33.3 % needed diagnostic investigations, whereas 83.9 % of OPs affirmed the presence of difficulty in issuing a fitness for work judgement without limitations or prescriptions. These difficulties are mainly due to the typology of occupational risk factors (57.8 %) that MS workers are exposed to, ergonomic nature of the workstation (50.6 %), physical characteristics of the workplace (37.3 %) and working hours (34.9 %) (Figure 6).

**Figure 6: Reasons related to the difficulties in issuing a fitness for work judgement without limitations or prescriptions. Multiple-choice question. Percentage of cases\***

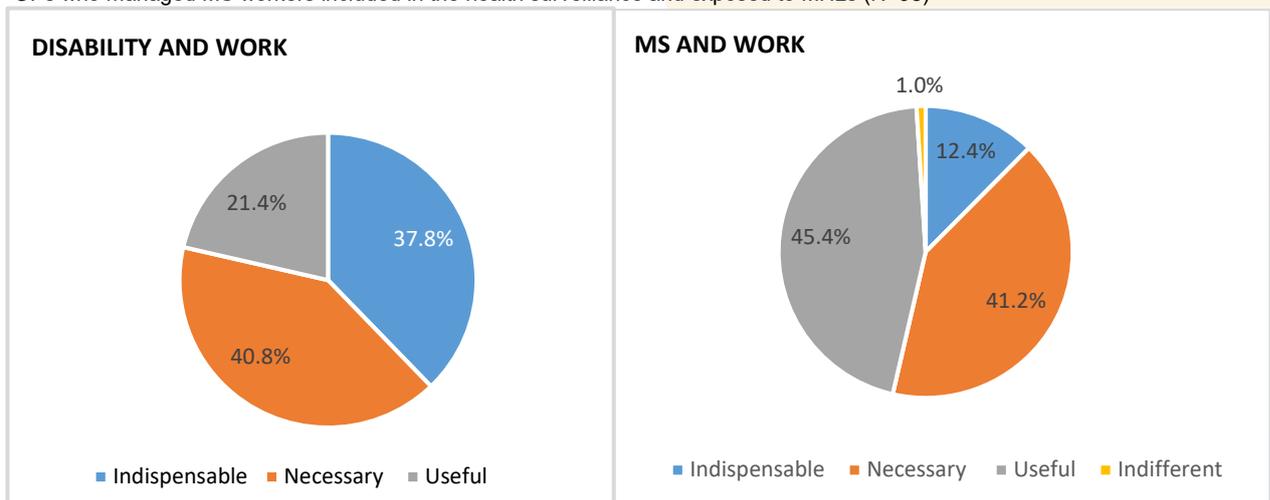


\*OPs who managed MS workers included in the health surveillance and exposed to MHLs (N=98)

Furthermore, information demands and training/updating needs may also be particularly helpful in defining, developing and implementing strategies, procedures and training programmes to support workers affected by MS; these themes were also investigated in the survey. The results processed on the sub-sample of OPs who managed MS workers exposed to MHLs show that 40.8 % of the sample considered training on ‘disability and work’ necessary and 37.8 % considered this activity indispensable, whereas training on ‘MS and work’ is considered useful by 45.4 %, necessary by 41.2 % and indispensable by 12.4 % (Figure 7).

**Figure 7: OPs’ opinions on specialist training topics. Percentage values\***

\*OPs who managed MS workers included in the health surveillance and exposed to MHLs (N=98)



## Conclusions

The abovementioned issues underline the complexity of maintaining and managing working activity for PwMS, but also highlight areas for potential interventions and development of preventive strategies.

The results of the survey on OPs, highlighting the different cases/types of difficulties in issuing a fitness for work judgement, especially for workers exposed to MHLs, outline the need for both the adoption of specific 'reasonable accommodation' in the workplace and the empowerment through training of prevention professionals, in particular the OPs.

As highlighted in the paper, MSDs and their causes in MS are not well understood, but they can be considered one of the main causes of pain in PwMS. Backpain, asymmetric posture, walking impairment, sensitive dysfunction and spasticity are extremely frequent in PwMS, with relevant impact on daily life activities and working ability. In this context, the implementation of a multidisciplinary care process, in particular taking into account the role of occupational therapy, would, at least partially, cover both the needs for evaluating workplace environmental factors and the delivery of ad hoc vocational rehabilitation interventions. The primary goal of occupational therapy is to enable people to participate in the activities of everyday life (Baum et al., 2013). Therefore, occupational therapists are key to the management of PwMS by enhancing participation through interventions that minimise impairment or increase performance in meaningful activities, by providing environmental support and reducing social and environmental barriers, and by enhancing personal coping strategies.

The implementation of the Italian Multiple Sclerosis Register, with detailed data on employment status, would foster the mapping of risks that MS workers are exposed to, aimed both at reconstructing the determinants of early exit from work and at identifying specific prevention interventions. These should later be adapted and implemented by companies in the risk management context for the best health and safety protection of MS workers, in order to maintain their workplace.

With regard to the training aspects, in particular, the need/usefulness of updates on MS and work arises. These findings are also in line with what emerges from a survey – conducted in 2014 (Persechino et al., 2015; Persechino et al., 2016) – where about 75 % of the OPs interviewed affirmed being involved (always/often) by the employer in the relocation of unsuitable workers.

On the issue of MS and work, INAIL funded the PRISMA project, which involves a partnership of excellence – including FISM – whose general objective is to analyse the working reality of PwMS in Italy, to define innovative models and programmes to improve inclusion in the world of work.

The results of PRISMA will contribute to the identification of policies and strategies for inclusion and maintenance of the workplace for PwMS, also with a view to identifying 'good practices' in the OSH field, as well as preparing effective information/training tools for the empowerment of workers and company prevention professionals.

## References

- AISM (Italian Multiple Sclerosis Society), 2017. Barometro della Sclerosi Multipla 2017. [https://agenda.aism.it/2021/download/Barometro\\_della\\_Sclerosi\\_Multipla\\_2017.pdf](https://agenda.aism.it/2021/download/Barometro_della_Sclerosi_Multipla_2017.pdf)
- AISM (Italian Multiple Sclerosis Society), 2021. Barometro della Sclerosi Multipla. <https://agenda.aism.it/2021/>
- Baum C, Carey L, Polatajko HJ. (2013) Occupational Therapy. In: Gellman M.D., Turner J.R. (eds) Encyclopedia of Behavioral Medicine. Springer, New York, NY. [https://doi.org/10.1007/978-1-4419-1005-9\\_905](https://doi.org/10.1007/978-1-4419-1005-9_905)
- Bevan S, Steadman K, 2015. Multiple Sclerosis and Employment in Europe - Literature Summary. The Work Foundation and the European Multiple Sclerosis Platform, London.
- Bøe Lunde HM, Telstad W, Grytten N et al., 2014. Employment among patients with multiple sclerosis-a population study. PLoS ONE 9(7):e103317. doi:10.1371/journal.pone.0103317
- Borgel F, 2009. Pain and early stage of multiple sclerosis. Rev. Neurol. (Paris) 165(Suppl 4):S129-34. doi:10.1016/S0035-3787(09)72124-1

- Brichetto G, Piccardo E, Pedullà L et al., 2015. Tailored balance exercises on people with multiple sclerosis: A pilot randomized, controlled study. *Mult. Scler. J.* 21(8):1055-63. doi:10.1177/1352458514557985
- Brichetto G, Monti Bragadin M, Fiorini S et al., 2020. The hidden information in patient-reported outcomes and clinician-assessed outcomes: multiple sclerosis as a proof of concept of a machine learning approach. *Neurol. Sci.* 41(2):459-62. doi:10.1007/s10072-019-04093-x
- Brola W, Mitosek-Szewczyk K, Opara J, 2014. Symptomatology and pathogenesis of different types of pain in multiple sclerosis. *Neurol. Neurochir. Pol.* 48(4):272-9. doi:10.1016/j.pjnns.2014.07.009
- Brownlee WJ, Hardy TA, Fazekas F et al., 2017. Diagnosis of multiple sclerosis: progress and challenges. *Lancet* 389:1336-46. doi:10.1016/S0140-6736(16)30959-X
- Caneiro JP, O'Sullivan P, Burnett A et al., 2010. The influence of different sitting postures on head/neck posture and muscle activity. *Man. Ther.* 15(1):54-60. doi:10.1016/j.math.2009.06.002
- Cohen JA, Reingold SC, Polman CH et al., 2012. Disability outcome measures in multiple sclerosis clinical trials: current status and future prospects. *Lancet Neurol.* 11(5):467-76. doi:10.1016/S1474-4422(12)70059-5
- Crawford JO, Giagloglou E, Davis A, Graveling R, 2021. Working with chronic musculoskeletal disorders — good practice advice. European Agency for Safety and Health at Work. doi:10.2802/31550
- Dagenais S, Caro J, Hademan S, 2008. A systematic review of low back pain cost of illness studies in the United States and internationally. *Spine J.* 8(1):8-20. doi:10.1016/j.spinee.2007.10.005
- Dimitroulas T, Duarte RV, Behura A et al., 2014. Neuropathic pain in osteoarthritis: a review of pathophysiological mechanisms and implications for treatment. *Semin. Arthritis Rheum.* 44(2):145-54. doi:10.1016/j.semarthrit.2014.05.011
- Doogan C, Playford ED, 2014. Supporting work for people with multiple sclerosis. *Mult. Scler. J.* 20(6):646-50. doi:10.1177/1352458514523499
- Doshi A, Chataway J, 2016. Multiple sclerosis, a treatable disease. *Clin. Med.* 16(Suppl 6):s53-9. doi:10.7861/clinmedicine.16-6-s53
- EU-OSHA (European Agency for Safety and Health at Work), 2004. Factsheet 53 - Ensuring the health and safety of workers with disabilities. <https://osha.europa.eu/en/publications/factsheet-53-ensuring-health-and-safety-workers-disabilities/view>
- European Multiple Sclerosis Platform, 2021. 2020 MS Barometer. <https://www.emsp.org/wp-content/uploads/2021/03/MS-Barometer2020-Final-Full-Report-Web.pdf>
- Fantoni-Quinton S, Kwiatkowski, Vermersch P et al., 2016. Impact of multiple sclerosis on employment and use of job-retention strategies: The situation in France in 2015. *J. Rehabil. Med.* 48(6):535-40. doi:10.2340/16501977-2093
- Feys P, Giovannoni G, Dijsselbloem N et al., 2016. The importance of a multi-disciplinary perspective and patient activation programmes in MS management. *Mult. Scler. J.* 22(Suppl 2):34-46. doi:10.1177/1352458516650741
- Findling O, Baltisberger M, Jung S et al., 2015. Variables related to working capability among Swiss patients with multiple sclerosis—a cohort study. *PLoS ONE* 10(4):e0121856. doi:10.1371/journal.pone.0121856
- Fiorini S, Verri A, Tacchino A et al., 2015. A machine learning pipeline for multiple sclerosis course detection from clinical scales and patient reported outcomes. *Annu. Int. Conf. IEEE Eng. Med. Biol. Soc.* 4443-6. doi:10.1109/EMBC.2015.7319381
- Giovannoni G, Butzkueven H, Dhib-Jalbut S et al., 2016. Brain health: time matters in multiple sclerosis. *Mult. Scler. Relat. Disord.* 9(Suppl 1):S5-48. doi:10.1016/j.msard.2016.07.003
- Glanz BI, Degano IR, Rintell DJ et al., 2012. Work productivity in relapsing multiple sclerosis: associations with disability, depression, fatigue, anxiety, cognition, and health-related quality of life. *Value Health* 15(8):1029-35. doi:10.1016/j.jval.2012.07.010

- Grange E, Marengo D, Di Giovanni R et al., 2021. Italian translation and psychometric validation of the ABILHAND-26 and its correlation with upper limb objective and subjective measures in multiple sclerosis subjects. *Mult. Scler. Relat. Disord.* 55:103160. doi:10.1016/j.msard.2021.103160
- Honarmand K, Akbar N, Kou N et al., 2011. Predicting employment status in multiple sclerosis patients: the utility of the MS functional composite. *J. Neurol.* 258(2):244-9. doi:10.1007/s00415-010-5736-8
- JAN (Job Accommodation Network), 2019. Accommodation and Compliance Series: Employees with multiple sclerosis. U.S. Department of Labor, Office of Disability Employment Policy. <https://askjan.org/publications/Disability-Downloads.cfm?pubid=382018&action=download&pubtype=pdf>
- Julian LJ, Vella L, Vollmer T et al., 2008. Employment in multiple sclerosis: Exiting and re-entering the work force. *J. Neurol.* 255(9):1354-60. doi:10.1007/s00415-008-0910-y
- Kobelt G, Berg J, Lindgren P et al., 2006. Costs and quality of life in multiple sclerosis in Europe: method of assessment and analysis. *Eur. J. Health. Econ.* 7(Suppl 2):S5-13. doi:10.1007/s10198-006-0365-y
- Kobelt G, Thompson A, Berg J et al., 2017. New insights into the burden and costs of multiple sclerosis in Europe. *Mult. Scler. J.* 23(8):1123-36. doi:10.1177/1352458517694432
- Kurtzke JF. 1983. Rating neurologic impairment in multiple sclerosis: an expanded disability status scale (EDSS). *Neurology.* 33:1444-52. doi:10.1212/WNL.33.11.1444
- Manacorda T, Bandiera P, Terzuoli F et al., 2021. Impact of the COVID-19 pandemic on persons with multiple sclerosis: Early findings from a survey on disruptions in care and self-reported outcomes. *J. Health Serv. Res. Policy* 26(3):189-97. doi:10.1177/1355819620975069
- Martinelli Boneschi F, Colombo B, Annovazzi P et al., 2008. Lifetime and actual prevalence of pain and headache in multiple sclerosis. *Mult. Scler. J.* 14(4):514-21. doi:10.1177/1352458507085551
- Massot C, Agnani O, Khenioui H et al., 2016. Back pain and musculoskeletal disorders in multiple sclerosis. *J. Spine* 5(285):2. doi:10.4172/2165-7939.1000285
- Messmer Uccelli M, Specchia C, Battaglia MA et al., 2009. Factors that influence the employment status of people with multiple sclerosis: a multi-national study. *J. Neurol.* 256(12):1989-96. doi:10.1007/s00415-009-5225-0
- MSIF (Multiple Sclerosis International Federation), 2010. MSIF survey on Employment and MS. <http://www.msif.org/wp-content/uploads/2014/10/Survey-on-employment-and-MS.pdf>
- MSIF (Multiple Sclerosis International Federation), 2013. Atlas of MS 2013: Mapping Multiple Sclerosis Around the World. <https://www.msif.org/wp-content/uploads/2014/09/Atlas-of-MS.pdf>
- MSIF (Multiple Sclerosis International Federation), 2016. Global MS Employment Report 2016. <https://www.msif.org/wp-content/uploads/2016/05/Global-MS-Employment-Report-2016.pdf>
- O'Connor AB, Schwid SR, Herrmann DN et al., 2008. Pain associated with multiple sclerosis: systematic review and proposed classification. *Pain* 137(1):96-111. doi:10.1016/j.pain.2007.08.024
- Perez C, Smith A, Nelson F, 2021. Expanded Disability Status Scale (EDSS). In *Multiple Sclerosis: A Practical Manual for Hospital and Outpatient Care*, Cambridge Manuals in Neurology, p. 215. Cambridge University Press, Cambridge. doi:10.1017/9781108907484.014
- Persechino B, Conte C, Forzano F, Iavicoli S, 2014. Sclerosi multipla e lavoro: i ragionevoli accomodamenti del Job Accommodations Network. INAIL. Tipolitografia INAIL di Milano, Edizione 2014. ISBN: 978-88-7484-368-8. 2014
- Persechino B, Buresti G, Rondinone BM et al., 2015. Indagine nazionale sulla salute e sicurezza sul lavoro. Medici Competenti. Tipolitografia INAIL di Milano. ISBN: 978-88-7484-459-3
- Persechino B, Fontana L, Buresti G et al., 2016. Professional activity, information demands, training and updating needs of occupational medicine physicians in Italy: National survey. *Int. J. Occup. Med. Environ. Health* 29(5):837-58. doi:10.13075/ijomeh.1896.00736

- Persechino B, Fontana L, Buresti G et al., 2019. Improving the job-retention strategies in multiple sclerosis workers: the role of occupational physicians. *Industrial Health* 57(1):52-69. doi:10.2486/indhealth.2017-0214
- Ponzio M, Bricchetto G, Zaratini P et al., 2015. Workers with disability: the case of multiple sclerosis. *Neurol. Sci.* 36(10):1835-41. doi:10.1007/s10072-015-2265-3
- Raggi A, Giovannetti AM, Schiavolin S et al., 2015. Development and validation of the multiple sclerosis questionnaire for the evaluation of job difficulties (MSQ-Job). *Acta Neurol. Scand.* 132(4):226-34. doi:10.1111/ane.12387
- Rosti-Otajärvi E, Hämäläinen P, Wiksten A et al., 2017. Validity and reliability of the Finnish version of the Multiple Sclerosis Impact Scale-29. *Brain Behav.* 7(7):e00725. doi:10.1002/brb3.725
- Schiavolin S, Leonardi M, Giovannetti AM et al., 2013. Factors related to difficulties with employment in patients with multiple sclerosis: a review of 2002–2011 literature. *Int. J. Rehabil. Res.* 36(2):105-11. doi:10.1097/MRR.0b013e32835c79ea
- Schwartz CE, Quaranto BR, Healy BC et al., 2013. Cognitive reserve and symptom experience in multiple sclerosis: a buffer to disability progression over time? *Arch. Phys. Med. Rehabil.* 94(10):1971-81. doi:10.1016/j.apmr.2013.05.009
- Simmons RD, Tribe KL, McDonald EA, 2010. Living with multiple sclerosis: longitudinal changes in employment and the importance of symptom management. *J. Neurol.* 257(6):926-36. doi:10.1007/s00415-009-5441-7
- Solaro C, Bricchetto G, Amato MP et al., 2004. The prevalence of pain in multiple sclerosis: A multicenter cross-sectional study. *Neurology* 63(5):919-21. doi:10.1212/01.WNL.0000137047.85868.d6
- Solaro C, Trabucco E, Signori A et al., 2015. Italian validation of the 12-item multiple sclerosis walking scale. *Mult. Scler. Int.* 2015:540828. doi:10.1155/2015/540828
- Wickström A, Fagerstrom M, Wickstrom L et al., 2017. The impact of adjusted work conditions and disease-modifying drugs on work ability in multiple sclerosis. *Mult. Scler. J.* 23(8):1137-47. doi:10.1177/1352458516671818

#### Authors:

Benedetta Persechino, Giuliana Buresti, Sergio Iavicoli, Department of Occupational and Environmental Medicine, Epidemiology and Hygiene, National Institute for Insurance against Accidents at Work (Istituto Nazionale per l'Assicurazione contro gli Infortuni sul Lavoro – INAIL), Italy

Mario A. Battaglia, Paolo Bandiera, Giampaolo Bricchetto, Grazia Rocca, Tommaso Manacorda, Italian Multiple Sclerosis Foundation (FISM), Italy

Project management: Sarah Copesey, Maurizio Curtarelli – European Agency for Safety and Health at Work (EU-OSHA)

This paper was commissioned by the European Agency for Safety and Health at Work (EU-OSHA). Its contents, including any opinions and/or conclusions expressed, are those of the authors alone and do not necessarily reflect the views of EU-OSHA.