Exploring the risk and extent of musculoskeletal disorders in UK heavy rail

Kirsten Huysamen, Owen McCulloch, Faye Bacon, Jemma Widdows, Barbro Arnes & Paul Leach

Rail Safety and Standards Board

SUMMARY

Musculoskeletal disorders (MSDs) are one of the leading causes of absence in the UK railway. The data required to address this issue is not readily available. The Rail Safety and Standards Board instigated a study to carry out the first industry-wide MSD survey to understand the prevalence and types of MSDs rail workers are experiencing and why this may be occurring. A railway-specific MSD survey was created using evidence from scientific literature and consultations with UK rail organisations, railway unions and the regulator, and the objectives of the survey. The survey underwent user testing to assess its readability, usability, and applicability to UK heavy rail. The survey was active for a duration of 5 months (July 2024 – December 2024) and open to all job roles contributing to heavy rail operations in the UK. The paper provides details on the survey development and initial findings.

KEYWORDS

Musculoskeletal disorders, musculoskeletal conditions, health and wellbeing, railway

Introduction

Musculoskeletal disorders (MSDs) are a significant issue in the UK rail industry, contributing to approximately 1 in 4 days of sickness absence and costing the industry approximately £89 million per year (ORR, 2019; RSSB, 2024). RSSB's Mental Wellbeing Survey (RSSB, 2021) found that nearly half of the rail workers that responded experienced backache (48%), upper body pain (54%) and lower limb pain (43%), in the past 12 months (4000 rail workers, 31 companies).

The UK rail industry currently has no reliable and consolidated data on the prevalence and types of MSDs, the affected job roles, and the tasks or risk factors contributing to their development. This makes it challenging to prevent and manage these disorders, develop targeted interventions, and determine where to focus effort.

The Rail Safety and Standards Board (RSSB) instigated a study to carry out the first industry-wide MSD survey to obtain the data required to understand the prevalence, type and risk factors of MSDs in UK heavy rail.

Method

Phase 1 produced a survey aligned to the project objectives, which are to:

- Understand the prevalence and types of MSDs rail workers are experiencing and the impact these have on workers' professional and personal lives.
- Identify the job roles affected by MSDs and, the tasks or risk factors contributing to the development of these disorders.

Phase 1 activities included a) review of scientific literature, standards, guidance and resources from reputable sources and b) consultations with UK rail organisations (rail operators, infrastructure and supply chain companies), railway unions and the regulator. A total of 11 consultations were conducted.

These activities gathered information on MSDs to inform the development of the survey, build an understanding of UK heavy rail job roles and MSDs within the industry, and identify validated or applicable MSD surveys. These findings, along with the project objectives, were used to create an online railway-specific MSD survey.

Phase 2 collected and analysed data from the survey and identified areas that need to be prioritised by the industry to improve musculoskeletal health. Before launching, the survey was user tested with 20 participants to evaluate its readability, usability and applicability to UK heavy rail. It was subsequently modified based on the feedback. This testing included participants with operational experience and utilised user scenarios to ensure a range of job roles were assessed.

The survey was active for five months (July 2024 to December 2024) and open to all job roles contributing to heavy rail operations in the UK. The data is currently in the process of being reviewed and analysed to identify key insights and trends, across all responses and within each individual job role. Several factors and relationships will be assessed, including but not limited to: a) the prevalence of trouble (aches, pain, discomfort) for each body part, b) the frequency of perceived high-risk tasks, c) exposure to MSD risk factors, d) likelihood of reporting, and e) perceptions of organisational culture related to MSDs. For each affected body part, aspects such as work as a causation factor, onset, sickness absence and medical interventions will be explored.

The remainder of this paper sets out findings from Phase 1, the survey development process, and initial survey data. As analysis is ongoing, data interpretation is not included.

Phase 1 Key Findings

Musculoskeletal disorders in UK heavy rail

Phase 1 findings revealed that MSDs are a significant issue in the UK heavy rail sector. Some rail organisations consulted attributed approximately 20% to 30% of their sickness absence to MSDs. Similar findings were reported by the Office of Rail and Road in 2019 (ORR, 2019). RSSB's Health and Wellbeing Data Hub, which collects health and wellbeing data from 21 companies across the GB rail industry, shows that MSDs and mental health issues are the two leading causes of sickness absence in the GB rail industry (McMahon et al., 2024; RSSB, 2024). The types of MSDs varied across organisations and railway sectors. Consultations most frequently highlighted lower limb and back issues, while RSSB's Mental Wellbeing Survey pointed to upper body concerns (RSSB, 2021). However, there was limited data for some job roles, the job roles most affected or the underlying causes.

The consultations confirmed that available detailed data on MSDs across the industry is limited, with some organisations having better insights than others. Organisations noted that this makes it difficult to identify trends and causation factors, leading to a reactive rather than proactive approach to MSD prevention and management.

Potential underreporting of MSDs in the rail industry was a key theme. Some organisations stated that employees tend to report MSDs only when they sustained an injury in the workplace requiring immediate medical attention or when pain becomes severe enough to prevent them from working. The latter makes it particularly challenging for organisations to identify causation factors and understand the prevalence and types of MSDs occurring. Moreover, there appears to be a discrepancy in reporting rates among job roles, with some reporting at a higher rate than others.

This means that some job roles may be overlooked, or their MSDs may go unnoticed. Organisations attributed underreporting to factors such as lack of MSD awareness, organisational culture (e.g., fear of job loss, the belief that aches, pain, and discomfort are part of the job, the perception that nothing will change) and gaps in reporting processes, for example, most organisation did not have a single, centralised process for reporting and capturing MSDs.

Contributing factors to musculoskeletal disorders

MSDs are considered multifactorial, often arising from a combination of factors rather than a single cause (Kiesel et al., 2024). There are numerous factors that can increase an individual's likelihood of developing an MSD (Punnett et al., 2004; HSE, 2002; da Costa et al., 2010; HSE, 2022, Kiesel et al., 2024). These can be grouped into three broad categories:

- Individual risk factors: Characteristics of an individual that can influence their susceptibility to developing an MSD (e.g., age, weight, health, fitness, lifestyle, past experiences etc.)
- Job & workplace risk factors: Physical demands and conditions of the job and workplace that contribute to the development of an MSD (e.g., manual handling, repetitive movements, awkward and static postures, bending and twisting, temperature, vibration etc.)
- Psychosocial risk factors: Cultural, social and psychological aspects of the job or working environment that are linked to the development of MSDs (e.g., job control, job demand, skill utilisation, recognition, breaks etc).

The consultations identified rail-specific MSD risk factors such as walking on ballast for extended periods, prolonged use of safety boots and working with damaged or old equipment. These were incorporated into the development of the survey.

Review of musculoskeletal disorder surveys

Numerous surveys were identified in the scientific literature and from reputable sources such as the Health and Safety Executive (HSE). Some of these surveys were designed for individuals with a preexisting MSD such as the Musculoskeletal Health Questionnaire (MSK-HQ) (Hill et al., 2016). Others were focused on identifying and understanding the potential musculoskeletal issues, if any, an individual has experienced in the past 3 or 12 months. These were typically based off the Nordic Musculoskeletal Questionnaire (NMQ) (Kuorinka et al., 1987). There were a few comprehensive MSD surveys, such as the Dutch Musculoskeletal Questionnaire (DMQ), which includes over 150 questions (Hildebrandt et al., 2001). These generally gathered information on potential musculoskeletal issues and exposure to MSD risk factors. There were also surveys that focused on a singular risk factor such as the HSE's Management Standards Indicator Tool (HSE-MS IT) which examines psychosocial risk factors in the workplace (Marcatto et al., 2014).

Developing a rail-specific musculoskeletal disorder survey

Using the Phase 1 evidence and project objectives, workshops were undertaken to identify the key information needed for the survey. Five categories of information were established, as shown in Table 1. None of the Phase 1 reviewed surveys fully captured this information, leading to the development of a heavy rail-specific MSD survey.

To develop the survey, each category of information was mapped to a relevant survey from Phase 1, where possible. The mapped surveys and their questions formed the foundation for the corresponding categories. Each question was then thoroughly reviewed and adapted to ensure relevance to UK heavy rail and alignment with the project's objectives. Non-relevant questions were excluded, and gaps were addressed by incorporating questions from other surveys or developing new ones. The main surveys used to develop the heavy rail-specific MSD survey, along with the mapped categories of information, are displayed in Table 1.

Table 1: The survey's five categories of information, with example data types and corresponding foundation surveys.

	Category	Type of information	Foundation surveys
1	General information	Demographic data, health, fitness, job role, experience, shift pattern, hours worked, contract type etc.	DMQ (Hildebrandt et al., 2001)
2	Musculoskeletal issues	Existing issues, the impact on work and daily life, characteristics of the issue (e.g., onset, frequency) etc.	Extended NMQ (Dawson et al., 2009) HSE's Body Mapping Tool (ORR, 2019)
3	High risk job tasks	Workplace tasks that could contribute to MSD development.	DMQ (Hildebrandt et al., 2001)
4	MSD risk factors	Exposure to job, workplace, and psychosocial MSD risk factors	DMQ (Hildebrandt et al., 2001) HSE-MS IT (Marcatto et al., 2014)
5	Organisation and reporting culture	Likelihood of reporting, MSD awareness, barriers to reporting, culture surrounding MSDs etc.	Not Applicable

The final version of the survey comprised six sections, as seen in Table 2. The final version was refined and modified based on feedback from rail organisations, railway unions and the user testing. The survey was also tested for technical feasibility at three rail organisations.

Table 2: The six sections of the UK heavy rail-specific MSD survey.

	Section title	Brief description of survey section
1	About you	Captures general information about the participant and their job.
2	Your musculoskeletal health	Identifies and explores musculoskeletal issues experienced in the past 12 months.
3	Your job tasks	Explores the tasks that may be causing aches, pain and discomfort at work.
4	Your job and work environment	Collects data on the exposure to factors linked to the development of MSDs.
5	Your work conditions	
6	Reporting in your organisation	Gathers information on the organisational culture surrounding MSDs and reporting thereof.

Phase 2 Initial Findings: Overall Survey Responses

This section presents some of the initial survey findings. As data analysis is still ongoing, this paper does not include data interpretation.

Demographic information

The survey received a total of 6,168 responses across various heavy rail job roles, with some roles being more represented than others. As seen in the Figure 1, job roles working on a train (e.g., train driver, conductor), had the highest response rate, whereas job roles working in a control or signalling location (e.g., signaller, controller) had the lowest response rate.

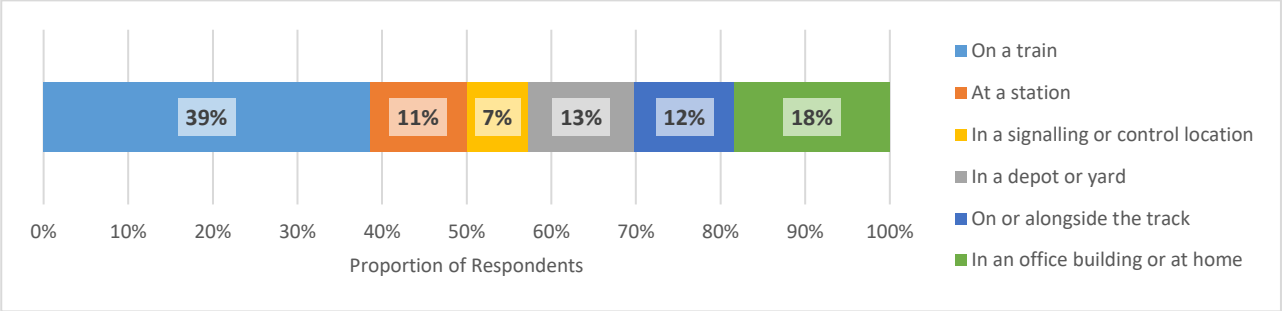

Figure 1: Proportion of MSD survey respondents by work location.

The age, experience level, and weekly working hours of respondents are presented in the Table 3. Most respondents were shift workers (77%), and on permanent employment contracts (93%). The majority were male (75%), while 24% were female and 1% indicated 'Other' or 'Prefer not to say'. Most respondents reported being in good physical and mental health and physically fit.

Table 3: Proportion of MSD survey respondents by age, experience level and hours worked.

Age		Rail industry experience		Job role experience		Hours worked per week	
Years	**% Responses**	**Years**	**% Responses**	**Years**	**% Responses**	**Hours**	**% Responses**
< 20	0.4%	< 1	4%	< 1	7%	0-20	5%
21-30	8%	1-5	18%	1-5	30%	21-30	3%
31-40	19%	6-10	19%	6-10	20%	31-40	56%
41-50	26%	11-15	11%	11-15	11%	41-50	30%
51-60	36%	16-20	14%	16-20	12%	51-60	5%
> 61	10%	> 21	34%	> 21	21%	> 61	1%

** % Responses refer to the proportion of respondents*

Musculoskeletal issues

Majority of respondents reported having trouble (aches, pain, discomfort) with one or more of their body parts in the past 12 months (94%). The most affected area was the lower back (64%), followed by the knees (48%), shoulder (46%) and neck (42%). The least reported were upper arms, elbows, and lower legs/calves. Further details are provided in Figure 2. The lower back was the most reported body part to cause trouble across all job roles with over 20 responses.

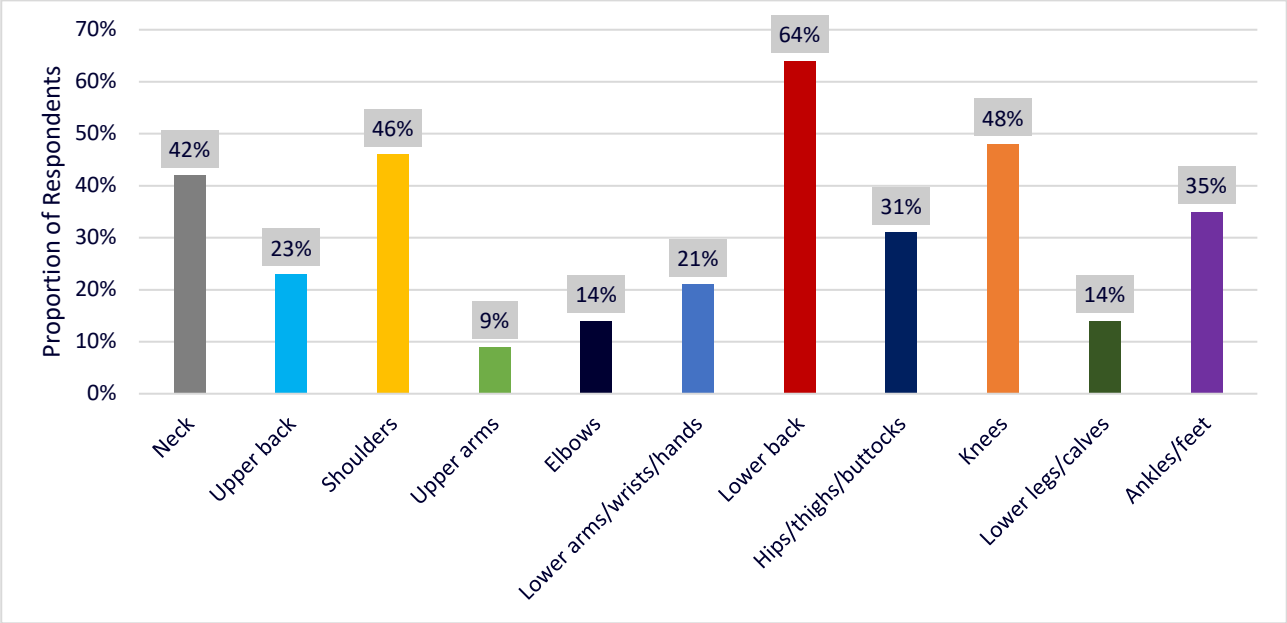

Figure 2: Proportion of MSD survey respondents reporting trouble (aches, pain, discomfort) by body part in the past 12 months.

Reporting and organisational culture

The findings indicate that musculoskeletal issues impacting an individual's ability to perform their duties may be underreported. 12% of survey respondents who indicated experiencing a musculoskeletal issue that affected their work duties in the past 12 months selected "no" when asked if they had reported it to their company. This trend was consistent amongst job roles, though the potential underreporting rate varied, with some job roles showing estimates of 20-25%. For example, for trackside 'Maintenance Workers', 57% indicated experiencing a musculoskeletal issue affecting their work, yet only 32% reported such issues to their company.

The top 5 reported reasons for not reporting were:

- Worrying about management responding negatively (38%)
- Believing that aches, pain and discomfort are part of their job (35%)
- Believing nothing will be done if they report a musculoskeletal issue (31%)
- Preference to not change their duties or job (28%)
- Being concerned about potential job loss (28%)

The primary reasons for not reporting varied slightly amongst job roles. For instance, among mainline 'Train Drivers', the most common reason was 'Worrying about management responding negatively' (50%), followed by 'Believing nothing will be done if they report a musculoskeletal issue' (46%). In contrast, for trackside 'Maintenance Workers', the top reason was 'Believing that aches, pain and discomfort are part of the job' (51%), with 'Worrying about management responding negatively' (44%) as the second most cited reason.

Phase 2 Initial Findings: Job Role Specific Responses

This section details initial findings for three job roles: mainline 'Train Drivers' (1083 responses), trackside 'Maintenance Workers' (390 responses) and lever frame box 'Signallers' (137 responses).

Musculoskeletal issues

Respondents across all three job roles most frequently reported experiencing trouble (aches, pain, discomfort) with their lower back in the past 12 months. The second and third most reported areas differed across the job roles, as seen in Table 4.

Table 4: The top 3 body parts most frequently reported to cause trouble for mainline 'Train Drivers', trackside 'Maintenance Workers' and lever frame box 'Signallers'.

	Most Frequently Reported		Second Most Reported		Third Most Reported	
Job role	**Body part**	**% Responses**	**Body part**	**% Responses**	**Body part**	**% Responses**
Mainline 'Train Drivers'	Lower back	71%	Shoulders and Neck			53%
Trackside 'Maintenance Workers'	Lower back	67%	Knees	56%	Shoulders	42%
Lever frame box 'Signallers'	Lower back	58%	Neck	45%	Shoulders	42%

** For mainline 'Train Drivers', the neck and shoulders were reported equally.*
** % Responses refer to the proportion of respondents.*

Lower back findings across job roles

More than half of mainline 'Train Drivers' (58%) and trackside 'Maintenance Workers' (61%) attributed their lower back trouble to work. This was slightly lower for lever frame box 'Signallers', with 30% reporting work as the cause. For all three job roles, at least 30% of respondents were unsure whether work caused their trouble. This suggests that a small proportion of respondents were confident that work was not a contributing factor (12%, 9% and 27% for mainline 'Train Drivers', trackside 'Maintenance Workers', and lever frame box 'Signallers', respectively).

A slightly higher proportion of trackside 'Maintenance Workers' (33%) took sickness absence because of their lower back trouble compared to mainline 'Train Drivers' (29%), while lever frame box 'Signallers' (19%) had the lowest rate. Lower back trouble appears to have a greater impact on the work duties of trackside 'Maintenance Workers', with 50% reporting it affected their work duties, compared to 34% for mainline 'Train Drivers' and 25% for lever frame box 'Signallers'.

More than half of respondents reported taking medication to alleviate pain or discomfort associated with their lower back trouble, while over 49% sought help from a medical professional (mainline 'Train Drivers': 60%, trackside 'Maintenance Workers': 54%, lever frame box 'Signallers': 49%). Most respondents stated their trouble was aggravated by work, was a recurring issue with a gradual onset, and that it impacted their leisure activities.

Perceived high risk tasks

Survey respondents were asked to describe up to two tasks that are likely to cause aches, pain, or discomfort at work, if applicable. The most frequently reported tasks included:

- Mainline 'Train Drivers': Sitting for long periods, operating the DSD pedal, driving the train and, boarding and alighting the train.
- Trackside 'Maintenance Workers': Manual handling, specifically lifting and carrying, and walking on or alongside the track on ballast.
- Lever frame box 'Signallers': Operating the signal and points levers, specifically pulling and pushing the levers.

MSD risk factors

Participants were asked to report the frequency of their exposure to various job, workplace, and psychosocial risk factors. Table 5 highlights the most frequently encountered risk factors across all three job roles. The top 5 job risk factors and top 3 psychosocial risk factors are presented, while workplace risk factors are included if more than 50% of respondents reported frequent exposure.

Table 5: The top 5 job risk factors, top 3 psychosocial risk factors, and workplace risk factors (reported by more than 50% of respondents as frequently encountered) for mainline 'Train Drivers', trackside 'Maintenance Workers', and lever frame box 'Signallers'.

Mainline 'Train Drivers'		**Trackside 'Maintenance Workers'**		**Lever frame box 'Signallers'**	
Job risk factors					
Sitting for long periods	98%	Prolonged walking or working on irregular, uneven or slippery surfaces	86%	Doing repetitive movements with the arms, hands or fingers.	89%
Performing repetitive movements with the arms, hands or fingers	89%	Frequent bending or twisting of the back/trunk	71%	Frequent bending or twisting of the back/trunk	66%
Repeating the same movements for long periods	80%	Standing for long periods	69%	Exerting great force with the arms, hands or fingers	61%
Performing repetitive movements with the legs or feet	80%	Doing repetitive movements with the legs or feet	60%	Repeating the same movements for long periods	61%
Frequent bending or twisting of the wrist or elbow	63%	Handling heavy loads (5kg - 20 kg)	56%	Handling heavy loads (5kg - 20 kg)	60%
Workplace risk factors					
Rarely experience tools or equipment that make work easier or more comfortable	64%	Working outdoors	93%	Rarely experience tools or equipment that make work easier or more comfortable	77%
Working with damaged, worn or old equipment, plant or locomotives	53%	Working in very cold or very hot temperatures	69%		
		A workstation, working environment or tools that cannot be adjusted	57%		
Psychosocial risk factors					
Concentrating very hard and paying close attention	98%	Concentrating very hard and paying close attention	75%	Performing the same task/ actions over and over again	92%
Performing the same task/ actions over and over again	95%	Performing the same task/ actions over and over again	58%	Concentrating very hard and paying close attention	92%

Staff aren't always consulted about a change at work	61%	Staff aren't always consulted about a change at work	50%	Limited opportunities for social interaction at work	82%

** % refers to the proportion of respondents who frequently encountered the risk factor.*

Conclusion and next steps

This study highlights the prevalence of musculoskeletal health issues in UK heavy rail, with lower back trouble identified as the most affected body area. These issues not only contribute to sickness absence but also negatively affect worker performance. Findings suggest that work-related factors play a role in both the development and aggravation of these conditions. MSDs are likely underreported, which may be influenced by organisational and reporting culture factors. This underreporting makes it challenging to identify trends and causation factors.

Although several MSD surveys exist, none fully captured the information required for this project, which led to the development of a heavy rail-specific MSD survey. It is likely that other safety-critical industries will also need to develop their own industry-specific surveys to capture relevant data. This paper outlines a method and process to create such a survey, which can be applied by other industries conducting similar studies.

The next steps include completing the data analysis and publishing the findings. The results will provide the industry with valuable insights, helping organisations understand the severity and extent of MSDs in the workplace. These findings will also highlight priority areas that need to be addressed to improve the musculoskeletal health of the UK heavy rail workforce. Additionally, the findings will inform the development of an industry-wide MSD strategy aimed at reducing the prevalence and impact of MSDs across various job roles.

References

da Costa, B. & Vieira, E. (2010). Risk factors for work-related musculoskeletal disorders: A systematic review of recent longitudinal studies. American Journal of Industrial Medicine, 53(3): 285-323.

Dawson, A., Steele, E., Hodges, P. & Stewart, S. 2009. Development and test-retest reliability of an extended version of the Nordic Musculoskeletal Questionnaire (NMQ-E): a screening instrument for musculoskeletal pain. The Journal of Pain, 10(5): 517-526.

Hildebrandt, V., Bongers, P., van Dijk, F., Kemper, H. & Dul, J. (2001). Dutch Musculoskeletal Questionnaire: description and basic qualities. Ergonomics, 44(12): 1038-1055.

Hill, J., Kang, S., Benedetto, E., Myers, H., Blackburn, S., Smith, S., Dunn, K., Hay, E., Rees, J., Beard, D., Glyn-Jones, S., Barker, K., Churchman, D., Ellis, B., Fitzpatrick, R., & Price, A. (2016). Development and initial cohort validation of the Arthritis Research UK Musculoskeletal Health Questionnaire (MSK-HQ) for use across musculoskeletal care pathways. BMJ Open, 6:e012331. doi:10.1136/bmjopen-2016-012331.

HSE. (2002). Upper limb disorders in the workplace. United Kingdom: Health and Safety Executive.

HSE. (2022). Work-related musculoskeletal disorders statistics in Great Britain, 2022. United Kingdom: Health and Safety Executive.

Kiesel, K., Matsel, K., Bullock, G., Arnold, T. & Plisky, P. (2024). Risk Factors for Musculoskeletal Health: A Review of the Literature and Clinical Application. International Journal of Sport Physical Therapy, 19(10): 1255-1262.

Kuorinka, I., Jonsson, B., Kilbom, A., Vinterberg, H., Biering-Sørensen, F., Andersson, G., & Jørgensen, K. (1987). Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. Applied Ergonomics, 18(3), 233–237.

Marcatto, F., Colautti, F., Filon, F., Luis, O. & Ferrante, D. (2014). The HSE Management Standards Indicator Tool: concurrent and construct validity. Occupational Medicine, 64(5): 365-371.

McMahon, N., Regan, L., Masetti, I, & Sobun, N. (2024). The Rail Industry Health and Wellbeing Performance Indicators Report: Quarter 1, 2024–25. London: Rail Safety and standards Board.

ORR. (2019). Closing the gap on health: ORR's review of health risk management in the rail industry for 2014-2019. United Kingdom: Office of Road and Rail.

Punnett, L. & Wegman, D. (2004). Work-related musculoskeletal disorders: the epidemiologic evidence and the debate. Journal of Electromyography and Kinesiology, 14(1): 13-23.

RSSB. (2021). The Rail Industry Mental Wellbeing Survey. London: Rail Safety and Standards Board.

RSSB. (2024). Annual Health and Safety Report 2023/24: A snapshot of GB rail's health and safety performance. London: Rail Safety and Standards Board.

RSSB. (2024). Annual Health and Safety Report 2023/24: A snapshot of GB rail's health and safety performance - Health and Wellbeing Data Appendix. London: Rail Safety and Standards Board.