This research alert highlights recent areas of interest in Work Health Safety (WHS) and workers' compensation. The summarised issues have emerged from a 6-month review of the grey literature, including national WHS conference topics and peer-reviewed publications from Occupational Health and Safety (OHS) industry journals.

Four themes were identified from this 6-month review and while the list is not exhaustive, it provides a snapshot of areas of current research/professional interest.

The four identified emerging themes are:

1. **Creating a more inclusive workplace for neurodivergent workers**

   Workplaces tend to be set up to for the needs of neurotypical people. Ensuring diversity and equity in the workplace for neurodivergent workers requires a shift in thinking from the medical model to a social model, where the unique capacity of the individual is celebrated rather than seen as a disability. A range of accommodations are suggested to help meet the needs of the neurodivergent workforce.

2. **The role of safety leadership in the workplace**

   Effective safety leadership drives safety performance, through providing a unified safety vision, role modelling, recognition, appropriate policies and procedures, knowledge management and safety resourcing. Organisations should not solely focus on management leadership styles but also consider how styles, such as transformational, transactional and servant, affect the safety culture within the organisation.

3. **Measuring safety performance**

   With advances in technology there are increasing opportunities to measure safety performance in a range of different ways. This may overcome some issues associated with current data collection approaches, which are either reactive (injury statistics), or focus on the ability to identify hazards. This review identifies some novel methods for measuring safety performance.

4. **Gender and mental health in the workplace – the role of bullying**

   Bullying at work has been identified as a significant threat to mental health in the workplace, however there remains a paucity of literature on how gender affects the risk of adverse mental health outcomes. The evidence suggests that males are more likely to develop mental health issues following exposure to bullying behaviour which may indicate a difference in how bullying behaviour is perceived between the genders.

1. Creating a more inclusive workplace for neurodivergent workers

Supporting diversity in the workplace challenges organisations to consider their approach to worker recruitment, selection, retention and health and safety policies (Volpone et al., 2022). Neurodiversity affects a large amount of people, with estimates of approximately 15–20% of the population demonstrating neurodivergence (Doyle, 2020). Accommodating to the needs of neurodivergent workers has been reported as the new frontier for human resource development (Johnson et al., 2020).

Neurodiversity describes '… the natural way that people think, learn, perceive the world, interact, and process information differently' (Employer Assistance and Resource Network on Disability Inclusion, 2024). Neurodivergent conditions include attention deficit hyperactivity disorders (ADHD), autism (including Asperger's syndrome), anxiety, depression, dyscalculia, dysgraphia, dyslexia, dyspraxia, learning disabilities, obsessive-compulsive disorder (OCD), intellectual disability, schizophrenia and Tourette syndrome (Dahlstrom, 2024; Volpone et al., 2022).

Society has traditionally viewed neurodiversity within the medical model (Haney, 2018), which promotes these conditions as diseases, dysfunctions, disabilities or disorders (Krcek, 2013), characterised by inabilities and impairments (Jaarsma & Welin, 2012). Increasingly, workplaces are realising the limitations of this medical model, and are exploring a social model, where neurodiversity is viewed as a difference rather than as a disorder (Muskat, 2017).

The social model reflects a societal movement promoting inclusion, self-determination and recognition of diverse cognitive styles as part of one's identity (Haney, 2018). This model leads organisations to focus on the strengths that applicants and employees bring to the organisation. For example, research has shown that professionals with autism can be 3 times more productive than average employees (Hutson & Hutson, 2023), and neurodiverse software-testing teams were 30% more productive than others (Austin & Pisano, 2017).

As the workplace is set up with neurotypical people in mind, acceptance and integration of a neurodiverse workforce requires some accommodation in the workplace for individuals that are neurodivergent.

Recruitment

The use of personality tests and interviews have formed part of the recruitment process for many years (Deel, 2023). However, both interviews and personality tests may put neurodivergent candidates at a disadvantage. As neurodivergent people, by definition, respond differently from neurotypical people (Wegmeyer & Speer, 2023), their responses may not fit the expected response. Instead, organisations could explore the use of hiring strategies that are sensitive to the individual applicant's capacity whilst focusing on the specific needs of the role. This may include reframing interview assessments away from the traditional focus on structured question sets that assess behavioural responses. For example, assessments could shift from looking for timely verbal responses and eye contact to a greater focus on questions designed to learn about the applicant's strengths, letting the applicant have space and time to analyse the questions, or even being able to return their response on another day (Burnett & Trerise, 2019).

Workplace accommodations

Possible workplace accommodations that have been proposed to deal with the challenges in the workplace for neurodivergent workers include:

a) **Communication**: Neurodivergent individuals reported a preference for electronic forms of communication, for example, email, online communicators, or chats to support effective communication (Tomczak & Ziemianski, 2023).

b) **Time management, setting priorities, and organisation of work**: Suggested workplace accommodations include flexible working time, remote work, use of computer and mobile applications facilitating work-time control and task prioritisation (Tomczak & Ziemianski, 2023).

c) **Stress management**: Mechanisms to assist include stress level measuring devices (i.e. wrist-worn devices) and dynamic customisation of the office environment to reduce sensory overload (Tomczak & Ziemianski, 2023).

d) **Sensory sensitivity:** Consider office space arrangements based on the needs of neurodivergent individuals (i.e. provision of chill rooms, avoiding bright colours, working with headphones) and personalisation of the workplace according to the individual preferences of the users (furniture and office equipment; adjusting the parameters of the environment: temperature, humidity, noise, smell, sunlight exposure) (Tomczak & Ziemianski, 2023).

e) **Management style:** Certain types of leadership can aid neurodiversity-related efforts to be more inclusive. Transformational leadership is a less effective leadership style for neurodivergent employees as the visionary aspects are often too abstract to provide guidance to employees that think in more specific ways (Hurley-Hanson & Giannantonio, 2017). Authentic leadership appears to be a leadership style that is more inclusive of neurodiverse workforce (Hurley et al, 2017).

f) **Training and development**: Alternative types of learning such as self-paced tutorials or on-the-job training, compared to classroom training or training that takes place on a computer (Patton, 2019) appear more suitable to neurodivergent workers (Volpone et al., 2022).

Television portrayals of neurodiverse people in the workplace often show them in inclusive environments where their unique abilities are welcomed and valued (for example, Dr Shaun Murphy in 'The Good Doctor'). Unfortunately, the real-life experience of neurodivergent workers is often very different. Ensuring diversity and equity in the workplace for neurodivergent workers requires a shift in thinking from the medical model to a social model, where the unique capacity of the individual is celebrated rather than seen as a disability.

References

1. Volpone, S., Avery, D. R., & Wayne, J. (2022). Shaping organizational climates to develop and leverage workforce neurodiversity. In *Neurodiversity in the Workplace*. Taylor & Francis.

2. Doyle, N. (2020). Neurodiversity at work: a biopsychosocial model and the impact on working adults. *British medical bulletin,* 135(1), 108–125.

3. Johnson, K. R., Ennis-Cole, D., & Bonhamgregory, M. (2020). Workplace success strategies for employees with autism spectrum disorder: A new frontier for human resource development. Human Resource Development Review, 19(2), 122–151.

4. Employer Assistance and Resource Network on Disability Inclusion (2024) *Neurodiversity in the Workplace.* https://askearn.org/page/neurodiversity-in-the-workplace

5. Dahlstrom, C. (2024). Understanding Neurodiversity and Executive Disfunction to Discover More Effective Accommodations and Create a More Inclusive Workforce for Neurodivergent Individuals. *Honors Theses and Capstones*. 794. https://scholars.unh.edu/honors/794

6. Haney, J. L. (2018). Reconceptualizing autism: An alternative paradigm for social work practice. *Journal of Progressive Human Services*, 29(1), 61–80.

7. Krcek, T. E. (2013). Deconstructing disability and neurodiversity: Controversial issues for autism and implications for social work. *Journal of Progressive Human Services*, 24, 4–22.

8. Jaarsma, P., & Welin, S. (2012). Autism as a natural human variation: Reflections on the claims of the neurodiversity movement. *Health Care Analysis*, 20, 20–30.

9. Muskat, B. (2017). Celebrating neurodiversity: An often-overlooked difference in group work. *Social Work with Groups*, 40, 81–84.

10. Hutson, P., & Hutson, J. (2023). Neurodiversity and Inclusivity in the Workplace: Biopsychosocial Interventions for Promoting Competitive Advantage. *Journal of Organizational Psychology*, 23(2), 1–16.

11. Austin, R., & Pisano, G. (2017). Neurodiversity as a Competitive Advantage. *Harvard Business Review*. https://hbr.org/2017/05/neurodiversity-as-a-competitive-advantage

12. Deel, G. L. (2023). Examining Current Research on Personality Assessments Used in Hiring. *Journal of Business & Educational Leadership*, 13(1), 42–66.

13. Wegmeyer, L., & Speer, A. (2023). Examining personality testing in selection for neurodiverse individuals. *Industrial and Organizational Psychology*, 16(1), 61–65.

14. Tomczak, M. T., & Ziemiański, P. (2023). Autistic Employees' Technology-Based Workplace Accommodation Preferences Survey—Preliminary Findings. *International Journal of Environmental Research and Public Health*, 20(10), 5773.

15. Hurley-Hanson, A. E., & Giannantonio, C. M. (2017). LMX and autism: Effective working relationships. In T. A. Scandura & E. Mouriño-Ruiz (Eds.), *Leading diversity in the 21st century* (pp. 281–302). Charlotte, NC: IAP Information Age Publishing.

16. Patton, E. (2019). Autism, attributions and accommodations: Overcoming barriers and integrating a neurodiverse workforce. *Personnel Review*, 48, 915–934.

17. Burnett, K., & Trerise, M. (2019). Embracing neurodiversity in the workplace. Training Journal. https://www.trainingjournal.com/2019/interviews/tj-magazine-embracing-neurodiversity-workplace/

2. The role of safety leadership in the workplace

The ultimate goal of a workplace health and safety policy is an injury-free workplace that also encourages and supports positive health behaviours in the workforce. A central tenet underpinning this goal is the assumption that all injuries/ill health are preventable, therefore initiating policies and practices in the workplace should lead to the goal of an injury-free, health promoting workplace.

Preventable workplace injuries are often the result of unsafe behaviours or workplace conditions (Zara et al., 2023), which are influenced by the culture within the organisation. Employee behaviour and compliance with safety policies can lead to a positive safety culture and a reduction in the number of accidents (Amirah et al., 2024). Studies have shown a strong relationship between safety culture and safety performance (Naji et al., 2021) and safety behaviours (Uzuntarla et al., 2020).

Safety culture describes what an organisation is and does in the pursuit of safety, and is the result of individual and group beliefs, values, attitudes, perceptions, competencies, and patterns of behaviour that determine the organisation's commitment to safety (The Joint Commission, 2017). According to the Institute of Nuclear Power Operations (Institute of Nuclear Power Operators, 2013) a strong safety culture is characterised by:

1. Leader's decisions and behaviours demonstrate commitment to safety

2. Decisions on safety are systematic, rigorous and thorough

3. Trust and respect permeate the organisation

4. Safety issues are identified, evaluated, and addressed in a timely way

5. Personnel feel free to raise safety concerns without intimidation, harassment, discrimination, or fear of retaliation.

Effective leadership has been shown to effect safety culture in an organisation leading to a better safety climate, fewer adverse events, and improved employee well-being (Tawfik et al., 2023).

Leadership style is the 'relatively consistent pattern of behaviour that characterises a leader' (DuBrin, 2016, p. 124). Managers positively affect safety outcomes by articulating a clear vision and mission for safety, motivating the workforce to achieve it, acting as role models, and showing genuine concern for employees. Leaders can motivate employees to work harder, follow established procedures, comply with policies, attain goals and standards, and take ownership of safety performance (Roughton et al., 2019).

Workers quickly learn how leadership values employee safety within an organisation through their conduct and management practices to ensure the integration of safety in everyday operations. Safety being valued by leadership, in turn, results in the development of a positive mindset and a sense of well-being in employees (DePasquale & Geller, 1999). When employees see that management is committed to safety, employees tend to comply with safety within the organisation (Griffin & Neal, 2000).

Lekka et al. (2012) in a review of effective safety leadership styles showed transformational leadership and transactional leadership were the two most promising leadership styles, whilst Cooper (2015) found support in the literature for servant leadership in improving safety performance.

Transformational leadership encompasses 4 main behaviours (Bass, 2009):

1. Idealised influence – inspiring trust and acting as a role model

2. Inspirational motivation – offering an attractive shared vision of the future

3. Intellectual stimulation – fostering non-traditional problem-solving techniques

4. Individual consideration – paying careful attention to subordinates' unique needs.

Safety-specific transformational leadership is 'a leadership style that delivers a shared vision of safety to employees and encourages them to exercise their energy, skills, and self-efficacy to realize this vision' Lu et al. (2019, p. 2). Essentially a manager utilises inspirational motivation, idealised influence, and intellectual stimulation to enhance worker safety performance through safety participation and compliance (Innes et al., 2010).

Transactional leadership 'maintains organisational stability through regular social exchanges, leading to goal achievement for both leaders and their followers' (Arenas, 2019, p. 3). In contrast to transformational leadership, transactional leadership focuses on day-to-day activities and processes to promote an injury-free workplace while conducting business.

Xue et al. (2020) examined the relationship between leadership and employee safety behaviour and found that senior managers with transformational leadership styles, as exemplified by safety concern and safety vision, have a more active role in enhancing employee safety behaviour than senior managers with a transactional leadership style.

In prior literature, the impact of transformational leadership has been studied on safety compliance (Wu et al., 2022), safety participation, safety climate (Shi, 2021), safety motivation (Smith et al., 2020), safety citizenship behaviour (Dartey-Baah et al., 2020), near miss recognition (Lu et al., 2019), psychological empowerment (Avolio et al., 2004), knowledge sharing (Yin et al., 2019), and goal commitment (DeArmond et al., 2018).

Whilst some authors have promoted transactional leadership in safety management others have also identified disadvantages, such as potentially negative effects on employee behaviour, as this leadership style rewards performance if the employee achieves a stipulated work goal (Bian et al., 2019). The authors hypothesised that employee safety behaviours were not motivated by incentives alone.

Servant leadership is a management style where the manager shares power with their team, assisting them in their development and helping them to perform (Robert K. Greenleaf Center for Servant Leadership, 2021). It has been suggested that this approach responds most effectively to the health and safety needs of the workforce. It has also been noted that this management style does not suit all organisations as a management approach as decisions take longer to be executed.

Effective safety leadership drives safety performance, through providing a unified safety vision, role modelling, recognition, appropriate policies and procedures, knowledge management and safety resourcing. Organisations should not solely focus on management leadership styles, but on how the leadership styles also affect the safety culture within the organisation.

References

1. Zara, J., Nordin, S. M., & Isha, A. S. N. (2023). Influence of communication determinants on safety commitment in a high-risk workplace: a systematic literature review of four communication dimensions. *Frontiers in Public Health*, 11.

2. Amirah, N. A., Him, N. F. N., Rashid, A., Rasheed, R., Zaliha, T. N., & Afthanorhan, A. (2024). Fostering a safety culture in manufacturing industry through safety behavior: a structural equation modelling approach. *Journal of Safety and Sustainability*.

3. Naji, G. M. A., Isha, A. S. N., Mohyaldinn, M. E., Leka, S., Saleem, M. S., Rahman, S. M. N. B. S. A., & Alzoraiki, M. (2021). Impact of safety culture on safety performance; mediating role of psychosocial hazard: An integrated modelling approach. *International Journal of Environmental Research and Public Health*, 18(16), 8568

4. Uzuntarla, F., Kucukali, S., & Uzuntarla, Y. (2020). An analysis on the relationship between safety awareness and safety behaviors of healthcare professionals, Ankara/Turkey. *Journal of Occupational Health*, 62(1), e12129.

5. The Joint Commission (2017). The Essential Role of Leadership in Developing a Safety Culture Sentinel Event Alert, Issue, 57 (Mar 1, 2017) https://www.jointcommission.org/-/media/tjc/documents/resources/patient-safety-topics/sentinel-event/sea-57-safety-culture-and-leadership-final2.pdf

6. Institute of Nuclear Power Operators. (2013). *Traits of a healthy nuclear safety culture* (Rev. 1).

7. Tawfik, D. S., Adair, K. C., Palassof, S., Sexton, J. B., Levoy, E., Frankel, A., & Profit, J. (2023). Leadership behavior associations with domains of safety culture, engagement, and health care worker well-being. *The Joint Commission Journal on Quality and Patient Safety*, 49(3), 156–165.

8. DuBrin, A. J. (2016). Leadership Research Findings, Practice, and Skills. Cengage Learning, Boston, MA.

9. Roughton, J., Crutchfield, N., & Waite, M. (2019). Safety culture: An innovative leadership approach. Butterworth-Heinemann.

10. DePasquale, J. P., & Geller, E. (1999). Critical Success Factors for Behaviour Based Safety: A Study of Twenty Industry-Wide Applications. *Journal of Safety Research,* 30, 237–24.

11. Griffin, M.A. & Neal, A. (2000). Perceptions of Safety at Work: A Framework for Linking Safety Climate to Safety Performance, Knowledge, and Motivation. *Journal of Occupational Health Psychology*, 5(3), 347–358.

12. Lekka, C. & Healey, N. (2012). A Review of the Literature on Effective Leadership Behaviors for Safety. Health and Safety Executive, London.

13. Cooper, M. D. (2015). Effective safety leadership: Understanding types and styles that improve safety performance. *Professional Safety, 60*(2), 49–53.

14. Bass, B. M., & Bass, R. (2009). The Bass handbook of leadership: Theory, research, and managerial applications. Simon and Schuster.

15. Lu, H., Wu, T., Shao, Y., Liu, Y., & Wang, X. (2019). Safety-specific leadership, goal orientation, and near-miss recognition: The cross-level moderating effects of safety climate. *Frontiers in Psychology*, 10, 437910.

16. Inness, M., Turner, N., Barling, J., & Stride, C. B. (2010). Transformational leadership and employee safety performance: a within-person, between-jobs design. *Journal of Occupational Health Psychology*, 15(3), 279.

17. Arenas, F.J., (2019). A Casebook of Transformational and Transactional Leadership. Routledge Taylor & Francis Group, New York.

18. Xue, Y., Fan, Y., & Xie, X. (2020). Relation between senior managers' safety leadership and safety behaviour in the Chinese petrochemical industry. *Journal of Loss Prevention in the Process Industries*, 65, 104142.

19. Wu T, Wang Y, Ruan R, & Zheng J. (2022). Divergent effects of transformational leadership on safety compliance: A dual-path moderated mediation model. *PLoS ONE,* 17(1), 1–17.

20. Shi, H. (2021). The Influence of Safety-Specific Transformational Leadership and High-Quality Relationships on Mindful Safety Practices Through Safety Climate: A Study in Chinese Petroleum Industry. *Journal of Applied Security Research,* 16(3), 328–344.

21. Smith, T. D., DeJoy, D. M., & Dyal, M. A. (2020). Safety specific transformational leadership, safety motivation and personal protective equipment use among firefighters. *Safety Science*, 131, 104930.

22. Dartey-Baah, K., Quartey, S. H., & Adotey, A. (2021). Examining transformational and transactional leadership styles and safety citizenship behaviors in the power distribution sector: evidence from Ghana. *International Journal of Energy Sector Management,* 15(1), 173–194.

23. Avolio, B. J., Zhu, W., Koh, W., & Bhatia, P. (2004). Transformational leadership and organizational commitment: Mediating role of psychological empowerment and moderating role of structural distance. Journal of Organizational Behavior: *The International Journal of Industrial, Occupational and Organizational Psychology and Behavior*, 25(8), 951–968.

24. Yin, J., Ma, Z., Yu, H., Jia, M., & Liao, G. (2020). Transformational leadership and employee knowledge sharing: Explore the mediating roles of psychological safety and team efficacy. *Journal of Knowledge Management*, 24(2), 150–171.

25. DeArmond, S., Bass, B. I., Cigularov, K. P., Chen, P., & Moore, J. T. (2018). Leadership and safety: The role of goal commitment. *Journal of Organizational Effectiveness: People and Performance*, 5(2), 182–198.

26. Bian, X., Sun, Y., Zuo, Z., Xi, J., Xiao, Y., Wang, D., & Xu, G. (2019). Transactional leadership and employee safety behavior: Impact of safety climate and psychological empowerment. *Social Behavior and Personality: an international journal*, 47(6), 1–9.

27. Robert K. Greenleaf Center for Servant Leadership. (2021). What is servant leadership? *Greenleaf Center for Servant Leadership*. https://www.greenleaf.org/what-is servant-leadership.

28. Hiquet, D. (2021). The implementation of leadership style to build health and safety culture in Aviation. https://www.researchgate.net/profile/Damien-Hiquet/publication/355170584_The_implementation_of_leadership_style_to_build_health_and_safety_culture_in_Aviation/links/6163dd96ae47db4e57c08df0/The-implementation-of-leadership-style-to-build-health-and-safety-culture-in-Aviation.pdf

3. Measuring safety performance

Continuous improvement models (CIMs) have been used by organisations to improve their performance and can be used across both productivity and safety domains. A range of CIMs are commonly used in industry including Lean, Kanban, Scrum, Six Sigma and Total Quality Management approaches. Whilst each approach is unique, they generally consist of at least four steps: Plan, Do, Check, and Act, commonly termed the 'PDCA' cycle.

The PDCA cycle depends on being able to measure the performance of the system at commencement of the cycle to identify the baseline performance and then following interventions (act) to monitor the effectiveness and help direct future cycles of improvement. The measurement of performance is indispensable to support the implementation of safety improvements, benchmark safety levels and communicate them to stakeholders (Cagno et al., 2023). In the area of OHS the traditional performance measure relates to the incidents of injuries or reported near misses over a set period of time. If the aim of a workplace health and safety policy is an injury-free workplace this reactive measure would seem to be 'closing the gate after the horse has bolted'.

Traditionally, safety performance measures have often been dependent on documentation of regular safety inspections and the ability of workers to recognise hazards (Dobrucali et al., 2024). In some industries, such as the construction sector, where the risks to workers are either catastrophic and immediate (i.e. fall from heights, electrocution), or longer term (noise induced hearing loss, stress, arthritis), there may be some complacency towards the hazards linked to these risks (Wang et al., 2017).

New technologies are providing exciting opportunities to explore safety performance measures that help inform safety and health management systems (Nnaji & Karakhan, 2020). For example, in the construction industry technology such as building information modelling (BIM) and wearable sensing devices (WSDs) have been proposed.

BIM is described in ISO 19650-1:2018 as 'Use of a shared digital representation of a built asset to facilitate design, construction and operation processes to form a reliable basis for decisions'. As an information resource it provides opportunities to modify information to the building model throughout its lifecycle (WBDG, 2021) to improve construction safety (Cortes-Perez et al., 2020). Authors have proposed integrating augmented reality (AR)/ virtual reality (VR), BIM and location-tracking technologies as part of a safety management system (Park & Kim, 2013).

Audits using BIM allow an enhanced visualisation of the workplace before it exists and a chance to measure safety performance early on. Lu et al. (2021) developed a plug-in to calculate safety risks for a set of different design alternatives and concluded that this approach optimised construction safety creating lower total fatality risk. Enshassi et al. (2016) identified that hazard identification and minimisation are the most essential safety-related applications offered by BIM tools for improving safety performance in construction.

Yang et al. (2012) proposed a safety identification system to improve the performance of proactive safety monitoring using radio-frequency identification (RFID) and wireless sensor network (WSN). The technology was introduced to heavy equipment (such as tower cranes and fork-lift trucks) and was used to monitor site safety. However, technological limitations imposed constraints on the data collected. Kanan et al. (2018) developed a safety monitoring system with general packet radio service (GPRS) and wearable devices to provide smart alerts for real-time avoidance of potential danger. These wearable devices could be deployed and integrated seamlessly into the construction site with

relatively low fixing and running costs. Ray and Teizer (2012) came up with 3-dimensional motion information for detecting the postures of workers, leading to improving the musculoskeletal related safety hazards.

Technology has also been used in low-frequency but high-consequence risk sectors such as road, aviation, and maritime transport where reliable human performance becomes critical for ensuring safety. The evidence indicates a positive correlation between individual factors (such as worker mental workload, emotion and fatigue) and safety behaviours in daily work and decision-making processes (Fan et al., 2021).

Whilst human performance measurement by experts in simulation activities following training has been a traditional approach in the transport industry, the approach has raised some concerns due to the possibility of introducing subjective bias. Concerns have been raised about issues such as recognition-primed inferences, where people tend to take actions that are familiar to the assessor and their ability is evaluated by how the assessor would accomplish it (Fan et al., 2021).

It has been proposed that, given the correlation between individual factors and safety behaviours, measures should also include physiological measures during human performance measurement (HPM). Neurophysiological measurements, such as electrocardiography (ECG), electromyography (EMG), electroencephalography (EEG), skin electrical response, and functional near-infrared Spectroscopy (fNIRS) have been proposed (Fan and Yang, 2023). fNIRS has become a popular wearable sensor, and is a non-invasive brain imaging modality for measuring cortical haemodynamic activity (Fishburn et al., 2014).

With advances in technology there are increasing opportunities to measure safety performance in a range of different ways. This may overcome some of the current issues associated with measuring safety performance, which are either reactive (injury statistics), or focus on the ability to identify hazards. This review identifies some novel methods for measuring safety performance.

References

1. Cagno, E., Negri, M., Neri, A., & Giambone, M. (2023). One framework to rule them all: an integrated, multi-level and scalable performance measurement framework of sustainability, circular economy and industrial symbiosis. *Sustainable Production and Consumption*, 35, 55-71.

2. Dobrucali, E., Demirkesen, S., Sadikoglu, E., Zhang, C., & Damci, A. (2024). Investigating the impact of emerging technologies on construction safety performance. Engineering, *Construction and Architectural Management*, 31(3), 1322-1347.

3. Wang, D., Chen, J., Zhao, D., Dai, F., Zheng, C. & Wu, X. (2017). Monitoring workers' attention and vigilance in construction activities through a wireless and wearable electroencephalography system, *Automation in Construction*, 82, 122-137.

4. Nnaji, C. & Karakhan, A.A. (2020). Technologies for safety and health management in construction: current use, implementation benefits and limitations, and adoption barriers, *Journal of Building Engineering*, 29.

5. Cortes-Perez, J.P., Cortes-Perez, A. & Prieto-Muriel, P. (2020). BIM-integrated management of occupational hazards in building construction and maintenance, *Automation in Construction*, 113.

6. Park, C.S. & Kim, H.J. (2013), A framework for construction safety management and visualization system, *Automation in Construction*, 33, 95-103.

7. Lu, Y., Gong, P., Tang, Y., Sun, S. & Li, Q. (2021). BIM-integrated construction safety risk assessment at the design stage of building projects, *Automation in Construction*, 124.

8. Enshassi, A., Ayyash, A. & Choudhry, R.M. (2016). BIM for construction safety improvement in gaza strip: awareness, applications and barriers, *International Journal of Construction Management,* 16(3), 249-265.

9. Yang, H., Chew, D.A.S., Wu, W., Zhou, Z. & Li, Q. (2012). Design and implementation of an identification system in construction site safety for proactive accident prevention, *Accident Analysis and Prevention*, 48, 193-203.

10. Kanan, R., Elhassan, O., & Bensalem, R. (2018). An IoT-based autonomous system for workers' safety in construction sites with real-time alarming, monitoring, and positioning strategies. *Automation in Construction*, 88, 73-86.

11. Ray, S. J., & Teizer, J. (2012). Real-time construction worker posture analysis for ergonomics training. *Advanced Engineering Informatics*, 26(2). 439-455.

12. Fan S, Blanco-Davis E, Zhang J, Bury A, Warren J, Yang Z, Yan X, Wang J, & Fairclough S. (2021). The role of the prefrontal cortex and functional connectivity during maritime operations: an fNIRS study. *Brain and Behavior*, 11(1), e01910.

13. Fan S, Blanco-Davis E, Zhang J, Bury A, Warren J, Yang Z, Yan X, Wang J, & Fairclough S. (2021). The role of the prefrontal cortex and functional connectivity during maritime operations: an fNIRS study. *Brain and Behavior*, 11(1), e01910

14. Fan, S., & Yang, Z. (2023). Towards objective human performance measurement for maritime safety: A new psychophysiological data-driven machine learning method. Reliability Engineering & System Safety, 233, 109103.

15. Fishburn FA, Norr ME, Medvedev AV, & Vaidya CJ. (2014). Sensitivity of fNIRS to cognitive state and load. *Front Hum Neurosci* 8:76.

4. Gender and mental health in the workplace – the role of bullying

Mental health in the workplace is increasingly recognised as an important issue internationally. The economic burden of mental health conditions globally has been projected to be US$6.1 trillion by 2030, up from US$2.5 trillion in 2010 (Bloom et al., 2011). This economic loss being secondary to lost productivity, most commonly in the form of absenteeism (i.e., number of days away from work) and presenteeism (i.e., diminished productivity while at work).

A recent review found clear evidence that poor mental health, most commonly presenting as depression or anxiety, was associated with increased absenteeism and presenteeism (de Oliveira et al., 2023). It has been shown that organisations that promote good mental health in the workplace and have initiatives that support individuals with mental health conditions are more likely to reduce absenteeism and presenteeism, and therefore improve worker productivity (Hamberg-van Reenen et al., 2012).

A mentally healthy workplace is 'one in which risk factors are acknowledged and appropriate action taken to minimise their potential negative impact on an individual's mental health. At the same time protective or resilience factors are fostered and maximized (Harvey et al., 2014). Significant changes in the workplace and work arrangements post the COVID-19 pandemic have made it more challenging to support mental health in the workplace (Zhang & Chen, 2022). Examples of such changes include:

- working from home while trying to balance work with home and care responsibilities
- hybrid working arrangements
- ensuring workplaces have COVID-19-secure measures in place.

Workplace bullying is considered a major workplace mental health hazard and has been associated with reduced well-being (Nielsen & Einarsen, 2012), mental and somatic health problems (Xu et al., 2018), sleep problems (Nielsen et al., 2020), posttraumatic stress symptoms (Nielsen et al., 2015), absenteeism (Nielsen et al., 2016), and suicidal ideation/suicide (Conway et al., 2022). Despite reports indicating a global prevalence of bullying behaviours at 15%, the reported prevalence of victimisation from bullying is approximately 11% (Nielsen et al., 2023). This differential between rates of bullying behaviour and the perception of being a victim of bullying reflects the subjective nature of the construct of bullying.

Whilst significant work has been undertaken in the area there remains some conjecture about the role of confounders in mediating the relationship between being subject to bullying behaviours and acknowledging that you are being bullied, and then the potential for this to affect a worker's mental health. This risk of exposure to bullying has been clearly demonstrated for minority groups such as immigrants (Rosander & Blomberg, 2022), and being lesbian, gay, bisexual, transgender, queer (or sometimes questioning), intersex, asexual, and others (LGBTQIA+) (Di Marco et al., 2021), but less is known about the role of gender and gender differences (Rosander et al., 2020).

Recent studies have sought to understand the relationship between gender, perceived bullying, and the effects on mental health. With regards to the risk of bullying and the potential consequences, the results are inconclusive and mixed when it comes to gender differences (Rosander et al., 2020). One observation has been that the studies reporting higher bullying rates for women used self-labelling as the method to measure workplace bullying (where the subject reports if they feel they have been a victim of bullying), while studies reporting higher bullying rates for men typically used the

behavioural experience method (where subjects report being exposed to a range of different bullying behaviours without ever mentioning bullying).

Einarsen and Nielsen (2015) reported an increased risk for psychological distress, in particular anxiety, as long as 5 years after being bullied, but only for male employees (OR: 4.22). A similar association between bullying and anxiety for men but not women has also been shown by Attell et al. (2017). Rosander et al. (2020) showed a stronger association for men between baseline bullying and subsequent mental health problems, but only for those who self-labelled as victims of bullying.

Rosander et al (2023) in their longitudinal study found an increased risk of bullying if being in a gender minority, but only for men in female-dominated workplaces, and primarily when exposed to person-related bullying (i.e. behaviours that attack the personal integrity of the target). For work-related bullying (i.e. behaviours that directly or indirectly have a negative effect on one's work tasks and performance), there was no increased risk.

For women working in male-dominated workplaces, there was no increased risk of being bullied, so being in a gender minority only seems to affect men working at female-dominated workplaces. There was also a small, but significant increase in depression symptoms for men working at female-dominated workplaces associated with both work- and person-related bullying, with again no corresponding increases in depression or anxiety symptoms for women working in male-dominated workplaces.

This suggests that being exposed to bullying behaviours are interpreted differently by men and women. Being viewed as a victim and weak could be seen as a threat to a man's self-image leading to more severe mental health consequences for a man. The threshold for admitting to oneself being a victim of bullying may be higher for men than for women, and therefore waiting longer before seeking help may also contribute to more severe consequences for men.

Bullying at work has been identified as a significant threat to mental health in the workplace, but there remains a paucity of literature on how gender affects the risk of adverse mental health outcomes. The evidence suggests that males are more likely to develop mental health issues following exposure to bullying behaviour which may indicate a difference in how bullying behaviour is perceived between the genders.

References

1. Bloom, D. E., Cafiero, E., Jané-Llopis, E., Abrahams-Gessel, S., Bloom, L. R., Fathima, S., & Weiss, J. (2011). The global economic burden of noncommunicable diseases (No. 8712). *Program on the Global Demography of Aging*.

2. de Oliveira, C., Saka, M., Bone, L., & Jacobs, R. (2023). The role of mental health on workplace productivity: a critical review of the literature. *Applied Health Economics and Health Policy*, 21(2), 167–193.

3. Hamberg-van Reenen, H. H., Proper, K. I., & van den Berg, M. (2012). Worksite mental health interventions: a systematic review of economic evaluations. *Occupational and Environmental Medicine*, 69(11), 837-845.

4. Harvey, S. B., Joyce, S., Tan, L., Johnson, A., Nguyen, H., Modini, M., & Groth, M. (2014). Developing a mentally healthy workplace: A review of the literature. National Mental Health Commission: Sydney, Australia, 2014.

5. Zhang, P., & Chen, S. (2022). Association between workplace and mental health and its mechanisms during COVID-19 pandemic: A cross-sectional, population-based, multi-country study. Journal of Affective Disorders, 310, 116–122.

6. Nielsen, M. B., & Einarsen, S. (2012). Outcomes of exposure to workplace bullying: A meta-analytic review. *Work & Stress,* 26(4), 309–332.

7. Xu, T. W., Hanson, L. L. M., Lange, T., Starkopf, L., Westerlund, H., Madsen, I. E. H., Rugulies, R., Pentti, J., Stenholm, S., Vahtera, J., Hansen, A. M., Kivimaki, M., & Rod, N. H. (2018). Workplace bullying and violence as risk factors for type 2 diabetes: A multicohort study and meta-analysis. *Diabetologia*, 61(1), 75–83.

8. Nielsen, M. B., Harris, A., Pallesen, S., & Einarsen, S. V. (2020). Workplace bullying and sleep - A systematic review and meta-analysis of the research literature. *Sleep Medicine Reviews*, 51(101), 289.

9. Nielsen, M. B., Tangen, T., Idsoe, T., Matthiesen, S. B., & Magerøy, N. (2015). Posttraumatic stress disorder as a consequence of bullying at work and at school. A literature review and meta-analysis. *Aggression and Violent Behavior*, 21(1), 17–24.

10. Nielsen, M. B., Indregard, A. M. R., & Øverland, S. (2016). Workplace bullying and sickness absence: a systematic review and meta-analysis of the research literature. Scandinavian Journal of Work, Environment & Health, 359–370.

11. Conway, P. M., Erlangsen, A., Grynderup, M. B., Clausen, T., Rugulies, R., Bjorner, J. B., & Høgh, A. (2022). Workplace bullying and risk of suicide and suicide attempts: A register-based prospective cohort study of 98 330 participants in Denmark. *Scandinavian Journal of Work, Environment & Health*, 48(6), 425.

12. Nielsen, M. B., Einarsen, S. V., Parveen, S., & Rosander, M. (2023). Witnessing workplace bullying—A systematic review and meta-analysis of individual health and well-being outcomes. *Aggression and Violent Behavior*, 101908.

13. Rosander, M., & Blomberg, S. (2022). Workplace bullying of immigrants working in Sweden. *The International Journal of Human Resource Management*, 33(14), 2914–2938.

14. Di Marco, D., Hoel, H., & Lewis, D. (2021). Discrimination and exclusion on grounds of sexual and gender identity: Are LGBT people's voices heard at the Workplace? *Spanish Journal of Psychology*, 24, e18.

15. Rosander, M., Salin, D., Viita, L., & Blomberg, S. (2020). Gender matters: Workplace bullying, gender, and mental health. *Frontiers in psychology*, 11, 560178.

16. Einarsen, S., & Nielsen, M. B. (2015). Workplace bullying as an antecedent of mental health problems: a five-year prospective and representative study. *Intern. Arch. Occup. Environ. Health* 88, 131–142.

17. Attell, B. K., Kummerow Brown, K., & Treiber, L. A. (2017). Workplace bullying, perceived job stressors, and psychological distress: Gender and race differences in the stress process. *Social Science Researc*h, 65, 210–221.

18. Rosander, M., Hetland, J., & Einarsen, S. V. (2023). Workplace bullying and mental health problems in balanced and gender-dominated workplaces. *Work & Stress*, 37(3), 325–344.