descalers and detergents. In Sweden, Meding et al. (2016) report occupational skin disease can prevent people from working, with painters, cement workers and plumbers at particularly high risk. Despite moves to regulate the supply of certain construction materials (see case example 2.3) to reduce the risks of occupational skin disease, skin disease is still a serious occupational health issue for many construction workers (Kaukiainen et al., 2005).

CASE EXAMPLE 2.3 REGULATING PRODUCT SUPPLY TO REDUCE OCCUPATIONAL ILL HEALTH

Cement contains water-soluble hexavalent chromium (chromate), which can penetrate the skin and cause a severe allergic reaction referred to as occupational allergic contact dermatitis (OACD). OACD is a debilitating skin condition that is common among construction workers in many countries around the world (Kridin et al., 2016). OACD significantly reduces workers' quality of life and can lead to economic hardship and early retirement (Roto et al., 1996; Wong et al., 2015). Winder and Carmody (2002) argue the toxicity of cement and concrete is underestimated by many builders and these products should, in fact, be treated as hazardous materials. OACD occurs when the skin is sensitised to contact with a chemical. Sensitisation to a chemical can occur the first time a worker is exposed or after a long period of repeated contact. However, once sensitised, contact with even a small amount of the chemical will produce an allergic reaction.

Steps to reduce the harmful effects of exposure to chromate in cement were introduced in Scandinavian countries 30-plus years ago. In 1983 Denmark passed legislation to require addition of ferrous sulphate to cement to reduce the hexavalent form of chromium to a trivalent form (chromium III), which is less soluble and does not readily permeate the skin (Wong et al., 2015). Finland and Germany introduced similar legislation in 1987 and 2000 respectively. Research evidence suggests that these steps were effective in reducing chromate sensitisation and OACD associated with cement exposure (Roto et al., 1996; Geier et al., 2011).

In 2003, European Union (EU) Directive 2003/53/EC required all member countries of the EU to reduce the chromate content in cement (European Union, 2003). The directive required laws to be passed in member countries that specifically targeted the production and supply of cement products to prohibit the sale of products containing more than 0.0002% (2 parts per million) of soluble chromium by dry weight of cement when hydrated. Importantly, all suppliers selling products in EU countries irrespective of where these products are manufactured need to comply with these laws.

Analysis of the incidence of OACD in the UK and France before and after the introduction of the legislation has revealed significantly lower incidence of

OACD following the changes among groups of workers engaged in construction and/or exposed to cement compared to non-exposed control groups (Stocks et al., 2012; Bensefa-Colas et al., 2017). However, in the absence of European style regulation, many construction workers (including those in Australia) may be exposed to harmful chromates which could be avoided through modification to manufacture and supply (Dear, 2020; Wong et al., 2015).

2.10 Musculoskeletal disorders

Musculoskeletal disorders (MSDs) are injuries or disorders of the muscles, nerves, tendons, joints, cartilage, and spinal discs. MSDs are described as work-related when "the work environment and performance of work contribute significantly to the condition; and/or the condition is made worse or persists longer due to work conditions" (Centers for Disease Control and Prevention, 2022). Commonly experienced types of work-related MSDs include back injury, carpal tunnel syndrome and arthritis. Construction workers are a high-risk group for work-related musculoskeletal disorders (WMSDs). For example, Boschman et al. (2012) report 67% of bricklayers and 57% of supervisors in a random sample of construction workers experience MSDs, the majority of which are attributed to work. Severe WMSDs can lead to functional impairment, permanent disability and early retirement among construction workers (Inyang et al., 2012). Risk factors commonly associated with WMSDs in construction include repetition, force, awkward posture, vibration, and contact stress (Wang et al., 2015).

Work-related MSDs are understood to occur when physical workload required by a job exceeds the physical capacity of a worker's body. Physical workload is influenced by the work tasks being performed, technologies being used, characteristics of the work environment, and the way that work is organised (Figure 2.2). Consequently, when considering ways to reduce the risk of WMSDs, consideration should be given to the way construction work is designed, organised and performed in the context of the worksite environment.

The risk of WMSD was investigated in the Australian construction industry using a whole-body system of wearable sensors to take biomechanical measurements when workers were performing everyday work tasks, such as jackhammering, shotcreting, steel-fixing, cable-pulling and shovelling. The results of this assessment revealed that workers are frequently exposed to static postures and repetitive movements that are potentially damaging, such as working with a bent back for a prolonged amount of time and flexing and extending the wrist. However, the study also revealed that these risks could be substantially reduced through the use of ergonomically designed equipment and/or alternative technologies (Lingard et al., 2017). The opportunity to reduce significant MSD risk in steel-fixing is described in case example 2.4.

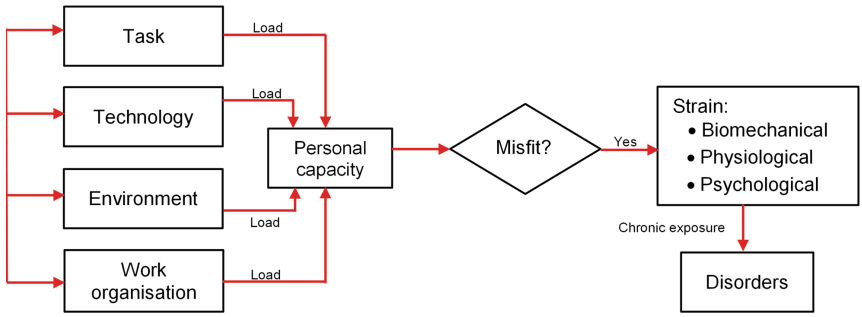

FIGURE 2.2 Factors that contribute to the development of work-related MSDs
Source: Karsh et al., 2001.

CASE EXAMPLE 2.4 TYING STEEL REINFORCEMENT BARS

Tying steel reinforcement bars is a high-risk activity for musculoskeletal injury to the back and upper extremities (Vi, 2003). Back injuries in workers engaged in tying steel reinforcement bars are attributed to frequently working in stooped postures, manually lifting heavy materials, often from toe to hip level, and working on poor walking surfaces (Niskanen, 1985; Tak et al., 2011; Umer et al., 2017). Importantly, WMSD risk exposure in steel tying varies significantly depending upon the specific work context, i.e., the nature of the structure being constructed and the site environment (Buchholz et al., 2003). This is because trunk posture (and the need for bending) varies according to the height at which work is performed. Steel tying is also a high-risk activity for WMSDs affecting the hand, wrist or fingers (Forde et al., 2005).

Australian data captured using a whole-body system of wearable sensors showed that the movements required to fix steel in place using a traditional pincer-cutter tool produce a high risk for WMSD of the wrist. When using a pincer-cutter, wrist flexion values ranged from 29.5 to 33.7 degrees. WorkSafe Victoria's *Manual Handling Code of Practice* recommends that, where the fingers are bent or applying higher forces (for example, gripping), flexion in excess of 15 degrees presents an elevated risk of injury when undertaking a task for more than 2 hours over a whole shift, or continually for more than 30 minutes at a time (WorkSafe Victoria, 2000). Wrist rotation was also a risk for WMSD when using the traditional pincer-cutter tool. However, both wrist rotation and flexion were significantly reduced by the use of a power-typing tool that eliminated the need to manually twist and tie the wire into place.

The analysis also revealed that trunk inclination data (forward flexion and extension in the sagittal plane) exceeded 50 degrees when fixing steel with a traditional pincer-cutter tool between ground level and hip height. WorkSafe

Victoria's *Manual Handling Code of Practice* identifies working with a trunk inclination greater than 20 degrees combined with undertaking a task for more than 2 hours over a whole shift, or continually for more than 30 minutes at a time, as a risk factor for work-related MSDs (WorkSafe Victoria, 2000). Trunk flexion was significantly reduced through the use of a long-handled steel tying tool (but still averaged more than 20 degrees when steel was being tied between ground level and hip height).

Source: *Lingard et al. (2019)*

The opportunity to select tools and equipment that reduce the risk of WMSD in the construction industry is significant. However, the industry has a low uptake of ergonomically designed equipment (Kramer et al., 2009; Glimskär & Lundberg, 2013). Van der Molen et al. (2005a) attribute this to the way that construction work is organised, in particular the reliance on temporary employment and multilevel contracting. The adoption of new ways of working that reduce the risk of WMSDs in construction is dependent on industry norms, organisation-level purchasing policies and appropriate consideration of risk inherent in work tasks at a project level (Kramer et al., 2010). Barriers to adoption can be reduced where it can be shown that solutions improve quality and production efficiency, while also reducing the risk of WMSDs (van der Molen, 2005b; Boatman et al., 2015).

2.11 Conclusion

It is sometimes said that the construction industry shouts safety but whispers health. Construction workers are exposed to a wide array of occupational health hazards and experience a disproportionately high incidence of many debilitating (and some fatal) occupational diseases. This chapter has highlighted the magnitude of the problem and laid out some of the challenges that need to be overcome in order to achieve better outcomes in the management of occupational health in the construction industry. Governments have a part to play in ensuring that appropriate standards are established and that product and materials supply networks are appropriately regulated to reduce worker exposure to harmful substances. Design professionals should be cognisant of the properties of products they specify and should consider the potential health implications of design decision-making. The potential occupational health impacts associated with specific construction methods and technologies should also be considered when designing how construction work will be performed. While there may be merit in organisational wellness strategies designed to assist workers to adopt health-promoting behaviours, such strategies do not satisfy or negate the principal duty of care borne by all construction organisations, which is to protect workers from harm arising from contributing to business operations. The evidence suggests

that the construction industry has considerable room for improvement in relation to ensuring that workers' health is not harmed as a result of their work.

2.12 Discussion and review questions

1 In what circumstances does workers' health become an organisational (rather than an individual) responsibility?
2 What should be the balance between individual and organisational responsibility for workers' health?
3 What is the hierarchy of control (HoC), and why is it helpful in selecting control measures for occupational health risk?
4 What are the barriers or challenges associated with reducing the risk of work-related illness in the construction industry?
5 How can governments, employers, managers, designers, manufacturers and suppliers of tools, plant and materials contribute to the reduction of occupational health risks in the construction industry?

2.13 Acknowledgements

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Note

1 Members of Safe Work Australia (the body that sets Australia's national policy on Workplace Exposure Standards) have recently determined that the exposure standard for RCS measured as a time weighted average over eight hours should be halved to 0.025 mg/m3. If enacted, this would become effective over a three-year transition period (Bence, 2023).

References

Akbar-Khanzadeh, F., & Brillhart, R. L. (2002). Respirable crystalline silica dust exposure during concrete finishing (grinding) using hand-held grinders in the construction industry. *Annals of Occupational Hygiene*, 46(3), 341–346.

Äkerstedt, T. (2006) Psychosocial stress and impaired sleep. *Scandinavian Journal of Work, Environment & Health*, 32 (6), 493–501.

Australian Broadcasting Corporation (2019). *Silicosis Surge Prompts More Calls for a Ban on Engineered Stone Products*. Accessed 14 November 2021: www.abc.net.au/news/2019-09-16/silicosis-surge-prompts-call-for-ban-on-engineered-stone-product/11516138

Australian Broadcasting Corporation (2021). *Calls for More Testing after Asbestos Found in Imported Toys and Building Materials*. Accessed 12 November 2021 from: www.abc.net.au/news/2021-11-09/asbestos-found-in-imported-toys-and-building-materials/100604278,

Australian Institute of Occupational Hygienists (AIOH) (2017). *Diesel Particulate Matter and Occupational Health Issues – Position Paper.* Australian Institute of Occupational Hygienists.

Bakke, B., Ulvestad, B., Stewart, P., & Eduard, W. (2004). Cumulative exposure to dust and gases as determinants of lung function decline in tunnel construction workers. *Occupational and Environmental Medicine*, 61(3), 262–269.

Barcenas, C. H., Delclos, G. L., El-Zein, R., Tortolero-Luna, G., Whitehead, L. W., & Spitz, M. R. (2005). Wood dust exposure and the association with lung cancer risk. *American Journal of Industrial Medicine*, 47(4), 349–357.

Bence, T. (2023), Australian Institute of Occupational Hygienists: Statement on Silicosis Prevention, https://www.aioh.org.au/news/a-message-to-members-from-aioh-president-tracey-bence/, accessed 1 April 2023.

Bensefa-Colas, L., Stocks, S. J., McNamee, R., Faye, S., Pontin, F., Agius, R. M.,... & Momas, I. (2017). Effectiveness of the European chromium (vi) directive for cement implementation on occupational allergic contact dermatitis occurrence: assessment in France and the UK. *British Journal of Dermatology*, 177(3), 873–876.

Bergdahl, I. A., Toren, K., Eriksson, K., Hedlund, U., Nilsson, T., Flodin, R., & Järvholm, B. (2004). Increased mortality in COPD among construction workers exposed to inorganic dust. *European Respiratory Journal*, 23(3), 402–406.

Bjorvatn, B., Sagen, I. M., Oyane, N., Waage, S., Fetveit, A., Pallesen, S., & Ursin, R. (2007) The association between sleep duration, body mass index and metabolic measures in the Hordaland Health Study. *Journal of Sleep Research*, 16(1), 66–76.

Boatman, L., Chaplan, D., Teran, S., & Welch, L. S. (2015). Creating a climate for ergonomic changes in the construction industry. *American Journal of Industrial Medicine*, 58(8), 858–869.

Boschman, J. S., Van der Molen, H. F., Sluiter, J. K., & Frings-Dresen, M. H. W. (2012). Musculoskeletal disorders among construction workers: a one-year follow-up study. *BMC Musculoskeletal Disorders,* 13(1), 1.

Buchanan, D., Miller, B. G., & Soutar, C. A. (2003). Quantitative relations between exposure to respirable quartz and risk of silicosis. *Occupational and Environmental Medicine*, 60(3), 159–164.

Buchholz, B., Paquet, V., Wellman, H., & Forde, M. (2003). Quantification of ergonomic hazards for ironworkers performing concrete reinforcement tasks during heavy highway construction. *AIHA Journal,* 64(2), 243–250

Centers for Disease Control and Prevention (2022). *Work-Related Musculoskeletal Disorders and Ergonomics*. Accessed 25 July 2022 from: www.cdc.gov/workplacehealthpromotion/health-strategies/musculoskeletal-disorders/index.html#:~:text=Musculoskeletal%20disorders%20(MSD)%20are%20injuries,to%20the%20condition%3B%20and%2For,

Chen, K. H., Su, S. B., & Chen, K. T. (2020). An overview of occupational noise-induced hearing loss among workers: epidemiology, pathogenesis, and preventive measures. *Environmental Health and Preventive Medicine*, 25(1), 1–10.

Choi, Y. H., & Kim, K. (2014). Noise-induced hearing loss in Korean workers: co-exposure to organic solvents and heavy metals in nationwide industries. *PloS one*, 9(5), e97538.

Cooper, J. H., Johnson, D. L., & Phillips, M. L. (2015). Respirable silica dust suppression during artificial stone countertop cutting. *Annals of Occupational Hygiene*, 59(1), 122–126.

Daniell, W. E., Swan, S. S., McDaniel, M. M., Camp, J. E., Cohen, M. A., & Stebbins, J. G. (2006). Noise exposure and hearing loss prevention programmes after 20 years of regulations in the United States. *Occupational and environmental medicine*, 63(5), 343–351.

Dear, K., Palmer, A., & Nixon, R. (2020). Allergic chromate dermatitis to cement in Australia: an ongoing problem. *Occupational and Environmental Medicine*, 77(9), 658–658.

Decopaint (2000). *Study on the Potential for Reducing Emissions of Volatile Organic Compounds (Voc) Due to the Use of Decorative Paints and Varnishes for Professional and Non-Professional Use*. Accessed 25 July 2022: https://ec.europa.eu/environment/archives/air/pdf/paint_solvents/decopaint.pdf

Dement, J. M., Ringen, K., Hines, S., Cranford, K., & Quinn, P. (2020). Lung cancer mortality among construction workers: implications for early detection. *Occupational and Environmental Medicine*, 77(4), 207–213.

Dement, J., Ringen, K., Welch, L., Bingham, E., & Quinn, P. (2005). Surveillance of hearing loss among older construction and trade workers at Department of Energy nuclear sites. *American Journal of Industrial Medicine*, 48(5), 348–358.

Dement, J., Welch, L. S., Ringen, K., Cranford, K., & Quinn, P. (2018). Hearing loss among older construction workers: Updated analyses. *American Journal of Industrial Medicine*, 61(4), 326–335.

Driscoll, T., Steenland, K., Prüss-Üstün, A., Nelson, D. I., & Leigh, J. (2004). *Occupational Carcinogens: Assessing the Environmental Burden of Disease at National and Local Levels*. World Health Organization.

European Union (2003). Directive 2003/53/EC of the European Parliament and of the Council of 18 June 2003 amending for the 26th time Council Directive 76/769/EEC relating to restrictions on the marketing and use of certain dangerous substances and preparations (nonylphenol, nonylphenol ethoxylate and cement), *Official Journal*. L 178, 24–27. Accessed 19 July 2022 from: https://op.europa.eu/en/publication-detail/-/publication/c2ee507b-0b20-48a2-8917-4f853b6a8804/language-en,

Fellner, C. (2021) *Ban on Popular Benchtops Being Considered as Wave of Deadly Illness Sparks Alarm*, Sydney Morning Herald. Accessed 14 November 2021: www.smh.com.au/national/ban-on-popular-benchtops-being-considered-as-wave-of-deadly-illness-sparks-alarm-20210416-p57jxy.html,

Flanagan, M. E., Seixas, N., Majar, M., Camp, J., & Morgan, M. (2003). Silica dust exposures during selected construction activities. *AIHA Journal*, 64(3), 319–328.

Forde, M. S., Punnett, L., & Wegman, D. H. (2005). Prevalence of musculoskeletal disorders in union ironworkers. *Journal of Occupational and Environmental Hygiene,* 2(4), 203–212.

Fritschi, L., & Reid, A. (2019), Engineered stone benchtops are killing our tradies. Here's why a ban's the only answer, The Conversation. Accessed 14 November 2021 from: https://theconversation.com/engineered-stone-benchtops-are-killing-our-tradies-heres-why-a-bans-the-only-answer-126489,

Frost, G., Darnton, A., & Harding, A. H. (2011). The effect of smoking on the risk of lung cancer mortality for asbestos workers in Great Britain (1971–2005). *Annals of Occupational Hygiene*, 55(3), 239–247.

Gangwisch, J. E., Heymsfield, S. B., Boden-Albala, B., Buijs, R. M., Kreier, F., Pickering, T. G., Rundle, A. G., Zammit, G. K., & Malaspina, D. (2006). Short sleep duration as a risk factor for hypertension: analyses of the first National Health and Nutrition Examination Survey. *Hypertension*, 47(5), 833–839.

Gangwisch, J. E., Malaspina, D., Boden-Albala, B., & Heymsfield, S. B. (2005). Inadequate sleep as a risk factor for obesity: Analyses of the NHANES I. *Sleep*, 28(10), 1289–96.

Geier, J., Krautheim, A., Uter, W., Lessmann, H., & Schnuch, A. (2011). Occupational contact allergy in the building trade in Germany: Influence of preventive measures and changing exposure. *International Archives of Occupational and Environmental Health*, 84(4), 403–411.

Glimskär, B., & Lundberg, S. (2013). Barriers to adoption of ergonomic innovations in the construction industry. *Ergonomics in Design*, 21(4), 26–30.

Gottlieb, D. J., Redline, S., Nieto, F. J., Baldwin, C. M., Newman, A. B., Resnick, H. E., & Punjabi, M. D. (2006). Association of usual sleep duration with hypertension: The Sleep Heart Health Study. *Sleep,* 29(8), 1009–1014.

Health and Safety Executive (HSE) (2020a). *Costs to Britain of Workplace Fatalities and Self-Reported Injuries and Ill Health, 2018/19.* Accessed 22 November 2021 from: www.hse.gov.uk/statistics/pdf/cost-to-britain.pdf.

Health and Safety Executive (HSE) (2020b). *Construction Statistics in Great Britain, 2020.* Accessed 9 November 2021 from: www.hse.gov.uk/statistics/industry/construction.pdf.

Health and Safety Executive (HSE) (2020c*). Work-related Chronic Obstructive Pulmonary Disease (COPD) Statistics in Great Britain, 2020.* Accessed 11 November 2021 from: www.hse.gov.uk/statistics/causdis/copd.pdf.

Health and Safety Executive (HSE). (2021). *Occupational Cancer Statistics in Great Britain, 2021.* www.hse.gov.uk/statistics/causdis/cancer.pdf, accessed 27 September 2022.

Hong, O. (2005). Hearing loss among operating engineers in American construction industry. *International Archives of Occupational and Environmental Health*, 78(7), 565–574.

Hoy, R. F., Baird, T., Hammerschlag, G., Hart, D., Johnson, A. R., King, P.,... & Yates, D. H. (2018). Artificial stone-associated silicosis: A rapidly emerging occupational lung disease. *Occupational and Environmental Medicine*, 75(1), 3–5.

Hoy, R. F., Glass, D. C., Dimitriadis, C., Hansen, J., Hore-Lacy, F., & Sim, M. R. (2021). Identification of early-stage silicosis through health screening of stone benchtop industry workers in Victoria, Australia. *Occupational and Environmental Medicine*, 78(4), 296–302.

Inyang, N., Al-Hussein, M., El-Rich, M., & Al-Jibouri, S. (2012). Ergonomic Analysis and the Need for Its Integration for Planning and Assessing Construction Tasks. *Journal of Construction Engineering and Management,* 138(12), 1370–1376.

Järvholm, B., & Burdorf, A. (2017). Effect of reduced use of organic solvents on disability pension in painters. *Occupational and Environmental Medicine*, 74(11), 827–829.

Järvholm, B., & Silverman, D. (2003). Lung cancer in heavy equipment operators and truck drivers with diesel exhaust exposure in the construction industry. *Occupational and Environmental Medicine*, 60(7), 516–520.

Jones, W., Gibb, A., Haslam, R., & Dainty, A. (2019). Work-related ill-health in construction: The importance of scope, ownership and understanding. *Safety Science*, 120, 538–550.

Karsh, B.-T., Moro, F. B. P., & Smith, M. J. (2001). The efficacy of workplace ergonomic interventions to control musculoskeletal disorders: A critical analysis of the peer-reviewed literature. *Theoretical Issues in Ergonomics Science,* 2(1), 23–96.

Kaukiainen, A., Riala, R., Martikainen, R., Akila, R., Reijula, K., & Sainio, M. (2004). Solvent-related health effects among construction painters with decreasing exposure. *American Journal of Industrial Medicine*, 46(6), 627–636.

Kaukiainen, A., Riala, R., Martikainen, R., Estlander, T., Susitaival, P., & Aalto-Korte, K. (2005). Chemical exposure and symptoms of hand dermatitis in construction painters. *Contact Dermatitis*, 53(1), 14–21.

Kramer, D. M., Bigelow, P. L., Carlan, N., Wells, R. P., Garritano, E., Vi, P., and Plawinski, M. (2010). Searching for needles in a haystack: Identifying innovations to prevent MSDs in the construction sector. *Applied Ergonomics*, 41(4), 577–584.

Kramer, D., Bigelow, P., Vi, P., Garritano, E., Carlan, N., & Wells, R. (2009). Spreading good ideas: A case study of the adoption of an innovation in the construction sector. *Applied Ergonomics*, 40(5), 826–832.

Kridin, K., Bergman, R., Khamaisi, M., & Weltfriend, S. (2016). Chromate allergy in northern Israel in relation to exposure to cement and detergents. *Dermatitis*, 27(3), 131–136.

Kurmis, A. P., & Apps, S. A. (2007). Occupationally-acquired noise-induced hearing loss: a senseless workplace hazard. *International Journal of Occupational Medicine and Environmental Health*, 20(2), 127–136.

Landwehr, K. R., Larcombe, A. N., Reid, A., & Mullins, B. J. (2021). Critical review of diesel exhaust exposure health impact research relevant to occupational settings: Are we controlling the wrong pollutants? *Exposure and Health*, 13(2), 141–171.

Leensen, M. C. J., Van Duivenbooden, J. C., & Dreschler, W. A. (2011). A retrospective analysis of noise-induced hearing loss in the Dutch construction industry. *International Archives of Occupational and Environmental Health*, 84(5), 577–590.

Leensen, M. C., & Dreschler, W. A. (2015). Longitudinal changes in hearing threshold levels of noise-exposed construction workers. *International Archives of Occupational and Environmental Health*, 88(1), 45–60.

León-Jiménez, A., Hidalgo-Molina, A., Conde-Sánchez, M. Á., Pérez-Alonso, A., Morales-Morales, J. M., García-Gámez, E. M., & Córdoba-Doña, J. A. (2020). Artificial stone silicosis: Rapid progression following exposure cessation. *Chest*, 158(3), 1060–1068.

Leso, V., Fontana, L., Romano, R., Gervetti, P., & Iavicoli, I. (2019). Artificial stone associated silicosis: A systematic review. *International Journal of Environmental Research and Public Health*, 16(4), 568.

Lewkowski, K., Heyworth, J. S., Li, I. W., Williams, W., McCausland, K., Gray, C.,... & Fritschi, L. (2019). Exposure to noise and ototoxic chemicals in the Australian workforce. *Occupational And Environmental Medicine*, 76(5), 341–348.

Lewkowski, K., McCausland, K., Heyworth, J. S., Li, I. W., Williams, W., & Fritschi, L. (2018). Questionnaire-based algorithm for assessing occupational noise exposure of construction workers. *Occupational and Environmental Medicine*, 75(3), 237–242.

Lie, A., Skogstad, M., Johannessen, H. A., Tynes, T., Mehlum, I. S., Nordby, K. C.,... & Tambs, K. (2016). Occupational noise exposure and hearing: a systematic review. *International Archives of Occupational and Environmental Health*, 89(3), 351–372.

Lin, R. T., Chien, L. C., Jimba, M., Furuya, S., & Takahashi, K. (2019). Implementation of national policies for a total asbestos ban: A global comparison. *The Lancet Planetary Health*, 3(8), e341–e348.

Lingard, H., Bird, S., Lythgo, N., Selva-Raj, I., & Troynikov, O. (2017). *Musculoskeletal Risk in the Rail Construction Sector.* RMIT University: Melbourne.

Lingard, H., Raj, I. S., Lythgo, N., Troynikov, O., & Fitzgerald, C. (2019). The impact of tool selection on back and wrist injury risk in tying steel reinforcement bars: A single case experiment. *Construction Economics and Building*, 19(1), 1–19.

Markowitz, S. B., Levin, S. M., Miller, A., & Morabia, A. (2013). Asbestos, asbestosis, smoking, and lung cancer. New findings from the North American insulator cohort. *American Journal of Respiratory and Critical Care Medicine*, 188(1), 90–96.

Masterson, E. A., Deddens, J. A., Themann, C. L., Bertke, S., & Calvert, G. M. (2015). Trends in worker hearing loss by industry sector, 1981–2010. *American Journal of Industrial Medicine*, 58(4), 392–401.

Masterson, E. A., Tak, S., Themann, C. L., Wall, D. K., Groenewold, M. R., Deddens, J. A., & Calvert, G. M. (2013). Prevalence of hearing loss in the United States by industry. *American Journal of Industrial Medicine*, 56(6), 670–681.

Meding, B., Wrangsjö, K., Burdorf, A., & Järvholm, B. (2016). Disability pensions due to skin diseases: a cohort study in Swedish construction workers. *Acta Dermato-Venereologica*, 96(2), 232–236.

Murgia, N., & Gambelunghe, A. (2021). Occupational COPD – The most under-recognized occupational lung disease? *Respirology*, 27, 399–410.

Neitzel, R. L., Stover, B., & Seixas, N. S. (2011). Longitudinal assessment of noise exposure in a cohort of construction workers. *Annals of Occupational Hygiene*, 55(8), 906–916.

Neitzel, R., & Seixas, N. (2005). The effectiveness of hearing protection among construction workers. *Journal of Occupational and Environmental Hygiene*, 2(4), 227–238.

Nelson, D. I., Nelson, R. Y., Concha-Barrientos, M., & Fingerhut, M. (2005). The global burden of occupational noise-induced hearing loss. *American Journal of Industrial Medicine*, 48(6), 446–458.

Newbigin, K., Parsons, R., Deller, D., Edwards, R., & McBean, R. (2019). Stonemasons with silicosis: Preliminary findings and a warning message from Australia. *Respirology*, 24(12), 1220–1221.

Nij, T. E., & Heederik, D. (2005). Risk assessment of silicosis and lung cancer among construction workers exposed to respirable quartz. *Scandinavian Journal of Work, Environment & Health*, 31(2), 49–56.

Nij, T. E., Hilhorst, S., Spee, T. O. N., Spierings, J., Steffens, F., Lumens, M., & Heederik, D. (2003). Dust control measures in the construction industry. *Annals of Occupational Hygiene*, 47(3), 211–218.

Nij, T. E., Höhr, D., Borm, P., Burstyn, I., Spierings, J., Steffens, F.,... & Heederik, D. (2004). Variability in quartz exposure in the construction industry: implications for assessing exposure-response relations. *Journal of Occupational and Environmental Hygiene*, 1(3), 191–198.

Niskanen, T. (1985), Accidents and minor accidents of the musculoskeletal system in heavy (concrete reinforcement work) and light (painting) construction work. *Journal of Occupational Accidents*, 7, 17–32.

O'Neill, R., Pickvance, S., & Watterson, A. (2007). Burying the evidence: How Great Britain is prolonging the occupational cancer epidemic. *International Journal of Occupational and Environmental Health*, 13(4), 428–436.

Rappaport, S. M., Goldberg, M., Susi, P. A. M., & Herrick, R. F. (2003). Excessive exposure to silica in the US construction industry. *Annals of Occupational Hygiene*, 47(2), 111–122.

Ringen, K., Dement, J., Welch, L., Dong, X. S., Bingham, E., & Quinn, P. S. (2014). Risks of a lifetime in construction. Part II: Chronic occupational diseases. *American Journal of Industrial Medicine*, 57(11), 1235–1245.

RMIT University, Control Measures for Occupational Health Risks Relevant to Civil Construction Work. file:///C:/Users/Helen/Downloads/control-measures-occupational-health-risks-relevant-civil-construction-work%20(5).pdf, accessed 27 September 2022.

Rose, C., Heinzerling, A., Patel, K., Sack, C., Wolff, J., Zell-Baran, L.,... & Harrison, R. (2019). Severe silicosis in engineered stone fabrication workers – California, Colorado, Texas, and Washington, 2017–2019. *Morbidity and Mortality Weekly Report*, 68(38), 813.

Roto, P., Sainio, H., Reunala, T., & Laippala, P. (1996). Addition of ferrous sulfate to cement and risk of chromium dermatitis among construction workers. *Contact Dermatitis*, 34(1), 43–50.

Safe Work Australia (2021). *Managing the Risks of Respirable Crystalline Silica from Engineered Stone in the Workplace: Code of Practice*. Safe Work Australia.

Saleh, S., Woskie, S., & Bello, A. (2017). The use of noise dampening mats to reduce heavy-equipment noise exposures in construction. *Safety and Health at Work*, 8(2), 226–230.

Sauvé, J. F. (2015). Historical and emerging workplaces affected by silica exposure since the 1930 Johannesburg conference on Silicosis, with special reference to construction. *American Journal of Industrial Medicine*, 58(S1), 67–71.

Seixas, N. S., Neitzel, R., Stover, B., Sheppard, L., Feeney, P., Mills, D., & Kujawa, S. (2012). 10-Year prospective study of noise exposure and hearing damage among construction workers. *Occupational and Environmental Medicine*, 69(9), 643–650.

Sherratt, F. (2016). Shiny happy people? UK construction industry health: Priorities, practice and public relations. In *Proceedings of the 32nd annual ARCOM conference* (Vol. 1, pp.447–456).

Snashall, D. (2005). Occupational health in the construction industry. *Scandinavian Journal of Work, Environment & Health*, 31, 5–10.

Snashall, D. (2007). Preventing occupational ill health in the construction industry. *Occupational and Environmental Medicine*, 64(12), 789–790.

Spiegel, K., Knutson, K., Leproult, R., Tasali, E., & Van Cauter, E. (2005). Sleep loss: A novel risk factor for insulin resistance and type 2 diabetes. *Journal of Applied Physiology*, 99(5), 2008–2019.

Stocks, S. J., McNamee, R., Turner, S., Carder, M., & Agius, R. M. (2012). Has European Union legislation to reduce exposure to chromate in cement been effective in reducing the incidence of allergic contact dermatitis attributed to chromate in the UK? *Occupational and Environmental Medicine*, 69(2), 150–152.

Summers, M. P., & Parmigiani, J. P. (2015). A water soluble additive to suppress respirable dust from concrete-cutting chainsaws: a case study. *Journal of Occupational and Environmental Hygiene*, 12(4), D29–D34.

Tak, S., Buchholz, B., Punnett, L., Moir, S., Paquet, V., Fulmer, S.,... & Wegman, D. (2011). Physical ergonomic hazards in highway tunnel construction: overview from the Construction Occupational Health Program. *Applied Ergonomics*, 42(5), 665–671.

Ulvestad, B., Lund, M. B., Bakke, B., Thomassen, Y., & Ellingsen, D. G. (2015). Short-term lung function decline in tunnel construction workers. *Occupational and Environmental Medicine*, 72(2), 108–113.

Umer, W., Li, H., Szeto, G. P. Y., & Wong, A. Y. L., 2017. Identification of biomechanical risk factors for the development of lower-back disorders during manual rebar tying. *Journal of Construction Engineering and Management*, 143(1), 04016080.

van der Molen, H. F., de Vries, S. C., Stocks, S. J., Warning, J., & Frings-Dresen, M. H. (2016). Incidence rates of occupational diseases in the Dutch construction sector, 2010–2014. *Occupational and Environmental Medicine*, 73(5), 350–352.

van der Molen, H. F., Koningsveld, E., Haslam, R., and Gibb, A. (2005a). Editorial. Ergonomics in building and construction: time for implementation. *Applied Ergonomics,* 36(4), 387–389.

van der Molen, H. F., Sluiter, J. K., & Frings-Dresen, M. H. W. (2005b). Behavioral change phases of different stakeholders involved in the implementation process of ergonomics measures in bricklaying. *Applied Ergonomics,* 36(4), 449–459.

Van Deurssen, E., Pronk, A., Spaan, S., Goede, H., Tielemans, E., Heederik, D., & Meijster, T. (2014). Quartz and respirable dust in the Dutch construction industry: A baseline exposure assessment as part of a multidimensional intervention approach. *Annals of Occupational Hygiene*, 58(6), 724–738.

Vi, P. (2003). Reducing risk of musculoskeletal disorders through the use of rebar-tying machines. *Applied Occupational and Environmental Hygiene*, 18(9), 649–654.

Wang, D., Dai, F., & Ning, X. (2015). Risk Assessment of Work-Related Musculoskeletal Disorders in Construction: State-of-the-Art Review. *Journal of Construction Engineering and Management,* 141(6), 04015008.

Winder, C., & Carmody, M. (2002). The dermal toxicity of cement. *Toxicology and Industrial Health*, 18(7), 321–331.

Wong, C. C., Gamboni, S. E., Palmer, A. M., & Nixon, R. L. (2015). Occupational allergic contact dermatitis to chromium from cement: Estimating the size of the problem in Australia. *Australasian Journal of Dermatology*, 56(4), 290–293.

WorkSafe Victoria (2000). *Code of Practice for Manual Handling.* Melbourne: Victorian WorkCover Authority.

WorkSafe Victoria (2021). *Changes to Protect Victorians Working with Engineered Stone.* Accessed 14 November 2021 from: www.worksafe.vic.gov.au/changes-protect-victorians-working-engineered-stone

World Health Organization (2014). *Chrysotile Asbestos.* Accessed 13 November 2021 from: www.who.int/ipcs/assessment/public_health/chrysotile_asbestos_summary.pdf.

3

WORK-RELATED FACTORS IMPACTING CONSTRUCTION WORKERS' PSYCHOLOGICAL HEALTH

3.1 Introduction

Some industries and occupations are more stressful than others (Bültmann et al., 2001) and, consequently, mental ill health can "cluster within high-risk industries and occupations" (Roche et al., 2016, p.280). In this chapter we examine evidence for the relationship between work and psychological health and consider features of working in the construction industry that are likely to contribute to the relatively low level of psychological health observed in the construction workforce in many countries.

We describe policy interventions that seek to ensure that workplace risk factors with the potential to affect workers' psychological health are systematically identified, assessed and controlled in appropriate ways. We examine limitations inherent in some types of mental health programmes that focus on providing individual workers with resources to better cope with adverse conditions of work. Consistent with occupational health and safety discourse, we suggest that construction organisations need to focus their efforts and energies on eliminating or reducing work-related factors rather than focusing on "fixing" individual workers. The different approach that is adopted to control safety risks compared to controlling risks with the potential to cause psychological harm is summed up in the following observation made by one of our industry partners: "In safety we stop people from falling into holes by covering these holes or erecting barriers to stop people from falling in, but, in psychological health we let people fall first and then try to pull them out once they are in trouble. We need to stop them falling in the first place."

The need to look more carefully at the quality of work in the construction industry and to think about how to design organisational and project environments that are free of adverse conditions is a recurring theme in this chapter. The

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prevention of psychological harm through effective risk management is a legal responsibility of employers and persons in charge of business undertakings. The prevention of psychological harm should therefore be afforded the same attention as the prevention of workplace accidents or elimination/reduction of risks to physical health (see Chapter 2). However, construction organisations have paid far less attention to addressing psychosocial risks that are known to contribute to work stress and psychological harm. Given the stressful nature of work and prevalence of mental ill health in the construction industry, there is an urgent need to address this imbalance.

3.2 The relationship between job quality and psychological health

Work plays an important role in people's lives. It provides people with an income that helps sustain their material standard of living and supports social and psychological wellbeing (Butterworth et al., 2011a). Epidemiological studies indicate a strong, positive association between unemployment and poor psychological health outcomes, including higher rates of overall mortality and suicide among unemployed men and women than among those in employment or the general population (Jin et al., 1995). However, although employment is usually associated with having better psychological health, the quality of work that people do is also very important (Findlay et al., 2013). Extensive research shows that unfavourable working environments, characterised by poor quality work, are harmful for psychological health (Niuwenhuijsen et al., 2010; Stansfeld & Candy, 2006; Netterstrom et al., 2008).

The prevalence of common mental disorders (CMDs) is actually similar for people in poor quality jobs to those who are unemployed (Butterworth et al., 2013). Poor quality work may therefore be as bad for psychological health as unemployment.

Job quality has been defined as "sets of work features which foster the wellbeing of the worker" (Strazdins et al., 2010, p.2052). While there is no universally agreed set of components for job quality, it is often understood to be reflected by the presence or absence of adverse conditions, including job demands and complexity, imbalance between effort and reward, low levels of job control, exposure to health and safety risks and insecurity of employment (Green, 2006; Strazdins et al., 2004).

Job quality is a determinant of sickness absence. In one Australian study the presence of adverse job conditions (i.e., low job security, low job control, high job demands and complexity and a perception of unfair pay) was examined as a determinant of sickness absence. Compared to people with no adverse job conditions, people with one, two or more than two adverse job conditions were found to take 26%, 28% and 58% more sickness absence respectively (Milner et al., 2015).

Analysis of data collected in longitudinal cohort studies in Australia and the UK also reveals that when people who change jobs move into jobs in which

they are exposed to more adverse conditions, they experience a subsequent increase in self-reported mental health problems and diagnosed mental disorders (Butterworth et al., 2011a, 2013). These relationships were found for people in unskilled and professional roles. Importantly the same causal relationship was not found for physical health. While adverse job quality appears to contribute to a deterioration in mental health over time, Butterworth et al. (2011a) explain that the association between poor physical health and low job quality reflects the likelihood that poor physical health acts as a barrier to entry into high quality jobs.

Poor job quality is reported to be particularly harmful to the psychological health of older workers and can also have inter-generational effects (Welsh et al., 2016). For example, Strazdins et al. (2010) found that children of mothers and fathers in poor quality jobs showed a significantly higher incidence of emotional and behavioural difficulties than other children, even when controlling for income, parents' education, family structure and work hours.

The relationship between job quality and psychological health was explored in a sample of manual/non-managerial construction workers, drawn from the same longitudinal cohort study of Australian workers (the Household, Income and Labour Dynamics in Australia data set). This is the same data set used by Butterworth et al. (2011a) and Milner et al. (2015) in their analyses. The analysis revealed that mental health declines in manual/non-managerial workers when exposed to adverse job conditions irrespective of their age. However, the decline is more marked and rapid in mid-aged workers who experience two or more adverse conditions. This may be explained by the fact that mid-life is a complex stage of development and mid-age workers are more likely than younger or older workers to be juggling work with family demands and to have more significant financial responsibilities. While the mental health of younger construction workers (up to the age of 25 years) was significantly affected by low job security and unfairness of effort and reward, the mental health of mid-aged (25–45 years of age) and older workers (46 or more years of age) was also negatively affected by high job demands and complexity and high work intensity (Pirzadeh et al., 2022). Differences between younger, older and mid-age workers' experiences highlight the need to understand and address factors that impact psychological health and wellbeing over the life course.

3.3 Theories linking work with psychological health

A number of key theories have been developed to explain the relationship between job characteristics and mental health:

- job demand-control (JD-C) model,
- job demands-resources (JD-R) model, and
- effort-reward imbalance (ERI) model.

A common feature of these theories is that they explain the link between work and psychological health in terms of the combined effects of the demands inherent in the job, and other factors that are believed to be protective or supportive of healthy functioning (i.e., job control, social support or resources).

The job demand-control (JD-C) theory is often cited to explain the relationship between work conditions and psychological health (Karasek, 1979). The JD-C theory describes two key dimensions of the psychosocial work environment, i.e., job demands and job decision latitude (Karasek, 1979). Job demands are psychological stressors present in the work environment, while job decision latitude reflects the extent to which someone has control over their work (Karasek, 1979). According to the JD-C model, jobs can be divided into four types: 1) high-strain jobs, characterised by high demands and low decision latitude, are considered to be the most problematic in relation to mental strain and health outcomes; 2) active jobs, involving simultaneously high demands and decision latitude, are associated with average levels of mental strain and are likely to facilitate employee development; 3) passive jobs, characterised by low demands and low decision latitude, are associated with average levels of mental strain but can be demotivating; and 4) low-strain jobs, combining low demands and high decision latitude, involve lower than average levels of mental strain and lower risk of ill health (Karasek, 1979).

The JD-C theory is supported by empirical evidence (Häusser et al., 2010). Drawing on the JD-C model, job demands and complexity, and job control have previously been linked to workers' experiences of psychological health (Butterworth et al., 2011a, 2013; Leach et al., 2010; Stansfeld & Candy, 2006).

The JD-C model was subsequently extended by Karasek and Theorell (1990) to incorporate social support as a third factor affecting workers' stress, strain and health impacts. Thus, it is argued that the most negative health outcomes will be found in workers whose jobs are high in demands, low in control and low in social support.

The job demands-resources (JD-R) model explains work stress as arising from an imbalance between:

- job demands, defined as physical, psychological, social or organisational aspects of a job that require workers to expend effort and energy and therefore create a physiological or psychological "cost" for workers, and
- job resources, defined as physical, psychological, social or organisational aspects of a job that support goal achievement, reduce demands or stimulate learning, growth and development (Bakker & Demerouti, 2007).

The effort-reward imbalance (ERI) theory posits that an imbalance between (high) effort and (low) reward causes a strain reaction that negatively affects workers' health (Siegrist, 1996). This model assumes that work is underpinned by a norm of reciprocity whereby efforts are rewarded commensurately with rewards, which can be in the form of money, esteem, career opportunities or

job security (Siegrist et al., 2004). However, sometimes workers' efforts exceed perceived rewards and this imbalance between high "costs" and low "gains" can lead to a state of sustained strain reactions in the autonomic nervous system and ultimately produce emotional distress (Siegrist, 1996). This is particularly evident when workers have few alternatives in the labour market, for example because they are low in skill or have restricted mobility (Siegrist et al., 2004).

According to Siegrist (2012, p.3), three hypotheses are derived from the ERI model:

1. An imbalance between high effort and low reward (non-reciprocity) increases the risk of reduced health over and above the risk associated with each one of the components.
2. Overcommitted people are at increased risk of reduced health (whether or not this pattern of coping is reinforced by work characteristics).
3. The highest risks of reduced health are expected in people who are characterised by conditions (1) and (2).

The ERI model is supported by empirical research (van Vegchel et al., 2005). Based on the ERI model, fair pay and job security have been previously linked to mental health (Butterworth et al., 2011a, 2011b; Milner et al., 2015).

The combined effects of the JD-C and ERI models on workers' health are reportedly stronger than their separate effects (De Jonge et al., 2000; Rydstedt et al., 2007).

3.4 Work-related stress in construction work

During the UN General Assembly in September 2015, decent work and the four pillars of the Decent Work Agenda – employment creation, social protection, rights at work, and social dialogue – became central dimensions of the 2030 Agenda for Sustainable Development. Goal 8 of the 2030 Agenda seeks to "promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all" (ILO, 2015, p.18). Despite the recognition of the importance of decent work for sustainable global development, the negative impact of work stress is far reaching and is now considered as a social phenomenon in urgent need of attention due to its cost at the individual, organisational, and societal levels (Hassard et al., 2018). The human costs of workplace stress include the emotional strain and reduction in quality of life experienced by affected individuals, and a decline in the quality of relationships with spouse, children and other family members. There are also significant financial burdens on individuals, organisations and societies. At the individual level the impacts of work stress may be related to increased medical and insurance costs and reduced income. At the organisational level, the financial implications of work-related stress are associated with a reduction in productivity, increased levels of absenteeism, and employee turnover (Hassard et al., 2014).

Work stress has been defined as "the adverse reaction people have to excessive pressures or other types of demand placed on them at work" (HSE, 2019, p.3). The Health and Safety Executive (2019) also distinguish between pressure and stress. According to this distinction, experiencing some pressure at work can be motivating but the experience of excessive pressure can cause stress.

The JD-C theory has been used to explain the relationship between conditions of work and work-related stress among construction industry workers (Bowen et al., 2014). A recent report undertaken on behalf of the Chartered Institute of Building revealed that construction industry workers are worse off than workers in other industries in terms of experiencing:

- poor work–life balance
- high workload
- excessive travel time
- technology overload, and
- unrealistic deadlines (Cattell et al., 2017).

Work speed and quantity of work have also been linked to symptoms of depression in bricklayers and construction supervisors, while low participation in decision making and low levels of supervisor support were linked with symptoms of depression in supervisors (Boschman et al., 2013). Job autonomy is reported to be especially beneficial for older construction workers as a protective factor against mental ill health (Zaniboni et al., 2016). Low job control and high demands have also been identified as risk factors for suicide among Australian men (Milner et al., 2016).

The construction industry possesses characteristics with the potential to amplify the impact of work on mental ill health. Construction work is project-based, and work hours are long and inflexible. The impact of working time on workers' psychological health is discussed in Chapter 4. However, construction also has other characteristics that make it stressful.

Co-worker/supervisor support and job insecurity have also been linked to stress-related disorders in male workers (Nieuwenhuijsen et al., 2010). The delivery of construction projects is heavily reliant on winning competitive tendering opportunities and projects are delivered through a complicated multitiered subcontracting system. Intense competition for contracts, coupled with low profit margins and incentive payment systems, increases the pressure experienced throughout the supply chain. Flexible employment practices have increased workforce casualisation and concerns about job security have been linked to construction workers' psychological wellbeing (Turner & Lingard, 2016). Mayhew and Quinlan (2006) report long work hours, stressed and chronically fatigued workers in similar multitiered subcontracting arrangements in the Australian trucking industry. The health impacts of subcontracting have also been reported in international studies in which subcontracted workers are reported to be three times more likely to experience anxiety or depression,

TABLE 3.1 Risk factors for mental ill health in construction

Risk factor category	*Example*
Job demand	Work overload / quantity of work
	Hours worked
Job control	Little opportunity to participate in decision making
Family	Work–home conflict
Welfare and socioeconomic	Job insecurity
Work hazard	Occupational injury/hazard
	Musculoskeletal pain/injuries
Coping mechanism	Substance abuse
	Alcohol abuse
Work support	Minimal social support from co-workers
	Criticism
	Lack of feedback
Workplace injustice	Gender discrimination
	Harassment/bullying

Source: Chan et al., 2020.

and to miss work due to illness, compared to directly employed workers (Min et al., 2013). Milner et al. (2017) analysed coronial findings to identify the stressors precipitating death by suicide in a sample of Australian construction workers. Transient work conditions, concerns about job insecurity and feelings of pressure were all identified as precipitating factors in these deaths (Milner et al., 2017).

The research conducted in the construction industry is consistent with studies linking conditions of work with job strain and mental ill health in other industries (Cohidon et al., 2012). However, the industry's characteristics (discussed above) create conditions in which workers are at a particularly high risk of mental ill health. Research has found that adverse work conditions (high demands, low control and job insecurity) influence mental health independently of one another. This means that jobs that combine two or three adverse conditions present a higher mental health risk, than jobs in which only one risk factor is present (Strazdins et al., 2011).

It is now well established that construction workers can suffer from a wide range of work factors which can contribute to mental ill health (Chan et al., 2020; Sun et al., 2022). Chan et al. (2020) undertook a systematic review of risk factors for mental ill health in construction and the results are summarised in Table 3.1. Risk factors comprised job demand as the highest ranked risk factor, followed by low job control, family, welfare and socioeconomic conditions, work hazards, use of coping mechanisms, the availability of work support, and workplace injustice.

In a meta-analysis review examining the relationship between psychosocial hazards and mental health in the construction industry, Sun et al. (2022) found

that construction professionals (e.g., project managers, architects, engineers) and construction trade workers experienced similar adverse effects caused by psychosocial hazards on mental health. Some differences were found between construction professionals and trade workers for psychosocial hazards and their impact on mental health. For example, high job demands (e.g., role overload, interpersonal conflict, job insecurity) generally affected the mental health of construction trade workers more strongly than that of construction professionals. Low job control was found to affect the mental health of construction professionals more strongly than that of construction trade workers. Lack of job support had a similar impact on the mental health of both construction trade workers and professionals.

The findings of Sun et al. (2022) raise an important point regarding the exposure to psychosocial hazards and the impact on mental health. The construction workforce is not a homogeneous group. Instead, experience of risk factors is nuanced and can be driven by occupation, gender, age, and worksite and we explore these in more detail throughout the book. For example, in Chapter 5 we examine the risk factors to which women are exposed and how this can affect their health, and in Chapter 8 we explore young workers' health and wellbeing and specific risk factors that construction workers experience during the early stage of their career.

3.5 Psychosocial hazards and the management of risk

The International Labour Office (ILO) first defined psychosocial factors at work as "interactions between and among work environment, job content, organisational conditions and workers' capacities, needs, culture, personal extra-job considerations that may, through perceptions and experience, influence health, work performance and job satisfaction" (ILO, 1986, p.3).

Since this initial conceptualisation, the language of occupational health and safety risk management has been adopted to describe psychosocial factors and their potential to cause harm. Specifically, the term "psychosocial hazard" is used to refer to aspects of the design and management of work and its social and organisational context that have the potential to cause harm (Leka & Jain, 2010) and "psychosocial risk" describes the potential of psychosocial hazards to cause harm (Leka et al., 2015).

Work stress (discussed above in relation to the construction industry) has been identified as an outcome of exposure to psychosocial hazards in the work environment. Importantly, stress can be experienced when the risk of harm occurring is present, even if that harm has not yet occurred. For example, workers who have been exposed to workplace violence can experience stress if they believe the risk has not been effectively controlled, even if the violence has not re-occurred (Safe Work Australia, 2022a).

Psychological harm that can occur as a result of exposure to psychosocial hazards in the workplace includes conditions such as anxiety, depression, post-traumatic stress disorder (PTSD) and sleep disorders (Safe Work Australia,

2022a). Exposure to psychosocial hazards is also linked to physical health conditions, including musculoskeletal disorders (Answer et al., 2021), cardiovascular conditions (Santosa et al., 2021) and diabetes (Hackett & Steptoe, 2016), and can be a factor in fatigue-related workplace incidents causing physical injury (Safe Work Australia, 2022a).

Some commonly identified psychosocial hazards are:

- *Job content* – a lack of variety or short work cycles, fragmented or meaningless work, under use of skills, high uncertainty, continuous exposure to people through work
- *Workload and work pace* – work overload or under load, machine pacing, high levels of time pressure, continually subject to deadlines
- *Work schedule* – shift working, night shifts, inflexible work schedules, unpredictable hours, long or unsociable hours
- *Control* – low participation in decision making, lack of control over workload, pacing, etc.
- *Environment & equipment* – inadequate equipment availability, suitability or maintenance; poor environmental conditions such as lack of space, poor lighting, excessive noise
- *Organisational culture & function* – poor communication, low levels of support for problem solving and personal development, lack of definition of, or agreement on, organisational objectives
- *Interpersonal relationships at work* – social or physical isolation, poor relationships with superiors, interpersonal conflict, lack of social support, bullying, harassment
- *Role in organisation* – role ambiguity, role conflict, and responsibility for people
- *Career development* – career stagnation and uncertainty, under-promotion or over-promotion, poor pay, job insecurity, low social value to work, and
- *Home-work interface* – conflicting demands of work and home, low support at home, dual career problems (Leka and Jain, 2010, p.5).

Poorly managed organisational change, inadequate reward and recognition, poor organisational justice, witnessing, investigating or being exposed to traumatic events or materials and exposure to workplace violence or aggression have also been identified as psychosocial hazards in the workplace (Safe Work Australia, 2022b).

Leka et al. (2015) identified challenges to the practical management of psychosocial risk in workplaces, as follows:

- psychosocial risk is poorly understood by industry stakeholders who do not appreciate that existing legislative frameworks include requirements for the management of psychosocial risk;
- industry stakeholders do not appreciate that effective management of psychosocial risk can (in addition to reducing harm) also improve positive

outcomes for organisations (e.g., work engagement, improved quality and performance); and
- methods and tools for assessing and managing psychosocial risk are perceived to be difficult to use, particularly by small-to-medium sized enterprises.

The management of psychosocial risk has been required by mainstream occupational health and safety legislation for many years, in the European Union under the European Union Framework Directive 339/89/EEC (Leka et al., 2011) and countries in which the UK Robens-style model of health and safety regulation has been implemented (Johnstone et al., 2011). General obligations in these regimes require employers to manage all types of risks to workers' health and safety, including psychosocial risks. However, although they are clearly covered by general duties requirements, Johnstone et al. (2011) describe challenges associated with the enforcement of Australian occupational health and safety legislation in relation to psychosocial risk. In a qualitative study of government-employed health and safety inspectors, legal requirements for psychosocial risks were perceived to be insufficiently clear to enable effective enforcement and agency managers lacked confidence that enforcement action in relation to psychosocial issues would be successful in the courts.

Arguments have been made in favour of establishing regulations with clear and specific requirements for the management of psychosocial risk. In August 2022, Safe Work Australia released a set of model regulations and a model Code of Practice (CoP) on managing psychosocial hazards at work. The CoP provides guidance on how to comply with the laws, including how to manage the risks to psychological health in the workplace. Safe Work Australia is a national body that develops policy to improve occupational health and safety and workers' compensation arrangements across Australia.

To have effect, these model regulations and CoP need to be implemented by States/Territories as, in Australia, occupational health and safety is regulated (for the most part) by States and Territories.

The Safe Work Australia model CoP establishes a risk management process for psychosocial risk that comprises the following steps:

- Identify hazards – find out what could cause harm
- Assess risks – consider how serious the harm could be
- Control risks – implement the most effective controls that are reasonably practicable in the workplace context, and
- Review control measures – monitor risk to ensure controls are working as expected.

Consultation between employers and workers is important throughout all steps in the risk management process. The importance of consulting workers in identifying and assessing the risk posed by psychosocial hazards is arguably even greater than for physical occupational health and safety hazards. Research shows

that managers and workers perceive psychosocial risks differently (Houtman et al., 2020). This may be because psychosocial risks are less "visible" and, consequently, they may be under-estimated by managers, who might also regard psychosocial risks as being sensitive and more relevant to individuals rather than the organisation. Effective consultation is therefore important to understand hazards present in a work environment and the risks posed by these hazards to workers.

When consulting workers in relation to psychosocial hazards and risks, it is important to recognise that workers may describe hazards using different terminology. There is anecdotal evidence to suggest that psychosocial risk mitigation programmes implemented in the construction industry have been hampered by the use of language that workers do not easily understand. Managers implementing these programmes describe how they have had to "translate" psychosocial risk concepts into language that workers relate to. The Safe Work Australia CoP also suggests workers may talk about a range of different feelings in relation to their work (e.g., feeling burnt out, exhausted, anxious, scared, humiliated, degraded, undermined, angry, confused, distressed or traumatised) that may be caused by exposure to psychosocial risks (Safe Work Australia, 2022a). It is therefore important to listen to workers and identify underlying work-related factors that contribute to these feelings. For example, a feeling of anger may be caused by organisational policies being applied unfairly or a feeling of fear might be caused by interacting with an aggressive co-worker. It is also important to consider whether the workplace culture supports harmful behaviour or whether different psychosocial hazards in a work environment interact with one another to increase the potential for harm.

Understanding the nature and extent of psychosocial risks in a workplace can be difficult and multiple sources of information can be used. Incident reports and data relating to complaints, absenteeism, turnover and issues raised and discussed in health and safety committee meetings and toolbox talks, etc. can provide indicators of the presence of psychosocial hazards. Observing the work environment to see how people work (e.g., are they rushed?) and interact (e.g., is communication sufficient and respectful?) can also provide useful insights into the quality of the psychosocial work environment. The extent to which psychosocial hazards are present in a workplace can also be measured using anonymous employee perception surveys. The advantage of anonymous surveys is that they can overcome workers' concerns that they may be identified and victimised as consequence of reporting the presence of psychosocial risk in a workplace. For example, the UK's Health and Safety Executive has developed a Work-Related Stress Indicator Tool that is used to assess risk associated with six areas of work design that are associated with poor health: demands; control; support; relationships; role; and change (Edwards et al., 2008).

The traditional hierarchy of control (HoC) concept was developed for application to physical health and safety risks. The HoC arranges risk control measures in a descending order of effectiveness (see Chapter 2 for examples of the application of the HoC to physical health risks). In relation to the selection of control

measures for psychosocial risks the same principles as embodied in the HoC apply. That is, wherever possible hazards should be eliminated. If it is not possible to eliminate a hazard, then psychosocial risks should be minimised by changing the environment in which work takes place, considering making changes to job/work design, the systems of work and/or the physical work environment. These controls correspond in some ways to the technological controls of substitution, isolation and engineering in the traditional HoC because they seek to make the workplace intrinsically safer. Further down the hierarchy are controls that focus on human behaviour within the work environment, such as implementing safe work systems and procedures and encouraging desirable worker behaviours. Safe Work Australia (2022a) provide examples of possible controls for different psychological risks, noting that the selection of controls should always be based upon an assessment of the risks present in a specific workplace.

3.6 ISO 45003

Published in 2021, ISO 45003, *Occupational health and safety management – Psychological health and safety at work – Guidelines for managing psychosocial risks* provides guidance on the management of psychosocial risks and promotion of wellbeing at work, as part of an organisation's occupational health and safety management system. ISO 45003 groups psychosocial hazards into three categories as follows: (i) aspects of work organisation, (ii) social factors at work, and (iii) work environment, equipment and hazardous tasks. Examples of these are provided in Table 3.2.

ISO 45003 requires that organisations first understand their internal and external contexts to fully understand their operating environment, including the needs and expectations of their workers and other relevant stakeholders, and the factors that could affect the effectiveness of management processes implemented for psychosocial risk. For example, in the construction industry organisational factors, such as hierarchical systems of subcontracting and unfavourable contractual conditions governing the client-contractor relationship, may influence the experience and management of psychosocial risk. Construction workers may also be exposed to psychosocial risks arising from the work environment, equipment and tasks they perform – for example, working in conditions of extreme heat or cold and in unfavourable work environments characterised by exposure to high levels of noise and other physical health or safety hazards. The social environment in construction work is also shaped by the highly male-dominated work environment and prevailing masculine culture.

Once the organisational context for managing psychosocial risk is understood, ISO 45003 requires organisations to establish strong leadership commitment to the management of psychosocial risk (as part of the organisation's occupational health and safety management activities) and ensure that the management of psychosocial risk is addressed in organisational policy documents. ISO 45003 requires that organisational roles, responsibilities and authorities relating to the

TABLE 3.2 Psychosocial hazard types and examples

Aspects of work organisation	*Social factors at work*	*Work environment, equipment and hazardous tasks*
Roles and expectations, e.g., ambiguous roles, conflicting roles or roles that involve a duty of care for other persons Job autonomy and control, e.g., little opportunity to participate in decision making, little control over workload, etc. Job demands, e.g., having too much to do within a certain time or with a set number of workers, conflicting demands and deadlines, lack of task variety or performing highly repetitive tasks, etc. Organizational change management, e.g., lack of practical support provided to assist workers during transition periods, etc. Remote and isolated work, e.g., working in locations that are far from home, family, friends and usual support networks, working alone without social/human interaction at work (working at home), etc.	Interpersonal relationships, e.g., poor communication, interpersonal conflict, harassment, bullying and victimisation. Leadership, e.g., lack of clear vision and objectives, abuse of power, etc. Organisational/workgroup culture, e.g., poor communication, low levels of support for problem solving and personal development, etc. Recognition and reward, e.g. imbalance between workers' effort and formal and informal recognition and reward. Career development, e.g., career stagnation and uncertainty, under-promotion or over-promotion, lack of opportunity for skill development. Support, e.g., lack of support from supervisors and co-workers, lack of access to support services. Supervision, e.g., lack of constructive performance feedback and evaluation processes, lack of support and/or resources to facilitate performance improvement, misuse of digital surveillance.	Inadequate equipment availability, suitability, reliability, maintenance or repair. Poor workplace conditions such as lack of space, poor lighting and excessive noise. Lack of the necessary tools, equipment or other resources to complete work tasks. Working in extreme conditions or situations, such as very high or low temperatures, or at height. Working in unstable environments such as conflict zones.

Workload and work pace, e.g., work overload or underload, high levels of time pressure, continually subject to deadlines, etc.

Working hours and schedule, e.g., shift work, inflexible work schedules, unpredictable hours, long or unsociable hours, etc.

Job security and precarious work, e.g., uncertainty regarding work availability, possibility of redundancy or temporary loss of work with reduced pay, non-standard employment, etc.

Civility and respect, e.g., lack of trust, honesty, respect, civility and fairness in interactions (internal and external to the organisation).

Work–life imbalance, e.g., work tasks, roles, schedules or expectations that cause conflicting demands of work and home, impact the ability to recover, etc.

Violence at work, i.e., incidents involving an explicit or implicit challenge to health, safety or well-being, such as abuse, threats, assault (physical, verbal or sexual) including gender-based violence.

Harassment, i.e., unwanted, offensive, intimidating behaviours (sexual or non-sexual in nature) which relate to characteristic(s) of the targeted individual, such as race, gender identity, religion, etc.

Bullying and victimisation, i.e., repeated unreasonable behaviours which can present a risk to health, safety and well-being at work, such as social or physical isolation, name-calling, insults and intimidation, etc.

Source: Adapted from ISO 45003: Occupational health and safety management – Psychological health and safety at work – Guidelines for managing psychosocial risks.

management of psychosocial risk are clearly established and robust processes for consulting workers about psychosocial risks and how best to manage them are also implemented.

Reflecting on the definition of the organisational context, ISO 45003 requires that specific plans be developed in regard to how psychosocial hazards are to be dealt with to prevent psychological injury and ill health, as well as strategies for workers returning to work following an injury/illness. Planning processes should also identify opportunities for improvement, including promotion of wellbeing at work. Wellbeing at work is defined in ISO45003 as "fulfilment of the physical, mental, social and cognitive needs and expectations of a worker related to their work."

Thus, ISO 45003 references both prevention of negative outcomes and promotion of positive outcomes for workers' psychological health. Organisations are also required to develop, review and maintain systems, processes and reporting structures focused on the management of psychosocial risks. Based on understanding what could create or affect the management of psychosocial risk within a particular operating context, ISO 45003 requires that organisations set appropriate objectives, determine how these objectives will be met and demonstrate a commitment to continual improvement that, where possible, goes beyond fulfilling minimum legal requirements.

ISO 45003 requires that hazards (sources of harm) be identified before appropriate risk control measures are selected. Moreover, processes for hazard identification need to be proactive and ongoing to ensure that changes to operational context or conditions that change hazard exposures are understood and dealt with. When assessing the risk (i.e., potential for harm) posed by psychosocial hazards, ISO 45003 specifically requires that organisations compare groups of workers that differ in exposure to hazards. For example, in the construction context, professional/managerial and manual/non-managerial workers are likely to be at risk of harm from different psychosocial risk factors. Subcontracted workers and direct employees may also be exposed to different hazards, particularly those relating to job security and employment conditions.

ISO 45003 also requires risks to be assessed with due consideration to the interaction of psychosocial risks with risks from other identified hazards and to consider the diversity of the workforce and the needs of particular groups in determining the risk of harm. Some worker groups may be particularly vulnerable to some psychosocial risk factors, such as young and inexperienced workers being frequently exposed to bullying behaviours. Women workers are also a minority group in the construction industry and are likely to experience psychosocial risk differently to male workers (see also Chapter 5).

ISO 45003 requires organisations to establish, provide and maintain resourcing (considering human, financial, technological and other resource requirements) to ensure plans relating to the management of psychosocial risk are properly implemented and objectives are met. In particular, organisations are required to actively develop workforce competence in relation to the identification and management of psychosocial risks and ensure workers are familiar with processes

for reporting hazards or raising concerns. Importantly, workers' needs, experience, language skills and literacy should be considered in the design and delivery of any training or development activity undertaken.

Traditional training approaches are not always effective in the construction industry and alternative methods may be more effectively used to develop competency in certain "soft skills" relevant to the management of psychosocial risk, as illustrated in case example 3.1.

CASE EXAMPLE 3.1 DIGITAL ROLE PLAY GAME TO DEVELOP SUPERVISORS' AND APPRENTICES' COMMUNICATION SKILLS

Role play is a well-established approach to developing soft skills, such as how to best communicate in particular situations and displaying empathy (Lane et al., 2007; Ma et al., 2021). Role play involves playing a role in a specific situation or scenario. The role played can reflect a participant's own role or the role of another person, and learning is enhanced because roles are played in a safe environment, permitting participants to experiment and learn with no risk of irreversible consequences (Ladousse, 1987). Digital role play games are increasingly used to help users to improve interpersonal skills (e.g., communication, negotiation, leadership).

A recent Australian study used a participatory approach to develop a digital role play game to help apprentices and their supervisors to develop better ways to communicate with one another in the workplace. Specific communication characteristics included as learning objectives in the digital role play game included: demonstrating empathy, using emotional intelligence, respecting personal boundaries, communicating with respect, the difference between being assertive and being aggressive, and being supportive and approachable.

The digital role play game was developed in consultation with young men and women engaged in construction industry apprenticeship training and was based on their real life stories (lived experiences).

Scenarios were developed and trainees (players) are asked to navigate through these scenarios by making turn-based decisions, which lead to different outcomes. Every outcome demonstrates the importance of effective communication in improving the safety, health and wellbeing of young workers. Figure 3.1 shows a screenshot from the digital role play game.

Trainees have commented that this type of approach to developing interpersonal communication skills is more engaging and effective than classroom-based training methods and that they are more likely to feel confident dealing with difficult workplace situations having played the game.

FIGURE 3.1 A screenshot from the digital role play game

With regard to the operational planning and control of psychosocial risk, organisations are required by ISO 45003 to eliminate hazards and reduce risks by considering the best fit between tasks, structures and work processes and the needs of workers, as well as to design and manage work in ways that prevent psychosocial risk and promote wellbeing at work. Risk assessments should take into account existing controls in place for psychosocial risk and the adequacy and effectiveness of these controls. Where new controls are needed the hierarchy of control should be used to guide the selection of these. ISO 45003 also suggests that a combination of primary, secondary and tertiary controls be implemented (see also Table 3.2). ISO 45003 specifically states that organisations should implement controls for psychosocial risk related to work organisation, which often involves a redesign of work processes (not just the adjustment of tasks). Control measures that address psychosocial risks related to social factors and to work environment, equipment and hazardous tasks should also be implemented.

ISO 45003 acknowledges that organisational and work-related change (to objectives, activities, work processes, leadership, work tasks and working conditions) can affect existing psychosocial risks or create new ones. Organisational change processes need to be carefully managed so that risks to psychological health and safety are identified and controlled. Risks posed by the procurement of products and services and the outsourcing of work (for example, engaging subcontractors) can also have an effect on psychosocial risks experienced by workers. ISO 45003 requires organisations to consider the effects of procurement and outsourcing on psychosocial risk exposure and ensure risks are managed effectively. ISO 45003 also requires organisations to manage the psychosocial risk associated with exposure to or experience of emergency situations in workplaces

TABLE 3.3 Example metrics/indicators for the management of psychosocial risk

Category	*Example indicators*
Work hours	Contract enforcing work hours restrictions Percentage of overtime Average hours worked per worker per month
Understanding the prevalence of mental health issues	Employee engagement surveys, health and safety culture surveys or regular pulse surveys focused on mental health Facilitated focus groups to gather feedback on psychological health and safety and organisational climate around mental health reporting
Raising awareness about psychological health	Extent of information sharing on psychosocial risk management processes (e.g., feedback, experiences, outcomes, improvement opportunities)
Return-to-work monitoring	Number of workers returned to pre-work hours and duties after being off with a mental illness, recovery duration, and identifying trends and any relationship to initiatives and processes in place
Psychological risk exposure	Percentage of workers reporting being exposed to psychosocial hazards at their workplace in the last 12 months (including: bullying, undesired sexual attention, feeling that work drains so much energy that it has a negative effect on private life; employees unable to express their views and feelings; feeling of lacking any influence on what they do at work)
Psychological risk control	Percentage of worksites that provide free or subsidised clinical assessments for depression by a provider, followed by directed feedback and clinical referral when appropriate Percentage of worksites that provide educational materials on stress management Percentage of identified psychosocial risks that have been eliminated or reduced through work design

(for example witnessing safety incidents) and to design and implement appropriate rehabilitation and return-to-work programmes to support workers who have been absent from work due to exposure to psychosocial hazards.

A systematic approach to performance monitoring and review is required by ISO 45003 to determine whether the organisation's objectives with regard to the management of psychosocial risk are being met and organisational policy is being followed. Effective performance monitoring, using qualitative and quantitative and leading and lagging metrics, helps organisations to determine if risk controls are having the desired effect in reducing psychosocial risk. Table 3.3 shows some example metrics that could be used.

ISO 45003 requires organisations to perform internal audits to evaluate their performance in managing psychological risk on a regular basis. These audits

should evaluate compliance with policy (and legislation) and identify opportunities to improve the management of psychosocial risk. Opportunities with the greatest potential to reduce psychosocial risk and/or improve worker wellbeing should be prioritised.

3.7 Workplace mental health programmes

There is an increasing emphasis on the workplace as a point of intervention for targeting the prevention of mental illness and the promotion of psychological wellbeing (Harvey et al., 2014). The workplace is seen to be an effective point of intervention for mental health promotion programmes, particularly among men who are reported to have lower levels of mental health literacy and be less likely than women to seek help for personal difficulties (Roche et al., 2016).

Roche et al. (2016) argue that:

- large numbers of people can be accessed through workplace interventions,
- workplaces already contain existing infrastructure and frameworks to support the implementation of mental health and wellbeing programmes, and
- addressing mental health as part of workplace occupational health and safety management activities reduces stigma and encourages help-seeking behaviour in relation to mental health.

Some initiatives have already been implemented and are having a positive impact in the construction industry. For example, the Mates in Construction programme provides a training/peer support programme that is widely accepted in the construction industry and is effectively changing attitudes towards mental health and help-seeking behaviour (Ross et al., 2019).

While changing attitudes and behaviour in relation to mental ill health is important, long-term prevention measures also need to target the construction industry's culture and entrenched practices that contribute to the emergence of mental ill health. Dextras-Gauthier et al. (2012) argue that the behaviours, structures and processes that produce adverse conditions of work are shaped by the values, assumptions and beliefs inherent in an industry or organisational culture. They argue that "when dealing with mental health issues, including burnout, depression, and psychological distress, managers need to tread further upstream to identify those elements of organizational culture that are ultimately causing ill health" (Dextras-Gauthier et al., 2012, p.97).

Safe Work Australia (2019) also clarifies the role played by health promotion programmes that focus on promoting a healthy lifestyle, personal development and learning, and non-work-related health behaviours. These initiatives do not protect workers from harmful exposure to workplace psychosocial (or physical) hazards and are therefore not a substitute for a systematic management process for psychosocial risks.

With the growing recognition that job stress can have adverse outcomes for individuals and organisations, literature on interventions seeking to address job stress has rapidly expanded (LaMontagne et al., 2007; Karanika-Murray & Biron, 2015). Organisational stress and wellbeing interventions are diverse and said to operate at three levels (Hurrell, 2005; LaMontagne et al., 2007):

- primary interventions eliminate or reduce job stressors,
- secondary interventions alter the way that workers perceive or respond to job stressors, and
- tertiary interventions treat and rehabilitate workers with job stress-related illness.

While primary prevention is generally more effective than secondary prevention, and secondary is generally more effective than tertiary prevention, it is acknowledged these prevention approaches are not mutually exclusive and should be used in combination (LaMontagne et al., 2007).

Primary-level interventions are proactive and aim to prevent exposure to job stressors. Interventions at this level address sources of stress in the workplace through modifications to the physical or psychosocial work environment or through organisational changes (LaMontagne et al., 2007). Examples of primary preventive interventions include job redesign, changes in work pacing, enhancement of social support, and the formation of joint labour/management health and safety committees. Most primary preventive interventions are directed at the organisation or the work environment, but some can also be directed at individuals when addressing stressors rather than stress responses.

Secondary-level interventions aim to modify an individual's response to or perception of stressors. Secondary interventions target the individual with "the justifiable underlying assumption that addressing individuals' responses to stressors should be done in addition to removing or reducing stressors" (LaMontagne et al., 2007, p.225). Examples of secondary prevention interventions include stress management training to assist workers to either modify or control their perception of stressful situations, such as the development of meditation skills.

Tertiary interventions focus on treating stress-related illness, and aim to minimise the effects of stress-related problems once they have occurred through management or treatment of symptoms or disease and to reintegrate the affected worker back into the workforce. These include counselling (such as in the form of employee assistance programmes), rehabilitation, return-to-work, and other programmes (LaMontagne et al., 2007).

There is alignment between the three intervention levels and the HoC framework (LaMontagne et al., 2007), as interventions and controls are in descending order of likely effectiveness and protectiveness. In Table 3.4, we outline the intervention and hierarchy of control levels and corresponding control measures for time pressures or fast-paced work which is a common job demand experienced by construction workers. Control measures at the primary and secondary levels

TABLE 3.4 Control measures for time pressures or fast-paced work

	Intervention level	*Hierarchy of control*	*Control measure*
Most effective	Primary: eliminate or reduce job stressors	Control at the source through removal or designing out the hazard through: • Elimination • Substitution • Isolation • Engineering controls	Schedule tasks to avoid intense or sustained high job demands (e.g., schedule non-urgent work for quieter periods) Plan the workforce so there is an adequate number of appropriately skilled staff to do the work and so that tasks utilise workers' skills
	Secondary: alter the way that workers perceive or respond to job stressors	Control at the worker level through: • Administrative controls • Training and education • PPE	Have regular conversations about work expectations, workloads, deadlines and instructions to ensure job demands are understood and can be managed Time management training Stress management training
Least effective	Tertiary: treat and rehabilitate workers with job stress-related illness	Control at the level of illness through: • Treatment • Rehabilitation	Employee Assistance Programme Therapy

Source: Adapted from LaMontagne et al., 2007.

are drawn from *Managing Psychosocial Hazards at Work: Code of Practice* (Safe Work Australia, 2022a). We have added time management training as it is a commonly utilised control used to assist workers with planning and managing their work time, and stress management training which is also a commonly utilised control to manage workers' response to stress. Table 3.4 highlights that, importantly, control measures/interventions are most effective when they are directly aligned with addressing the specific hazard.

Training and education are positioned at the individual level in the HoC framework and are not usually associated with elimination of the hazard. However, in some instances training and education may lead to hazard

elimination. For example, we refer to the elimination of harmful behaviour that women in construction can experience. Harmful behaviour is identified as a psychosocial hazard and incorporates:

- violence and aggression
- bullying
- harassment including sexual harassment or gender-based harassment, and
- conflict or poor workplace relationships and interactions (Safe Work Australia, 2022a).

In 2022, the Victorian Government released a Respect Code for the construction industry. The Respect Code aims to create safe and respectful workplaces for women where safety, inclusiveness and wellbeing are paramount (Victorian Government, 2022). Implementation of the Respect Code seeks to change individuals' behaviour towards women. In this instance, training and educating workers on respectful workplace behaviour and acceptable standards functions as a primary intervention and is aligned with controlling the hazard through elimination. Together with training and education, implementing practices in which disrespectful behaviour by an individual has consequences contributes to a control system with the potential to eliminate harmful behaviour.

Case example 3.2 describes the development of Mental Health Action Plans in civil construction organisations which aimed to drive reductions in work-related stress factors, prevent burnout and improve mental health.

CASE EXAMPLE 3.2 POSITIVE PLANS – POSITIVE FUTURES PROGRAM

The Civil Contractors Federation (CCF) of Victoria (Australia) received funding from WorkSafe Victoria under the WorkWell Mental Health Improvement Fund. The project aimed to make mental health a priority in construction workplaces. The CCF Chief Executive at the time commented: "We have cultural heritage plans, energy efficiency plans and COVID-safe plans but we think it is time for construction businesses to have a mental health action plan" (Plumbing Connection, 2021). The Positive Plans – Positive Futures Program engages civil construction organisations to develop Mental Health Action Plans to drive reductions in work-related stress factors, prevent burnout and improve mental health (Construction Advisor, 2021). The work commenced with a third-party survey undertaken in each participating organisation that provided insights into factors in the working environment and business that could impact mental health, including job demands, access to management, and communication (Roads & Infrastructure, 2022). This data was

used to develop Mental Health Action Plans targeting specific areas of need within each organisation. Construction companies participating in the programme were supported with resources developed by WorkSafe Victoria, regular engagement in capacity building activities and knowledge-sharing opportunities, facilitated by CCF personnel. The Safety Health Environment and Quality (SHEQ) Systems Manager at one participating organisation commented: "In my experience, if you were to search mental health online, it tends to go directly to a diagnosed mental health condition. We really want to focus on the wellness side, and what are the practical things that you can do to stay well, to be able to manage the normal stresses in your life" (Roads & Infrastructure, 2022). This organisation focused their initial efforts on integrating mental health terminology and concepts into their health and safety and human relations management systems, providing information in accessible format and language that workers could understand and building up trust to encourage people to seek help if they needed help. Toolbox style information sessions were also held on topics identified as being relevant to workers' stress, including financial counselling and budgeting. The SHEQ Systems Manager commented: "We're more understanding and considerate of each other. Our behaviour has changed and there's now an extra level of sincerity and compassion that people are starting to show. Our employees are able to say 'look, I'm just not in the right headspace today, I can't concentrate on this particular task'. That is critical in a high-risk industry such as our own" (Roads & Infrastructure, 2022). The CCF suggests that participating organisations can use their Mental Health Action Plans to demonstrate (when tendering for work) that opportunities to reduce stress have been adequately considered in project planning and resourcing decision-making. Companies also report regularly against their Mental Health Action Plans to determine the extent to which psychosocial risk factors are being effectively managed. To support organisations in the implementation of the Positive Plans – Positive Futures Program, the CCF ran Regional Roadshows and convened annual Mental Health Summits that were attended by 300-plus business owners and senior managers. This information sharing was considered to be a critical success factor because, as the Positive Plans – Positive Futures Project Manager explained: "We know that managing mental health in the workplace can be a complex issue. Not knowing where to start can put businesses off doing anything about it" (Roads & Infrastructure, 2022).

3.8 Conclusion

Construction workers are a high-risk group for work-related stress due to the nature and organisation of work tasks. The impacts of work-related stress are felt by the worker and their family members, the company, and the wider

construction industry. There is now growing awareness that companies can and should proactively protect both the physical and psychological health of workers. ISO 45003 (*Occupational health and safety management – Psychological health and safety at work – Guidelines for managing psychosocial risks)* provides companies with guidance on the management of psychosocial risks and promotion of psychological wellbeing at work, as part of an organisation's occupational health and safety management system. Integrating psychosocial risk management more effectively into strategic policy and business decision-making will help to create construction work environments, that are supportive, sustainable and inclusive.

3.9 Discussion and review questions

1. What are the key theories linking psychological health with work? What are the key differences between these theories?
2. What work-related factors do construction workers experience that have the potential to affect their psychological health?
3. What actions can construction organisations take to protect workers' psychological health?

3.10 Acknowledgements

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References

Anwer, S., Li, H., Antwi-Afari, M. F., & Wong, A. Y. L. (2021). Associations between physical or psychosocial risk factors and work-related musculoskeletal disorders in construction workers based on literature in the last 20 years: A systematic review. *International Journal of Industrial Ergonomics*, 83, 103113.

Bakker, A. B., & Demerouti, E. (2007). The Job Demands-Resources model: State of the art. *Journal of Managerial Psychology*, 22(3), 309–328.

Boschman, J. S., Van der Molen, H. F., Sluiter, J. K., & Frings-Dresen, M. H. W. (2013). Psychosocial work environment and mental health among construction workers. *Applied Ergonomics,* 44(5), 748–755.

Bowen, P., Edwards, P., Lingard, H., & Cattell, K. (2014). Occupational stress and job demand, control and support factors among construction project consultants. *International Journal of Project Management,* 32(7), 1273–1284.

Bültmann, U., Kant, I., van Amelsvoort, L. G., van den Brandt, P. A., & Kasl, S. V. (2001). Differences in fatigue and psychological distress across occupations: results from the Maastricht Cohort Study of Fatigue at Work. *Journal of Occupational and Environmental Medicine*, 43, 976–983.

Butterworth, P., Leach, L. S., McManus, S., & Stansfeld, S. A. (2013). Common mental disorders, unemployment and psychosocial job quality: Is a poor job better than no job at all? *Psychological Medicine*, 43(8), 1763.

Butterworth, P., Leach, L. S., Rodgers, B., Broom, D. H., Olesen, S. C., & Strazdins, L. (2011a). Psychosocial job adversity and health in Australia: analysis of data from the HILDA Survey. *Australian and New Zealand Journal of Public Health*, 35(6), 564–571.

Butterworth, P., Leach, L. S., Strazdins, L., Olesen, S. C., Rodgers, B., & Broom, D. H. (2011b). The psychosocial quality of work determines whether employment has benefits for mental health: Results from a longitudinal national household panel survey. *Occupational and Environmental Medicine*, 68(11), 806–812.

Cattell, K. S., Bowen, P. A., Cooper, C. L., & Edwards, P. J. (2017). *The State of Well-Being in the Construction Industry*. Chartered Institute of Building.

Chan, A. P. C., Nwaogu, J. M., & Naslund, J. A. (2020). Mental ill-health risk factors in the construction industry: Systematic review. *Journal of Construction Engineering and Management,* 146(3), 04020004.

Cohidon, C., Santin, G., Chastang, J. F., Imbernon, E., & Niedhammer, I. (2012). Psychosocial exposures at work and mental health: potential utility of a job-exposure matrix. *Journal of Occupational and Environmental Medicine,* 54(2), 184–191.

Construction Advisor (2021). Positive Plans, Positive Futures Project – Working To Improve Mental Health In Construction. Accessed 2 September 2022 from: www.constructionadvisor.com.au/positive-plans-positive-futures/

De Jonge, J., Bosma, H., Peter, R., & Siegrist, J. (2000). Job strain, effort-reward imbalance and employee well-being: A large-scale cross-sectional study. *Social Science & Medicine*, 50(9), 1317–1327.

Dextras-Gauthier, J., Marchand, A., & Haines III, V. (2012). Organizational culture, work organization conditions, and mental health: A proposed integration. *International Journal of Stress Management*, 19(2), 81–104.

Edwards, J. A., Webster, S., Van Laar, D., & Easton, S. (2008). Psychometric Analysis of the UK Health and Safety Executive's Management Standards Work-related Stress Indicator Tool. *Work & Stress*, 22(2), 96–107.

Findlay, P., Kalleberg, A. L., & Warhurst, C. (2013). The challenge of job quality. *Human Relations*, 66(4), 441–451.

Green, F. (2006). *Demanding Work: The Paradox of Job Quality in the Affluent Economy*. Princeton University Press.

Hackett, R. A., & Steptoe, A. (2016). Psychosocial factors in diabetes and cardiovascular risk. *Current Cardiology Reports*, 18(10), 1–12.

Harvey, S. B., Joyce, S., Tan, L., Johnson, A., Nguyen, H., Modini, M., & Growth, M., (2014), *Developing a Mentally Healthy Workplace: A Review of the Literature,* A report for the National Mental Health Commission and Mentally Healthy Workplace Alliance, University of New South Wales, Sydney.

Hassard, J., Teoh, K. R. H., Visockaite, G., Dewe, P., & Cox, T. (2018). The cost of work-related stress to society: A systematic review. *Journal of Occupational Health Psychology*, 23(1), 1–17.

Hassard, J., Teoh, K., Cox, T., Dewe, P., Cosmar, M., Gründler, R. A. , Flemming, D., Cosemans, B., & Van den Broek, K. (2014). Calculating the Cost of Work-Related Stress and Psychosocial Risks. Technical Report. Publications Office of the European Union, Luxembourg. Downloaded from: https://eprints.bbk.ac.uk/id/eprint/20923/

Häusser, J. A., Mojzisch, A., Niesel, M., & Schulz-Hardt, S. (2010). Ten years on: A review of recent research on the Job Demand–Control (-Support) model and psychological well-being. *Work & Stress*, 24(1), 1–35.

Health and Safety Executive (2019*). Tackling Work-Related Stress Using the Management Standards Approach,* The Stationery Office, Norwich. Accessed 6 September 2022 from: www.hse.gov.uk/pubns/wbk01.pdf,

Houtman, I., van Zwieten, M., Leka, S., Jain, A., & de Vroome, E. (2020). Social dialogue and psychosocial risk management: Added value of manager and employee representative agreement in risk perception and awareness. *International Journal of Environmental Research and Public Health*, 17(10), 3672.

Hurrell, J. (2005). Organizational stress intervention. In J. Barling, E. K. Kelloway and M. R. Frone (Eds.), *Handbook of Work Stress*. SAGE Publications (pp.623–646).

International Labour Organization (ILO) (1986). *Psychosocial Factors at Work: Recognition and Control. Report of the Joint ILO/WHO Committee on Occupational Health*, ninth session, Geneva, 18–24 September 1984.

International Labour Organization (ILO) (2015). *Transforming Our World: The 2030 Agenda for Sustainable Development*. International Labour Organization.

International Organization for Standardization (ISO) (2021). *Occupational health and safety management – Psychological health and safety at work – Guidelines for managing psychosocial risks* (ISO Standard No. 45003:2021). Accessed 20 June 2022 from: www.iso.org/obp/ui/#iso:std:iso:45003:ed-1:v1:en

Jin, R. L., Shah, C. P., & Svoboda, T. J. (1995). The impact of unemployment on health: A review of the evidence. *Canadian Medical Association Journal*, 153(5), 529.

Johnstone, R., Quinlan, M., & McNamara, M. (2011). OHS inspectors and psychosocial risk factors: Evidence from Australia. *Safety Science*, 49(4), 547–557.

Karanika-Murray, M., & Biron, C. (2015). Introduction – Why do some interventions derail? Deconstructing the elements of organizational interventions for stress and well-being. In M. Karanika-Murray & C. Biron (Eds.), *Derailed Organizational Interventions for Stress and Well-Being: Confessions of Failure and Solutions for Success.* Springer Netherlands (pp. 1–15).

Karasek, R. A. (1979). Job Demands, Job Decision Latitude, and Mental Strain: Implications for Job Redesign. *Administrative Science Quarterly*, 24(2), 285–308.

Karasek, R., & Theorell, T. (1990). *Healthy Work. Stress, productivity and the reconstruction of work life*. Basic Books: New York.

Ladousse, G. P. (1987). *Role-play.* Oxford University Press.

LaMontagne, A.D., Keegel, T., & Vallance, D. (2007). Protecting and promoting mental health in the workplace: Developing a systems approach to job stress. *Health Promotion Journal of Australia*, 18 (3), 221–228.

Lane, C., & Rollnick, S. (2007). The use of simulated patients and role-play in communication skills training: a review of the literature to August 2005. *Patient Education and Counseling*, 67(1–2), 13–20.

Leach, L. S., Butterworth, P., Strazdins, L., Rodgers, B., Broom, D. H., & Olesen, S. C. (2010). The limitations of employment as a tool for social inclusion. *BMC Public Health*, 10(1), 1–13.

Leka, S., & Jain, A. (2010). *Health impact of psychosocial hazards at work: An overview.* World Health Organization. https://apps.who.int/iris/handle/10665/44428

Leka, S., Jain, A., Widerszal-Bazyl, M., Żołnierczyk-Zreda, D., & Zwetsloot, G. (2011). Developing a standard for psychosocial risk management: PAS 1010. *Safety Science*, 49(7), 1047–1057.

Leka, S., Van Wassenhove, W., & Jain, A. (2015). Is psychosocial risk prevention possible? Deconstructing common presumptions. *Safety Science*, 71, 61–67.

Ma, Z., Huang, K. T., & Yao, L. (2021). Feasibility of a Computer Role-Playing Game to Promote Empathy in Nursing Students: The Role of Immersiveness and Perspective. *Cyberpsychology, Behavior, and Social Networking*, 24(11), 750–755.

Mayhew, C., & Quinlan, M. (2006). Economic pressure, multi-tiered subcontracting and occupational health and safety in Australian long-haul trucking. *Employee Relations*, 28(3), 212–229.

Milner, A., Butterworth, P., Bentley, R., Kavanagh, A. M., & LaMontagne, A. D. (2015). Sickness absence and psychosocial job quality: an analysis from a longitudinal survey of working Australians, 2005–2012. *American Journal of Epidemiology*, 181(10), 781–788.

Milner, A., Maheen, H., Currier, D., & LaMontagne, A. D. (2017). Male suicide among construction workers in Australia: A qualitative analysis of the major stressors precipitating death. *BMC Public Health*, 17(1), 584.

Milner, A., Page, K., Witt, K., & LaMontagne, A. (2016). Psychosocial working conditions and suicide ideation. *Journal of Occupational and Environmental Medicine*, 58(6), 584–587.

Min, K. B., Park, S. G., Song, J. S., Yi, K. H., Jang, T. W., & Min, J. Y. (2013). Subcontractors and increased risk for work-related diseases and absenteeism. *American Journal of Industrial Medicine*, 56(11), 1296–1306.

Netterstrøm, B., Conrad, N., Bech, P., Fink, P., Olsen, O., Rugulies, R., & Stansfeld, S. (2008). The relation between work-related psychosocial factors and the development of depression. *Epidemiologic Reviews*, 30(1), 118–132.

Nieuwenhuijsen, K., Bruinvels, D., & Frings-Dresen, M. (2010). Psychosocial work environment and stress-related disorders, a systematic review. *Occupational Medicine*, 60(4), 277–286.

Pirzadeh, P., Lingard, H., & Zhang, R. P. (2022), Job Quality and Construction Workers' Mental Health: A Life Course Perspective, *Journal of Construction Engineering and Management*. In press.

Plumbing Connection (2021). https://plumbingconnection.com.au/ccf-vic-building-capability-in-construction/, accessed 2 September 2022

Roads & Infrastructure, (2022). https://roadsonline.com.au/a-journey-for-positive-mental-health-with-nvc-precast/, accessed 2 September 2022.

Roche, A. M., Pidd, K., Fischer, J. A., Lee, N., Scarfe, A., & Kostadinov, V. (2016). Men, work, and mental health: A systematic review of depression in male-dominated industries and occupations. *Safety and Health at Work*, 7(4), 268–283.

Ross, V., Caton, N., Gullestrup, J., & Kõlves, K. (2019). Understanding the barriers and pathways to male help-seeking and help-offering: A mixed methods study of the impact of the Mates in Construction Program. *International Journal of Environmental Research and Public Health*, 16(16), 2979.

Rydstedt, L. W., Devereux, J., & Sverke, M. (2007). Comparing and combining the demand-control-support model and the effort reward imbalance model to predict long-term mental strain. *European Journal of Work and Organizational Psychology*, 16(3), 261–278.

Safe Work Australia (2019). Work-related Psychological Health and Safety: A systematic approach to meeting your duties. National guidance material. Safe Work Australia.

Safe Work Australia (2022a). Managing Psychosocial Hazards at Work: Code of Practice. Safe Work Australia.

Safe Work Australia (2022b). www.safeworkaustralia.gov.au/safety-topic/managing-health-and-safety/mental-health/psychosocial-hazards, accessed 5 September 2022.

Santosa, A., Rosengren, A., Ramasundarahettige, C., Rangarajan, S., Chifamba, J., Lear, S. A.,... & Yusuf, S. (2021). Psychosocial risk factors and cardiovascular disease and

death in a population-based cohort from 21 low-, middle-, and high-income countries. *JAMA network open*, 4(12), e2138920–e2138920.

Siegrist, J. (1996). Adverse health effects of high-effort/low-reward conditions. *Journal of Occupational Health Psychology*, 1(1), 27–41.

Siegrist, J. (2012). *Effort-Reward Imbalance at Work: Theory, Measurement and Evidence*. Department of Medical Sociology, University of Düsseldorf.

Siegrist, J., Starke, D., Chandola, T., Godin, I., Marmot, M., Niedhammer, I., & Peter, R. (2004). The measurement of effort–reward imbalance at work: European comparisons. *Social Science & Medicine*, 58(8), 1483–1499.

Stansfeld, S., & Candy, B., (2006). Psychosocial work environment and mental health – a meta-analytic review. *Scandinavian Journal of Work, Environment & Health*, 32(6), 443–462.

Strazdins, L., D'Souza, R. M., Clements, M., Broom, D. H., Rodgers, B., & Berry, H. L. (2011). Could better jobs improve mental health? A prospective study of change in work conditions and mental health in mid-aged adults. *Journal of Epidemiology & Community Health*, 65(6), 529–534.

Strazdins, L., D'Souza, R. M., Lim, L. L. Y., Broom, D. H., & Rodgers, B. (2004). Job strain, job insecurity, and health: rethinking the relationship. *Journal of Occupational Health Psychology*, 9(4), 296.

Strazdins, L., Shipley, M., Clements, M., Obrien, L. V., & Broom, D. H. (2010). Job quality and inequality: Parents' jobs and children's emotional and behavioural difficulties. *Social Science & Medicine*, 70(12), 2052–2060.

Sun, C., Hon, C. K. H., Way, K. A., Jimmieson, N. L., & Xia, B. (2022). The relationship between psychosocial hazards and mental health in the construction industry: A meta-analysis. *Safety Science,* 145, 105485.

Turner, M., & Lingard, H. (2016). Improving workers' health in project-based work: job security considerations. *International Journal of Managing Projects in Business*, 9(3), 606–623.

Van Vegchel, N., De Jonge, J., Bosma, H., & Schaufeli, W. (2005). Reviewing the effort–reward imbalance model: Drawing up the balance of 45 empirical studies. *Social Science & Medicine*, 60(5), 1117–1131.

Victorian Government (2022). *Respect Code Building and Construction Industry.* Accessed 9 September 2022 from: www.vic.gov.au/respect-code-building-and-construction-industry

Welsh, J., Strazdins, L., Charlesworth, S., Kulik, C. T., & Butterworth, P. (2016). Health or harm? A cohort study of the importance of job quality in extended workforce participation by older adults. *BMC Public Health*, 16(1), 1–14.

Zaniboni, S., Truxillo, D. M., Rineer, J. R., Bodner, T. E., Hammer, L. B., & Krainer, M. (2016). Relating age, decision authority, job satisfaction, and mental health: a study of construction workers. *Work, Aging and Retirement*, 2(4), 428–435.

4

WORKING TIME, HEALTH AND WELLBEING

4.1 Introduction

This chapter will discuss different approaches to working time and their associated effects on the health and wellbeing of workers in the Australian construction industry. It will review how time is understood in project-based construction work, and look at the connection between long work hours and health and wellbeing and consider the effects of long hours in the construction context. It will also outline the factors related to balancing time spent at work (or on work-related activities) and non-work activities and consider the role played by gender in shaping workers' experiences of balancing work and non-work life. The chapter considers the way that work hours are distributed over the working week and explores alternative ways of scheduling work that may help construction workers to achieve a better life balance. These alternatives include a compressed working week operating between Monday and Friday, or reduced working hours during Monday to Friday and offset with working on Saturday. The right to disconnect from the pressures and activity of work after leaving the worksite is discussed, as are the new-found flexible working regimes that have become normalised during the COVID-19 pandemic. The chapter ends with a consideration of the factors that shape working time within the construction industry.

4.2 Time in project-based construction work

Time performance (i.e., completion of work to a pre-determined timeline) is considered an essential determinant of success in construction projects (Serrador & Turner, 2015). Soderlund (2005) argues that project deadlines are a "fundamental organisational rationale for project organising" (p.381) and project

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management teams play a role in setting the pace of work, changing the time orientations of workers to respond to project milestones, and monitoring the "rhythms" of the project to identify and resolve activities that may be out of step with requirements. Soderlund (2005) acknowledges that the work of project managers involves putting pressure on project participants to ensure timelines are met, which can create the feeling that project-based work is "constantly under time pressure" (p.384). Furthermore, when unexpected project events threaten time-related goal attainment, workers experience this as stressful (Gällstedt, 2003). Limited time resources affect project workers' wellbeing (Nordqvist et al., 2004) and create psychological distress (Zika-Viktorsson et al., 2006). Unexpected delays can also contribute to an intensification of work, increase required work pace, and have a damaging impact on workers' health (Tuchsen et al., 2005).

4.3 Long work hours, health and wellbeing

Long hours of work have important implications for work–life balance, mental and physical health (Charlesworth et al., 2011; Fagan & Walthery, 2011). For example, long hours are associated with heightened stress, burnout, anxiety and depression (Artazcoz et al., 2009; Bannai & Tamakoshi, 2014; Dinh et al., 2017). Australian research by Milner et al. (2017) reports that long, inflexible and unsocial hours contribute to the high suicide rates experienced in the construction industry. Multiple studies have also found a direct link between long work hours and chronic diseases, such as cardiovascular disease and diabetes (Van der Hulst, 2003; Artazcoz et al., 2009). Importantly, in 2021 the World Health Organization and International Labour Organization published research indicating that, in 2016, 398,000 people died from stroke and 347,000 from heart disease as a result of having worked at least 55 hours a week. Moreover, the number of deaths from heart disease and stroke due to working long hours increased by 42 and 19 per cent respectively between 2000 and 2016 (World Health Organization, 2021).

Furthermore, the risk of workplace injury increases as work hours rise due to fatigue and burnout (Dembe et al., 2005; Kecklund, 2005; Dong, 2005). Lombardi et al. (2010) found that rates of workplace injury increased from 2.03 per 100 workers for those working less than 20 hours per week to 3.71 for 50–60 hours, and 4.34 for those working more than 100 hours per week (Lombardi et al., 2010). In the USA, research shows that construction workers working more than eight hours per day were 1.57 times more likely to be injured than those working between seven and eight hours per day (Dong, 2005).

Health-related impacts of long hours are attributed to:

(i) less time to recover from work,
(ii) longer exposure to work-related hazards, and
(iii) interference with time spent in non-work activities (Caruso, 2006).

However, the relationship between work hours and health is not simple and linear. Up to a certain point, paid work hours contribute to good health. Employment provides income required to support health and wellbeing and provides the opportunity for regular social interactions and the creation of shared experiences with people outside the family (Australian Government Productivity Commission, 2019). However, once work hours become long or excessive both physical and mental health can be negatively affected. There are only 24 hours each day, so working long hours shifts time away from care, sleep, exercise and healthy eating, which, in turn, can have adverse social, psychological and physical impacts. Long work hours therefore reduce time allocated to health and reduce participation in beneficial health behaviours. It is noteworthy that long work hours are one of the biggest barriers to healthy eating and physical activity and contribute to time scarcity (Venn & Strazdins, 2017). Devine et al. (2007) report that the time-demands of work interfere with family meals and healthy food choices in a sample of construction labourers. In particular, the experience of negative spillover between work and family life was associated with lower consumption of fruit and vegetables. In the Australian construction context, Lingard and Turner (2015) report that time scarcity impeded healthy eating and physical exercise among project-based workers, even in the context of an organisational health promotion programme focused on improving diet and exercise.

4.4 Long hours of work in construction

Work hours in project-based construction work are notoriously long (Lingard et al., 2010a), particularly in large public infrastructure construction projects which often work "around the clock" to optimise the use of machinery (Personn et al., 2006; Tuschen et al., 2005). Long work hours and overtime work have also been linked to stress at work and at home, fatigue, disrupted sleep, insufficient recovery opportunity and productivity losses in project-based construction work (Beswick et al., 2007; Goldenhar et al., 2003; Alvanchi et al., 2012).

Importantly, long hours of work in construction projects are experienced in conjunction with work overload and poor work–life balance. For example, a report undertaken on behalf of the Chartered Institute of Building (UK) revealed that construction industry workers are worse off than workers in other industries in terms of experiencing higher:

- poor work–life balance
- high workload
- excessive travel time
- technology overload
- unrealistic deadlines (Cattell et al., 2017).

4.5 The balance between work and non-work life

Work–life imbalance is a risk factor for poor health. Kossek et al. (2014) argue that work–life balance is a key component of wellbeing that is important for a sustainable workforce. However, achieving a balance between work and participation in other life domains is difficult in the context of long work hours, inflexible work schedules, demanding, intensive work and a lack of autonomy experienced by workers (Cooklin et al., 2016).

Work–family conflict (WFC), defined as "a form of interrole conflict in which role pressures from the work and family domains are mutually incompatible in some respect" (Greenhaus & Beutell, 1985, p.77) has been consistently linked to indicators of poor health and wellbeing, including job dissatisfaction, life dissatisfaction, turnover intention, general wellbeing, psychological strain, psychiatric disorders, substance abuse and problem drinking (Netemeyer et al., 1996; Boyar et al., 2003; O'Driscoll et al., 2003; Grant-Vallone & Donaldson, 2001; Hammer et al., 2004; Frone, 2000; Grzywacz & Marks, 2000; Allen et al., 2000; Wang et al., 2007).

Cooklin et al. (2016) studied the relationship between mental health and WFC, using a large longitudinal data set collected in Australia. They analysed changes in the experience of WFC over time in relation to mental health experiences. Cooklin et al. (2016) report that Australian working men and women who get "trapped" in a situation of chronic WFC have the lowest levels of mental health, while those who report they "never" experience WFC had the best mental health scores. Men and women who move into a situation of WFC experienced deteriorating mental health, while those who move out of a situation of WFC experience significant improvements in mental health.

In the construction industry, levels of WFC are high (Lingard et al., 2010b). As in other sectors, construction workers who experience high levels of WFC are more likely to experience psychological distress, depression, anxiety, sleep problems, and negative attitudes towards mental health (Bowen et al., 2018; Kotera et al., 2020). Construction workers experiencing WFC also report higher levels of substance misuse and marital dissatisfaction (Tijani et al., 2021).

4.6 The gendered nature of work hours and health

Research suggests that long work hours affect men and women workers differently and reinforce gender and health inequality in industries like construction (Galea et al., 2018). Drawing on data from a large representative sample of Australians in paid work, Dinh et al. (2017) considered the interaction between work hours, gender and health. They found that across all workforce groups, working some time was good for mental health. These benefits arise because jobs provide income, as well as a sense of identity, security, status and inclusion. However, the positive relationship between work hours and mental health only

applied up to a threshold limit of 39 hours of paid work per week. When workers worked more than 39 hours a week, their mental health declined. The relationship between work hours and mental health was therefore shaped like an inverted letter "U."

Importantly, the tipping point for women was 34 hours per week, considerably less than it was for men who could work up to 47 hours a week before they experienced any negative impacts to their mental health. This 13-hour difference in weekly work hours means that the average Australian man can work 13 hours more each week than the average Australian woman before mental health is negatively affected. Dinh et al. (2017) explain this in terms of the fact that women are more likely to combine paid work with unpaid care and domestic work. Long hours therefore serve to reinforce traditional gender roles and the division of labour between paid work and care.

The research undertaken by Dinh et al. (2017) also shows that "unencumbered" workers, who do not have responsibility for the care of others and perform minimal domestic work, are able to work more hours before this affects their mental health, irrespective of their gender. Therefore, it is not being a man or a woman that determines the number of hours one can work before mental health deteriorates. Rather, the key determinant is the amount of domestic or care work that someone performs.

Case example 4.1 highlights how women working in construction can be affected by the expectation of long work hours, and how flexible work arrangements have been implemented in construction workplaces to help workers with caring responsibilities.

CASE EXAMPLE 4.1 LENGTH AND FLEXIBILITY OF WORK HOURS IN CONSTRUCTION

Interviews with leaders in the Australian construction industry (undertaken during an investigation of factors influencing mental health in the construction industry) suggest that women in project-based construction roles experience difficulty in juggling long work hours with family responsibility. One industry leader explained: "*I think it stops women entering the industry because they look at it and go, 'Why do I want to work in that industry when I can work somewhere else? And I can't see that I can have a family and be on site and do the hours and still be a mum', which is really sad.*" Another commented: "*So our women report that they love working on site but they cannot see how they can continue to do site-based roles and be a parent.*" However, the industry leaders also noted that some construction companies have implemented flexible work arrangements to support workers with family/caring responsibilities. While the industry leaders stressed that flexible working arrangements are important for men as well as women workers, some cultural barriers prevent

men from requesting flexibility to fulfil family obligations: "*We're making sure that the men feel that they can adopt the flexibility programmes as much as the females because … if you're a female and you say 'I have to leave work to pick up the kids or be with the kids' it's a somewhat more socially acceptable thing to do than, rather than the male that says 'I'm leaving work so I can have dinner with my family' … So we're trying to break down those barriers.*"

The International Labour Organization's (ILO) definition of 48 hours as the safe limit up to which people should work was set in 1919, when the labour market was almost entirely men and families operated on a "man breadwinner–woman homemaker model." Consequently, this work-time threshold did not consider the impacts of domestic or care work. Given emerging evidence that the ILO threshold is not appropriate for a gender-balanced workforce, it should be reconsidered in the interests of protecting the health and wellbeing of all workers with domestic or caring responsibilities. Curbing long work hours and providing greater flexibility can help to improve gender equality and mental health and wellbeing in "long hours" industries like construction.

4.7 Other facets of working time with relevance to health

Working long hours is not the only facet of working time that can affect workers' health and wellbeing (Burke et al., 2010; Strazdins et al., 2011). For example, Adam (1995) identifies the *tempo* and *timing* of work as facets of working time with the potential to affect health and wellbeing. The tempo of work refers to the number of activities to be conducted within a specific timeframe and is sometimes referred to as work pace or intensity. The timing of work reflects when work is scheduled and, in particular, the extent to which the timing of work is compatible with the timing of other life activities, e.g., family routines (Tammelin, 2018).

Hallberg's concept of "synchronous leisure" references the need for workplace strategies to synchronise working time with the different schedules of family carers, especially in the context of dual earner couples with dependent care responsibilities (Hallberg, 2003). When one or both carers are engaged in atypical work schedules that cause involuntary desynchronisations, juggling caring responsibilities is particularly challenging (Brown et al., 2011). In most cases, women workers bear the brunt of these challenges, often being forced to choose between (paid) work and (unpaid) caring. For example, in a study of dual earner couples in which at least one partner worked in the construction industry, Lingard and Francis (2008) describe how adaptive strategies used by couples to cope with long, inflexible work hours are highly gendered. In the majority of cases, women construction workers, or women partners of construction workers choose to reduce their involvement in paid work, thereby perpetuating gender pay gaps and inequality in economic security.

Both tempo and timing of work have been linked to workers' health experiences. For example, increases in work pace associated with lean production management processes have been linked to psychosocial risk factors at work (Koukoulaki, 2014). In addition, workers' wellbeing is reported to be negatively affected if work is scheduled at times that do not fit well with workers' family commitments and personal preferences (Golden et al., 2011). Kristensen et al. (2004) also observe interdependencies between work time, tempo and timing, such that a heavy workload and/or tight deadlines create pressures to work faster, as well as a need to work longer or non-standard hours.

A final facet of work time that has the potential to impact health and wellbeing is the degree to which workers have control over their working time. Härmä (2006) argues that control over work quantity, schedule, pace of work and when rest breaks can be taken are important determinants of wellbeing. This position is also empirically supported by research that shows that negative impacts of overtime on wellbeing, sleep and depressive symptoms depend on whether workers have control over their working hours or schedule (Beckers et al., 2008; Takahashi et al., 2011).

Case example 4.2 reflects data collected from project-based workers in the Australian construction industry. It reflects the extent to which project pressures necessitate long hours of work and the extent to which weekend work is disruptive to family life. It also suggests that low levels of work-schedule control and feelings of being constantly under pressure affect individuals' satisfaction and their long-term commitment to remaining in the construction industry.

CASE EXAMPLE 4.2 LONG WORK HOURS, WORK–LIFE IMBALANCE AND WORK ABILITY AT A ROAD CONSTRUCTION PROJECT

Working time, health and wellbeing experiences of workers working on an upgrade of a major arterial road in a major city in Australia were examined. Survey data was collected on work demands, including working time, work–family conflict and work ability. Work ability is often used to understand wellbeing in the workplace. The concept of work ability was developed by Professor Juhani Ilmarinen in the early 1980s at the Finnish Institute of Occupational Health. It reflects the extent to which a worker's physical and psychological health, as well as social and environmental factors (including working conditions, work and spare time activities), affect the ability to work (Ilmarinen et al., 2015). The majority of survey respondents were professional or managerial workers, rather than manual construction workers.

The average weekly working hours reported by survey participants was 57.6 and average weekly commuting time was 6.9 hours per week. Weekly work hours were significantly and negatively correlated with aspects of

work ability, i.e., working conditions, organisation of work, work community and management, and work and non-work activities. This suggests that working long hours significantly affects the environmental and social components of work ability, reducing participants' self-reported ability to work. The survey also revealed that longer weekly work hours were associated with higher reported time- and strain-based work interference with family life. Comments provided by 13 participants on the handwritten survey forms further indicate that long weekly work hours contribute to poor work–life balance, work stress and diminished wellbeing. One participant explained: "*I leave my house at 4.40am and get home 6.45pm onwards*." Long hours reduced time available for family life: "*Given the long hours/ early starts required on site, I spend limited time with my family during the week*." Weekend work was identified as being particularly problematic and participants explained that their families were negatively affected: "*One of the biggest issues is weekend work, this really impacts on work/family balance. Long days during the week are manageable, but the weekends really impact both myself and my family*."

Participants described how unexpected project events create a high-pressure work environment: "*Constantly reacting to changes with time implications means always putting out fires and constantly running on adrenaline*" and time pressure was unrelenting: "*[T]he construction machine keeps turning regardless of whether I have time. Any setbacks/things take longer, etc., increase my workload but we have no additional resources to get us back on track. This leads to rushing/corner cutting and mistakes, thus chewing up additional time*." The comments also revealed that opportunities for rest and recovery are limited due to resource constraints: "*The workload is not manageable by the small team we have for a 24/7 job.* [The] *culture for taking days in lieu is not there after working 80-hour weeks. Lack of resources therefore no coverage to take a day off.*" Limited resources also created a culture of presenteeism (i.e., remaining at work when unwell or needing a break to recover from work) because: "*No one picks up work when* [someone is] *away sick. Work just builds up – more work when returning.* [I] *put off taking needed sick or annual leave.*" Although the company involved in delivering this project had instigated wellbeing days (a quarterly day off for recovery), survey participants commented that the effectiveness of these recovery days was reduced by project-related time pressures: "*Wellbeing days can seem a little useless when all it does is put you under more pressure for the rest of the week*."

Eight participants participated in follow-up interviews that explored in more depth the demands that they experience at work, home and in general life. The demands identified as posing the greatest problems for participants occurred in the work domain and many were time-related, such as time spent in paid work and overtime hours, or else related to workload and/or normative

expectations of long work hours. Only one home-based demand was identified as being particularly challenging for the interview participants (i.e., time spent in household chores), although this was generally not considered to be as challenging as the work-related time demands. It is important to note that six of the eight interview participants were men and home-related demands may be experienced differently among professional/managerial women working in the construction industry.

The interview participants observed that long work hours are an entrenched component of the construction industry's culture and practice: "*I work 58–60 hours per week. There is an industry expectation of long hours. I have worked in the industry for 35 years and nothing has changed.*" Participants described how working long hours reduces their ability to participate in healthy activities outside work, including sport and social activities: "*I lose opportunities for things outside of work, sports and travel. I can't do what a normal guy in his mid-twenties would do due to work hours. I'm too tired to see friends after work.*" Engaging in health-promoting recovery activities is important and, when long work hours prevent people from psychologically detaching from work and relaxing, stress levels increase: "*Time at work means less time doing what I like – exercising and socialising. I used to play tennis weekly but* [that has] *dropped off, as has my running. However, exercise helps to manage my stress. And stress keeps me awake at night.*"

The interview participants suggested that long work hours required of project-based construction work are complicated and can be attributed to more systemic characteristics of the construction industry's supply arrangements, including clients' demands and expectations: "*I am running on adrenaline with high pressure, high workload, and expectations from the client.*" This was often driven by the client's focus on maintaining traffic flows as the contract with the client stipulated that the major arterial road being upgraded must remain open during the construction project. Interview participants' comments suggested that the lack of control they experience in relation to the work schedule (which is driven by traffic conditions) exacerbated the stress associated with long hours of work at the project. One participant commented: "*Travel volume and client demands drive work schedule. Work hours are often up in the air until the last minute.*" Another participant observed: "*There are constantly programme changes. If we are ahead of schedule, they draw in the schedule. So, if you think you have some breathing space, they bring the time forward.*"

The links to work ability were also reflected in interview participants' comments, with long working hours identified as the reason people leave the construction industry: "*Long hours are not sustainable for me in the long term. I will opt out and have planned my exit plan. A lot of the guys I know in the industry will also opt out and have their exit plan. It's a common thing.*"

4.8 Taxonomy of work schedules: Long hours, overtime and work schedule control

In a 2019 study, Brauner et al. outlined a taxonomy for the design of sustainable work schedules by considering working-time demands (the amount of physical and mental exertion required) in relation to working-time control (an individual's autonomy over the duration/timing of their work). By analysing data from the 2015 BAuA-Working Time Survey of the Federal Institute for Occupational Safety and Health in Germany, Brauner et al. identified six different classes of work schedules:

1. **Flexible extended**. This class did not work shifts but had a high probability of occasionally working on weekends and working overtime (high working-time demands/high working-time control).
2. **Extended shift**. This class had the highest probability of shift work and working overtime (high working-time demands/low working-time control).
3. **Rigid standard**. This class had the lowest probabilities of over-long working hours, frequent change in working hours and control over the beginning/end of work days (low working-time demands/low working-time control)
4. **Flexible standard**. This class had the lowest probability of working on weekends and were very likely to have control over the beginning/end of workdays and taking hours off (low working-time demands/high working-time control)
5. **Rigid all-week**. This class had the highest probability of working on weekends and were unlikely to have control over the beginning/end of workdays and taking hours off (high working-time demands/low working-time control)
6. **Rigid extended**. This class did not work shifts, but were likely to work overtime and on weekends (high working-time demands/low working-time control) (Brauner et al., 2019).

Brauner et al. note that workers with schedules that allowed for high working time control perceived increased health benefits. Of these six classes, "extended shift," "rigid all-week" and "rigid extended" are all characterised by high demand and low control, and can thus be considered as high-strain risk groups (Brauner et al., 2019). Workers in these three risk groups reported the worst health results, as well as the lowest satisfaction regarding balance between work and non-work lives (Brauner et al., 2019). As highlighted in case example 4.2, project-based construction work can be characterised by long work hours, weekend work and low levels of work-schedule control. These characteristics in combination are therefore likely to negatively affect workers' health.

4.9 Working time modifications and reductions

At an organisation or project level, a variety of models have been adopted with the aim of reducing or modifying work hours. Broadly, these include the following:

- reducing the work week, e.g., compressing the work week by reducing the number of days worked each week;
- reducing daily work hours, e.g., reducing the length of work shifts;
- reducing the work month, e.g., working three longer weeks followed by a week off;
- reducing the work year, e.g., introducing additional free time such as annual leave.

Compressed work weeks often redistribute rather than reduce hours, such that the length of the workday is increased, but the number of days worked per week is decreased. Thus, the compressed work week departs from a standard eight-hour working day, traditionally favoured by trade unions, although a cap may still be applied to the number of hours worked each week. Compressed work weeks can take different forms.

Bambra et al. (2008) identify three popular forms as follows:

- 12-hour compressed work week, which involves four 12-hour shifts (day, night) over four days with three or four days off;
- 10-hour compressed work week, which involves four 10-hour shifts followed by three days off;
- the Ottawa system, which involves three or four 10-hour morning or afternoon shifts spread over four days, then two days off. This is then followed by a block of seven 8-hour nights, then six days off.

Given the variety of different forms of compressing the work week, it is perhaps unsurprising that the health benefits associated with compressed work weeks are mixed (Bambra et al., 2008).

One of the critical factors associated with the introduction of working-time reductions or modifications is who bears the costs associated with the changes. In some instances, work-hour reductions for people who are paid by the hour have been accompanied by a commensurate reduction in pay. For example, in 1993, Volkswagen introduced a scheme to reduce work hours to avoid mass redundancies during an economic downturn. Weekly hours were reduced from 36 to 28.5 with a corresponding loss of income amounting to a 20 per cent decrease in pay. In order to offset the financial impact, the union negotiated a small increase in the hourly wage of workers as well as increased holiday pay and an annual bonus. However, even with these modifications, annual wages were reduced by 16 per cent (De Spiegelaere & Piasna, 2017). Workers' health and wellbeing were reported to be negatively affected by the changes (De Spiegelaere & Piasna,

2017). In particular, high levels of stress were reported by 75 per cent of the workforce and were particularly prevalent in "white collar" workers (Seifert & Trinczek, 2000).

In some instances, work-hour reductions have been implemented without any reduction in remuneration. Under these arrangements total work hours are reduced but wages are maintained, such that the worker does not incur any financial loss. The costs to business of this strategy are higher, although these costs may be offset by productivity increases and, in some instances, government incentives or subsidies.

One example of a reduction in work hours with no loss of pay occurred at a New Zealand firm that manages company trusts, Perpetual Guardian, in early 2018 (Graham-McLay, 2018). The initiative involved the introduction of a four-day work week, reducing work hours from 37.5 to 30 per week. All other employment conditions, including pay levels, remained unchanged during this six-week trial.

In an assessment of the initiative, Haar (2022) notes that significant improvements were observed in key areas of perceptions of organisational and supervisor support, teamwork, work–life balance, job attitudes, engagement, retention and wellbeing, following the implementation of the four-day week. Workers also reported significantly reduced job demands and stress, and 78 per cent of staff reporting that they were able to balance work and home commitments (compared to 54 per cent before the change in work hours).

4.10 Working-time modifications in the Australian construction industry

The sensitivity of workers to the costs associated with reducing or modifying working time was evident in a series of projects undertaken in the construction industry in Queensland. The different effects of working time modifications or reductions were highlighted in the construction industry in which various project working-time regimes were introduced and evaluated as part of a research project examining the work–life balance experiences of project-based workers.

Project 1

Project 1 implemented a compressed work week at a water infrastructure construction project (a dam upgrade). The compressed work week involved eliminating an 8-hour Saturday shift but extending the working hours from Monday to Friday from 10 to 11.5 hours in the summer months. In winter months the daily work hours were reduced from 11.5 to 10.5 (Lingard et al., 2007). Data was only collected following the implementation of the compressed work week, so no before-and-after comparisons could be made. However, data was also collected from a control group of workers engaged at another construction site being delivered by the construction company involved in project delivery. The control site was working a standard six-day week (Lingard et al., 2007).

A total of 42 workers (23 waged and 19 salaried) completed a survey to gauge their preferences for the compressed work week, as well as their wellbeing, satisfaction with balance between work and non-work life, and perceptions of work–life conflict. Self-reported wellbeing and satisfaction with balance between work and non-work life were generally high. On a 7-point scale, with "7" representing the highest level of wellbeing and "1" representing the lowest level of wellbeing, salaried workers' mean wellbeing rating was 5.4 and waged workers' mean wellbeing rating was 5.5. Both waged and salaried workers at Project 1 also reported high levels of satisfaction with their work life, their non-work life, and the balance between their work and non-work lives. Workers indicated a preference for the five-day week with an average preference score of 1.8, scored on a 7-point scale, where "1" reflected a "very strongly prefer five-day week" and "7" reflected a "very strongly prefer six-day week." No salaried workers but a small number of waged workers indicated they preferred a six-day week.

Interview data in Project 1 supported the benefits of the compressed work week on work–family interaction. Interviews with workers at the six-day week comparison site reported lower levels of satisfaction with the balance between their work and non-work life than at Project 1 working a compressed week.

Project 1 was also completed six months ahead of schedule and significantly under budget. The project manager indicated he thought the compressed work week had improved workers' morale, commitment to the project, and health and safety performance, and reduced the incidence of workplace disputes (both with the union and between individuals).

Project 2

Project 2 implemented a five-day week in another water infrastructure construction project. At this project, the leadership team was focused on improving work–life balance and modified the project schedule from a traditional six-day week to a compulsory five-day week (10-hour shifts daily between Monday and Friday).

Anecdotal evidence suggested that waged workers at the project were not happy with the impact of the change on their remuneration as they lost out on penalty rates paid for work on Saturdays ("time and a half" for the first four hours and "double time" thereafter for Saturday work). The project management team observed that many (approximately 30 per cent) of the waged workers left the site to work at other projects where they could continue to earn penalty rates on Saturdays. Anecdotally, this left less skilled and inexperienced workers at Project 2 which affected productivity and performance. In response, the change to the five-day week was not sustained and the leadership team decided to revert to a six-day work week. However, salaried workers were permitted to have alternate Saturdays off.

Townsend et al. (2012) report that, although waged workers recognised that not working on Saturdays provided them with substantial benefits, including

mental and physical recovery and time to spend with their family or engage in non-work activities, many of these waged workers were unhappy about the impact on their weekly remuneration. In contrast, salaried workers, for whom working on Saturday did not attract overtime payments or penalty rates, strongly favoured the five-day week. Townsend et al. (2012) conclude that negotiating and implementing modified working-time arrangements in the construction industry is complicated due to the presence of two distinct groups of workers: salaried workers and waged workers. These groups were observed to have conflicting motivations and interests with regard to reducing work hours and eliminating weekend work.

Project 3

Project 3 involved a road construction project. At this project, survey data was collected from workers before and after the implementation of a compressed work week. A baseline survey was completed by 95 workers at Project 3 before the site changed from a six-day to a five-day working week. The revised roster followed a four-week cycle, such that workers enjoyed two "two-day" weekends, one "one-day" weekend, and one "three-day" weekend every four weeks. Site hours were extended to 6.30am to 5pm on weekdays (a 30-minute earlier start time) and from 6.30am to 3pm on the one Saturday worked each month. Follow-up surveys were conducted to determine whether work–life experiences were different under the new roster. A statistically significant reduction in perceived work-to-home conflict between the baseline and follow-up surveys was found (Lingard et al., 2008).

Qualitative data collected at Project 3 before the introduction of the compressed work week revealed concerns that work negatively affected non-work life among waged and salaried workers. Follow-up interviews revealed that waged and salaried workers were generally happy with the revised working time arrangements, although waged workers still indicated concerns about loss of pay associated with giving up regular Saturday work (Townsend et al., 2011).

Project 4

Project 4 involved another road construction project. At the commencement of the study, the site was working a standard six-day week. Workers at Project 4 were surveyed before the introduction of a modified work schedule to identify their baseline perceptions of the balance they experienced between their work and non-work life. The survey data indicated that most workers at Project 4 believed that their home life did not interfere with work to a great extent, but their work life was perceived to interfere with home life to a far greater extent.

The project leadership team decided to introduce a five-day week. However, although Project 4 was ahead of schedule, the managers were concerned that moving to a five-day week would negatively affect production. In response the

five-day week was optional and only available to workers who could demonstrate a "personal need" for the change. To utilise the option, workers also had to demonstrate that their work would not be adversely affected by the changed work schedule. Unlike the compressed work week implemented at the other case study projects, work hours between Monday and Friday were not extended. This meant that waged workers who decided to work five days would be considerably impacted financially.

Fewer than 20 out of more than 300 workers engaged at Project 4 opted to change their work schedules. All workers who changed their schedule were salaried workers. Eight of those who made the change were interviewed after they had done so. Their comments suggest that work–life balance was not significantly improved and that the culture of long hours was maintained at Project 4.

These four case study projects highlight challenges inherent in modifying and especially reducing work hours in the Australian construction industry. Although the elimination of weekend work was viewed favourably by workers at the case study projects, the findings also reveal the existence of two distinct groups of workers within the Australian construction industry. These groups operate in distinct labour markets and experience modified work-time arrangements differently. Managerial, professional, administrative and supervisory workers are salaried, meaning that they are paid a fixed annual salary irrespective of the hours they work each week. In contrast, skilled and unskilled trade workers and labourers (manual/non-managerial workers) are paid an hourly wage. This is based upon an hourly rate up to a standard work week, above which penalty rates (usually one and a half times the standard hourly rate) are paid. This penalty rate also applies to weekend work. Capping hours of work between Monday and Friday and/or eliminating Saturday work has a different impact on remuneration for waged and salaried workers. Reducing work hours, particularly overtime and weekend work, will not change the amount of money earned by salaried workers but could substantially reduce the take-home pay of waged workers.

It is no coincidence that the projects at which the modified working time arrangements were most successful (Projects 1 and 3) opted to implement a compressed work week (i.e., lengthening the workday between Monday and Friday and eliminating Saturday work). This limited the extent to which waged workers' pay was reduced. In comparison, when a standard 10-hour day was maintained and Saturday work was eliminated (as was offered as an option in Project 4), the uptake of the offer was low and no waged workers opted to make the change. At Project 2 the compulsory change from a six-day week to a "10 hours x 5 day" schedule resulted in waged workers leaving the project to work at other projects at which a six-day week was still in place.

Similar unintended consequences were observed at the Thames Tideway Tunnel project in the United Kingdom, at which an initiative to reduce the length of shifts worked underground was not favourably received by all workers (see case example 4.3).

CASE EXAMPLE 4.3 MANAGING WORK HOURS AT THAMES TIDEWAY TUNNEL

The Thames Tideway Tunnel project involves constructing a 25 km tunnel for London's sewerage system to increase its capacity. The project comprises 21 sites along the tunnel route and involves an ambitious timeline with an expected completion date in 2023, allowing the asset to become operational in 2024.

At a very early stage of the project, the project team initiated an innovative health and safety management programme with a health and safety vison about "zero harm, zero incidents and zero compromise in delivering a transformational health and safety performance" (Simons, 2014). The programme involves regular reviews and reflections on health and safety on every site, developing health and safety plans (including a 24-week look ahead), immersive inductions for employees, early safety engagement and health and safety communication assessment.

The project team was particularly keen to manage fatigue. However, it was recognised that the health benefits of shorter work shifts would depend on how workers spent time away from work. Factors affecting the outcomes of working shorter shifts included where workers lived and therefore the distance they travelled to and from work and the way they chose to spend time away from work. While the workers who lived near the site were more accepting of shorter shifts, those who travelled a long distance to work preferred to work longer hours. By working 12-hour shifts, tunnelling workers could work shorter weeks, i.e., completing their work hours in fewer days, commute less and return home for a longer rest period. Working shorter shifts meant that workers needed to spend more time in rented accommodation. Being away from their family and friends, the workers spent their free time on social activities, spent more money on leisure and rested less. The consequence was increased worker dissatisfaction with the new working time arrangements. It was also reported that the reduced pay that workers received as a result of working shorter shifts made jobs at the project less attractive (Smale, 2018).

In 2018, Park Health (specialists in occupational hygiene and fatigue risk management) was engaged by the project team to effectively monitor the shift patterns, manage fatigue and explore the possibility of safely extending work shifts to 12 hours. Based on the analysis of the project data, it was decided to enforce a maximum ten-hour shift length instead of eight hours. It was specified that workers must not spend more than ten hours underground. The ten-hour shift included one hour pre-shift to prepare workers for healthy and safe work and a one-hour post-shift recovery period before leaving the worksite. Contractors needed to develop fatigue management plans and provide them to the project team to ensure measures were in place to prevent workers becoming overly tired.

Other factors to consider were shift rotation and the number of consecutive night shifts or day shifts that contractors worked. As shift rotations can increase fatigue, it was necessary to allocate recovery time to workers.

A key aspect of implementing the change was developing a positive culture of supporting wellbeing on the project which was reinforced by working closely with shift leaders and providing training to develop an awareness of their own fatigue management. As a representative from Park Health explained:

> *Reducing the length of a shift is not a silver bullet when it comes to managing fatigue. The social, cultural and financial needs of the workforce have to be considered alongside their personal wellbeing but, equally, it is the duty of every employee to ensure they get enough rest. An employer cannot make an employee sleep but recognising that and each of us taking responsibility for getting enough rest means we all contribute to a safer working environment for everyone.*
>
> *Park Health, 2020*

4.11 Recovery and the right to disconnect

Recovery has been identified as an important mechanism explaining how acute stress reactions arising from work can contribute to chronic health impairment (Geurts & Sonnentag, 2006). Insufficient recovery from work over an extended period has, for example, been linked to health status and cardiovascular death (Sluiter et al., 2001; Kivimäki et al., 2006). A need for recovery describes the "sense of urgency that people feel to take a break from their demands, when fatigue builds up" (Demerouti et al., 2009, p.107). Need for recovery has been linked to job demands, including certain types of shift systems and working-time arrangements (Demerouti et al., 2009). Workers who are high in need for recovery report significantly poorer health, and higher levels of insomnia, burnout, stress, depression, sickness absence and working while sick (presenteeism) than workers low in need for recovery (Wentz et al., 2020).

The importance of recovery is often explained by two complementary theories. These are: (i) the effort-recovery model; and (ii) the conservation of resources theory (Sonnentag, 2001).

According to the effort-recovery model (Meijman & Mulder, 1998), the effort spent while working creates load reactions (such as accelerated heart rate, elevated blood pressure and fatigue). In a healthy situation, stress-related load reactions return to pre-stressor levels during after-work hours when the body's physiological responses are changed from a state of activation to one of rest (Demerouti et al., 2009). Recovery occurs when stressors are no longer present and has

been described as the process during which fatigue is reduced and a person's functioning returns to "a status of physiological and psychological performance readiness" (Demerouti et al., 2009, p. 91). If stress-related load reactions are reduced – through the recovery process – before the next work period (e.g., day or shift), health will not be negatively affected. However, if complete recovery cannot occur between work periods (for example in the case of long working hours, overtime or when demands continue after hours) a chronic load reaction can accumulate over time, and is a significant risk factor for impaired health and wellbeing (Sonnentag, 2001).

The underlying premise of the conservation of resources (COR) theory is that people seek to obtain, retain and protect resources, defined as "objects, personal characteristics and energies that are either themselves valued for survival, directly or indirectly, or that serve as a means of achieving these resources" (Hobfall, 1998, p.45). According to the COR theory, stress occurs when a person is threatened with resource loss, or fails to regain resources after effort expenditure. Unfavourable work situations can threaten or harm resources by depleting energy and vigour, increasing fatigue and tension, thereby negatively affecting health and functioning in other life domains (Grandey & Cropanzano, 1999). Taking a break from work can restore depleted resources or help people to gain new resources (Sanz-Vergel et al., 2010), thereby mitigating harmful impacts of resource loss. Time away from work enables people to invest time in restoring their resources, for example by engaging in restful or relaxing activities, looking after their health and fitness and drawing on sources of social support from friends and family (Sonnentag, 2001).

Research shows the importance of daily recovery between work hours, for health, wellbeing and performance (Derks & Bakker, 2014). Van Hooff et al. (2007) argue that after-work recovery opportunities may be inadequate in both quantity (amount of time available) and/or quality. The amount of time available for recovery can be affected by long hours of work, including overtime and engaging in weekend work. The quality of recovery can depend upon cognitive processes that prolong physiological activation to job stressors (Geurts & Sonnentag, 2006). For example, Geurts and Sonnentag (2006) describe how rumination, i.e., unintentionally thinking about past stressors or anticipating future stressors, impedes recovery (Demerouti et al., 2009). Being able to switch off and psychologically detach from work is reported to be more difficult when workers experience chronic time pressure (Sonnentag & Bayer, 2005).

The quality of recovery can also depend on what people do in their time away from work. For example, engaging in low-effort (e.g., watching television), social (e.g., meeting friends) or active (e.g., playing sport/exercising) leisure activities are reported to have positive effects on workers' overall evaluations of their wellbeing (Sonnentag, 2001). Van Hooff et al. (2007) report that jobs that require a high level of effort expenditure are associated with more overtime work and less engagement in active leisure (thereby affecting both the quantity and quality of recovery). High-effort jobs are also linked to higher levels of

fatigue during evenings and weekends and lower sleep quality during the week (van Hooff et al., 2007). The importance of recovery is likely to be enhanced in jobs in which workers have limited opportunity to take sufficient rest breaks during the working day (Geurts & Sonnentag, 2006). Importantly, engaging in work-related activity after hours is reported to have a negative effect on well-being (Sonnentag, 2001).

How time participating in work and non-work activities is experienced by workers (i.e., whether it is experienced as pleasurable or effortful) is also reported to affect recovery. Van Hooff et al. (2011) report workers' feelings of recovery are enhanced when work and non-work activities are experienced as pleasurable. In contrast, when time spent at work is effortful and unpleasant, recovery is impeded, highlighting the importance of providing well-designed work (van Hooff et al., 2011).

Smartphones and other devices have increased the extent to which people can be interrupted during their non-work time. In some contexts, this may be essential (for example, for on-call workers). In other cases, organisational cultures may shape the acceptability of out-of-hours contact and/or the expectation that workers will respond to work-related matters in their personal time. However, the experience of work-to-home interference and burnout is more severe among workers who report high, compared to low, smartphone use after hours (Derks & Bakker, 2014).

To address the impact of technology on work hours and unpaid overtime, the French government legislated a "right to disconnect" in 2017. Under the French labour code, companies with more than 50 workers have to draw up a charter setting out the hours during which staff are not obliged to send or action emails and receive or return work-related calls (De Spiegelaere & Piasna, 2017). The law does not mandate specific procedures that should be enacted but requires that parties enter negotiations with respective unions to produce agreements protecting employees' right to disconnect (Brin, 2019). Other European countries are considering similar legislation. Most recently, the EU Parliament announced that it will increase efforts to protect employees' "fundamental right to disconnect from work and not be reachable outside work hours" (Butt, 2021, p.1). Noting that teleworking, especially during the COVID-19 pandemic, has blurred the distinction between work and private life, the European Commission is proposing regulation that would "establish minimum requirements for remote working and clarify working conditions, hours and rest periods" (Butt, 2021, p.1).

4.12 Conclusion

Long work hours are known to be harmful for workers, yet long and inflexible work hours have continued to be the norm in construction, where workers suffer from high levels of work–family conflict, burnout and fatigue. Construction organisations can implement work schedules that enable workers to spend quality time with family and allow for sufficient rest and recovery. Yet, taking a

one-size-fits-all approach to work hours is problematic as different subsets of the construction workforce experience work hours and related impacts differently. Given the serious effects of long hours of work and low levels of control over working time on workers' health, construction organisations, clients, and unions are urged to take a collaborative approach to changing the long work hours culture of the industry so that workers' health is protected.

4.13 Discussion and review questions

1. Why do construction organisations continue to require workers to work long hours with little control over their working time? Do you think this needs to change? What would need to change to support work hour reductions in project-based construction work?
2. What are the types of harm created by long and inflexible hours of work? Should long hours be managed in the same way as other occupational health risks?
3. Why do long and inflexible work hours affect workers in the construction industry differently? Consider the difference between men and women and waged and salaried workers. How can healthy working time regimes be designed and implemented to protect all workers equally?
4. How can working time practices be modified so that workers do not experience harmful consequences?

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References

Adam, B. (1995). *Timewatch: The Social Analysis of Time*. Cambridge.

Allen, T. D., Herst, D. E. L., Bruck, C. S., & Sutton, M. (2000). Consequences associated with work-to-family conflict: a review and agenda for future research. *Journal of Occupational Health Psychology*, 5(2), 278–308.

Alvanchi, A., Lee, S., & AbouRizk, S. (2012). Dynamics of working hours in construction. *Journal of Construction Engineering and Management*, 138(1), 66–77.

Artazcoz, L., Cortès, I., Escribà-Agüir, V., Cascant, L., & Villegas, R. (2009). Understanding the relationship of long working hours with health status and health-related behaviours. *Journal of Epidemiology & Community Health*, 63(7), 521–527.

Australian Government Productivity Commission. (2019). *Mental Health*, Draft Report, October 2019. Canberra.

Bambra, C., Whitehead, M., Sowden, A., Akers, J., & Petticrew, M. (2008). "A hard day's night?" The effects of Compressed Working Week interventions on the health