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WORKPLACE SAFETY AND THE FUTURE OF WORK IN NZ

LITERATURE REVIEW

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AUTHORS

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Executive summary

This report examines the international and New Zealand literature to inform the question:

What are the possible implications of future-of-work trends for workplace health and safety (WHS) in NZ?

This review was the first step in a project undertaken by the NZ Work Research Institute (AUT) for WorkSafe which focused on providing empirical evidence to inform the above question.

The overall project used linked administrative and survey data from Statistics NZ's Integrated Data Infrastructure (IDI) and Longitudinal Business Database (LBD) to investigate the relationship between WHS outcomes and the characteristics of individuals and firms, with a focus on workplace safety outcomes based on ACC injury claims data. It linked these outcomes to individual characteristics, such as age, gender and ethnicity, as well as firm characteristics, such as industry, firm size, and whether the firm has adopted practices such as flexible work arrangements. (See Hennecke et al., 2021a.) This was aimed at providing insights into how possible future changes in worker characteristics (for example, due to an ageing population) and firm practices (for example, growth in particular future-of-work practices) could potentially change WHS outcomes going forward.

The future of work involves a confluence of several meta-trends. These include technological advances involving new production processes and products; as well as rise of the sharing economy. These trends facilitate and interrelate with changes in workplaces practices, such as increases in non-standard work and flexible working arrangements. Importantly, these changes are occurring against a backdrop of broader demographic, economic and environmental shifts, which are also influencing work patterns. These shifts include population ageing, increased diversity, globalisation, climate change and a growing importance of services in the economy.

Demographic trends present challenges for WHS

Looking first at demographic changes, what does the existing literature tell us about the implications of demographic changes for WHS? Like many other countries, NZ's workforce is ageing. Most international studies find that the number and severity of workplace injuries suffered by older workers is greater, which suggests that the ageing workforce will increase work-related injuries.

Another demographic trend is the increase in female labour force participation in NZ. While women have lower rates of workplace injuries than men, existing international evidence suggests that this largely reflects differences in industry and occupation. However, women are at greater risk of certain types of injuries, particularly musculoskeletal injuries and higher out-of-work responsibilities may heighten this injury risk as well as present psychosocial risks.

The high share of migrants in the NZ workforce is another demographic trend which presents challenges for WHS. Internationally and in NZ, migrant workers are found to have higher rates of workplace injuries than native-born workers, even in countries like NZ where migrants are relatively high skilled. Previous NZ work has highlighted the potential issues for WHS stemming from high levels of migration including language barriers, engagement in high-risk sectors and discrimination.

Māori and Pasifika workers also have higher rates of work-related injuries than other ethnic groups in NZ. This could reflect, among other factors, an over-representation in high-risk industries and occupations. Effectively addressing these gaps is important in itself, but is even more crucial given the Government's responsibilities towards Māori under the Treaty of Waitangi.

Industries with relatively low WHS risks are growing

As well as demographic changes, NZ is experiencing structural changes. As a result, the share of employment in relatively low-risk service industries has generally been increasing while the share of employment in higher-risk industries such as agriculture and manufacturing has been falling. While this is conducive to reductions in workplace harm, it still presents challenges as changes in industry mix change the prevalence of different types of WHS risks. The need to continue working to reduce harm in traditionally high-risk industries while simultaneously devoting resources to addressing issues that are prevalent within growth industries, such as musculoskeletal strain and psychosocial risks, presents new challenges.

Changing workplace practices are increasing complexity, which brings challenges for WHS

The future of work is also associated with changes in workplace practices. In recent years, many countries have seen the growth in non-standard work such as temporary, casual, contract and digital-platform work. While these bring advantages in terms of flexibility for both workers and employers, concerns have been voiced about job quality and other potential negative outcomes that may be associated with non-permanent employment. However, in NZ, existing evidence suggests that the extent of non-standard work in NZ is low and not showing signs of expanding. Nevertheless, it is important to understand what the relevant WHS considerations may be. The international literature highlights that non-standard employment is associated with higher workplace harm. For example, there is a positive relationship between job insecurity, self-employment and contract and temporary work and workplace injuries. Similarly, shift work and working long hours are associated with higher rates of workplace harm.

Domestic outsourcing is a related trend that increases the complexity of workplace arrangements and may reduce incentives for workers to prioritise WHS. Indeed, international evidence highlights that outsourcing is associated with a higher likelihood of injuries and ill health. There is scant information on outsourcing in NZ, which makes it difficult to determine if its use is increasing. However, there is some evidence that employers treat employees and contractors differently with respect to WHS, with the National Survey of Employers 2018/2019 reporting that 75% of businesses conducted WHS inductions for new employees, but only 53% conducted WHS inductions for contractors.

New organisational work practices encompass flexible work (eg, flexitime, teleworking), management practices and work organisation (eg, total quality management, team work, job rotation), incentive structures (eg, performance-based pay) and much more. The diversity of these practices make it difficult to generalise the consequences for WHS outcomes. However, the international literature suggests that practices aimed at creating high-performance workplaces are generally associated with worse WHS outcomes. Even for practices that are aimed more at improving worker wellbeing, such as flexible working arrangements, are not universally found to be positive for WHS in the empirical literature. Using teleworking as a specific example of why the relationship is not clear cut, it may have a positive effect on wellbeing and health through better work-life balance, but it could also reflect a move towards an 'always on' work culture whereby the traditional boundaries between home and work are eroding.

Technological developments present both challenges and opportunities for WHS

Many of these new work practices, such as the 'virtualisation' of work, are facilitated by technological developments. Indeed, technological changes affect all aspects of work, from who or what performs particular tasks, how and where tasks are performed and ways in which work is organised. This presents both challenges and opportunities for WHS. For example, digitalisation brings opportunities for monitoring of workers. Monitoring software, GPS trackers and wearable smart devices pose psychosocial and wellbeing risks by diminishing worker privacy and creating pressure to prioritise performance targets

over WHS. However, these technologies can also be used to better monitor safety, identify risks and provide real-time feedback.

Similar to digitalisation, automation and robotics bring opportunities and challenges for WHS. A big advantage for WHS is the increased ability to remove workers from high-risk situations. NZ's forestry sector offers a specific example of the ability of technology to remove workers from potentially hazardous situations. The increasing use of cabbed machines to fell trees offers greater protection for operators and has reduced injuries and fatalities. Going forward, the trend is towards further removing workers from high-risk situations via the use of autonomous machinery. On the other hand, a long-standing concern regarding automation is the possibility of workers being displaced, which presents a psychosocial risk.

Psychosocial risks: Workers' health is about more than absence of injury

Psychosocial risks highlight that workers' health is about more than the absence of injury. Concerns about psychosocial risks have been heightened by future-of-work trends including new forms of work organisation, new technologies and demographic changes. Psychosocial risks refer to the aspects of design and management of work and its social organisation contexts that may have the potential for causing psychological and physical harm. The definition hints at the breadth of this issue and also the complexity of addressing it. The international research on the link between exposure to psychosocial risks and workers' physical and mental health is broad, covering risks discussed under the umbrella of changing workplace practices, such as job insecurity, long hours and shift work, as well as psychosocial work factors such as social support, psychological demands and bullying.

Given the wide range of sources for potential workplace psychosocial risk, it is a difficult area for policy to address. The ACC system remains focussed on physical injuries as opposed to illness even though these may arise from, or be exacerbated by, working conditions. The OECD is critical of this focus on injuries and has recently recommended that NZ reconsider the strict distinction between injury and illness, highlighting that the division carries a particular cost for people with mental health conditions.

Health and safety training and education: Is it keeping up with changing workplace practices?

The training of health and safety professionals is a potentially important consideration for the effective implement of WHS measures. Although the empirical evidence in this area is not strong, international research suggests that the introduction of qualified WHS officers is associated with improved WHS outcomes.

Little is known about the current state of tertiary health and safety training and the presence of WHS professionals in workplaces in NZ. However, there are concerns internationally about whether the narrow focus of health and safety training is keeping up with changing workplace practices. As well as concerns about the training of specialist health and safety professionals, the international discussion also highlights the importance of improving general WHS education at lower education levels to increase familiarity with WHS from an early age.

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1 Introduction

This report examines the international and New Zealand literature to inform the question:

What are the possible implications of future-of-work trends for workplace health and safety (WHS)[1] in New Zealand (NZ)?

This review was the first step in a project undertaken by the NZ Work Research Institute (AUT) for WorkSafe which was primarily focused on providing empirical evidence to inform the above question. We used linked administrative and survey data to investigate the relationship between WHS outcomes, with a focus on workplace safety using injury claims data, and the characteristics of individuals and firms to provide insights into the possible implications of future-of-work trends for WHS in NZ. This was aimed at providing insights into how possible future changes in worker characteristics (for example, due to an ageing population) and firm practices (for example, growth in particular future-of-work practices) could potentially change WHS outcomes going forward. See Hennecke et al. (2021a) for the main report examining associations between injury claims and worker and firm characteristics, and Hennecke et al. (2021b) for analysis exploring the possibility of using mental health referrals data as WHS outcome measures.

This review proceeds as follows. The remainder of this section sets the scene by providing an overview of future-of-work trends, as well as the relevant WHS background and policy architecture (all within the NZ context). The next section looks at relevant demographic trends in NZ. Section 3 looks at industry structure trends. Section 4 examines changing workplace practices, discussing numerous trends such as increases in non-standard work and flexible work. Section 5 discusses technological changes, such as automation and digitalisation. Section 6 looks at some cross-cutting issues, specifically psychosocial risks and health and safety training. While these cross-cutting issues will be discussed in several of the earlier sections, this final section will draw some of the considerations and implications together. Psychosocial risks are discussed due to their growing prevalence and the issues they present to WHS policies, and health and safety training is discussed as this is an issue that industry stakeholders have raised as being important to their work. The inclusion of cross-cutting issues also highlights that the delineation between subjects is somewhat arbitrary and is made largely for practical purposes as many of these trends are interrelated. For example, new technologies are facilitating changes in workplace practices. Section 7 concludes.

1.1 The future of work trends in the NZ context: the same but different

The future of work involves a confluence of several meta-trends. These include technological advances involving new production processes and products. In turn, these advances are facilitating new approaches to delivering products and services, which has involved trends such as the rise of the sharing economy. These facilitate and interrelate with changes in workplace practices, such as increases in non-standard work and flexible working arrangements.

[1] For consistency, we use the term 'workplace health and safety (WHS)' throughout this review as a synonym for occupational safety and health (OSH) or occupational health and safety.

These trends are occurring against a backdrop of broader demographic, environmental and economic changes, which are also influencing work patterns. Globally, populations are ageing, as well as becoming increasingly diverse, driven in a large part by the increased international mobility of workers. Climate change is necessitating new ways of working to reduce environmental impacts. Globalisation and increased economic interdependence, particularly via global value chains, have contributed to economic growth, but also brings significant challenges, including an uneven distribution of costs and benefits both within and across countries. Related to this, the shift in manufacturing activities to emerging market economies such as China has contributed to the falling share of manufacturing and growing share of service industries in developed countries.

While these are global meta-trends, the specifics of each country's experience differ. For NZ, these specifics include relatively low levels of productivity compared with most other OECD countries. In terms of innovation and technological adoption, NZ businesses tend to adopt cutting-edge technology and techniques somewhat later than frontier countries. For considerations like emerging WHS issues, this allows NZ to look overseas for information on upcoming trends. Moreover, trends such as globalisation and the emergence of global value chains present particular challenges for NZ as a small remote country that does not have strong international connections (Conway, 2018). Even in terms of demographic trends, while NZ is facing an ageing population and an increasingly diverse population as in other OECD countries, there are some differences. NZ's population remains somewhat younger than the OECD average, and the degree of diversity is higher as NZ has one of the largest shares of foreign-born people in the population in the OECD.

Moreover, the regulatory context matters. As an example, the appropriate policy responses to future-of-work trends in NZ, which has relatively flexible labour markets and health and social security schemes funded out of general taxation, are likely to be somewhat different than the appropriate responses in many European countries, where the labour market is more stringently regulated and a social insurance approach is taken.

1.2 The future of work and WHS: An emerging area of interest

Future-of-work trends are considered to represent significant challenges to WHS (Gallagher & Underhill, 2012). Despite this, the implications of these trends and the appropriate policy responses in this area have not yet received as much consideration as other areas such as labour market, education and social security policy. Nonetheless, there is an emerging body of research and policy discussion in this area. Moreover, some of the future-of-work trends are already beginning to be acknowledged in WHS policy. For example, recognising that a traditional employer-employee relationship was no longer sufficient to cover the various types of modern workplace arrangements, NZ has replaced these concepts with broader ones of a 'Person Conducting a Business or Undertaking (PCBU)' and 'Workers' to cover all types of modern business and working relationships.

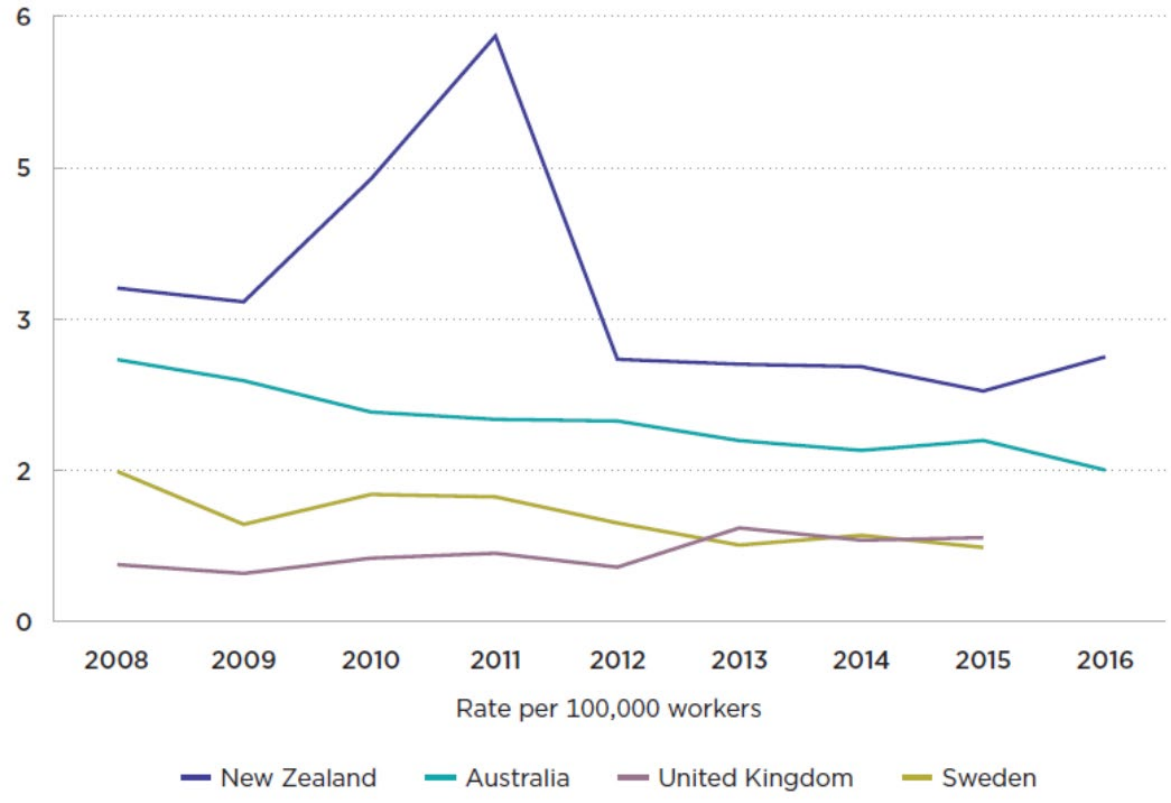
In the WHS space, NZ faces the same general issues as other developed countries. However, the specific context differs. For example, while NZ's industrial structure is generally similar to other OECD countries, traditionally high-risk industries such as agriculture, fishing and forestry remain relatively important. This creates challenges for mitigating risks in these industries while also identifying and mitigating risks in an increasingly diverse range of service industries. Numerous other examples will be discussed in more detail in the following sections.

As with other policy areas, the regulatory context also matters. As such, the next subsection briefly describes the main WHS-related policies in NZ.

1.3 Context matters: WHS policies in NZ

NZ has a relatively high level of work-related harm by international standards (Figure 1). In 2019, there were 108 work-related fatalities (WorkSafe, 2020). There were almost 240,000 work-related injury claims in 2018, amounting to just over one claim per 10 full-time-equivalent workers. Workplace harm extends beyond injuries at work and it is estimated that 750-900 people die every year from work-related ill health and that there are 5,000-6,000 work-related health hospitalisations a year (WorkSafe, 2019a). Some population groups are at particularly high risk of workplace harm, such as Māori, Pasifika, migrants, older workers and youth (MBIE, 2018). Furthermore, the estimates above regarding work-related injuries and health conditions only cover quantifiable harm. Importantly, psychosocial harm (which is a growing concern in workplaces) is not captured by these statistics.

Figure 1 International comparison of fatal work-related injury rates (per 100,000 workers)



Source: WorkSafe (2017). Towards 2020 – Progress towards the 2020 work-related injury reduction target – November 2017.

In 2012, in response to the Pike River disaster, the Independent Taskforce on WHS reviewed NZ's system. The Taskforce called for an urgent, sustainable and step change in harm prevention and a dramatic improvement in outcomes. It recommended major reform of health and safety legislation and the establishment of an independent regulator. This informed the establishment of WorkSafe in 2013 as the primary regulator. It also informed the Health and Safety at Work Act (HSWA) 2015, which is an

overarching piece of legislation with higher penalties for key offences, new duties on business leaders and new tools to improve compliance. The basis for this legislation was the Australian Work Health and Safety Act 2011, which was developed from the Lord Robens et al. (1972) report and the resulting UK Health and Safety at Work Act 1974 (Peace, Mabin & Cordery, 2017) and premised on self-regulation and performance-based standards rather than prescriptive requirements (Sherriff & Tooma, 2010). However, as acknowledged in the development of the Health and Safety at Work Strategy 2018-2028, while these changes provide a strong foundation, work continues towards implementing the regulatory reform programme. Any associated changes to WHS outcomes are expected to be gradual as cases are tested in the courts, associated regulations continue to be developed and further guidance and enforcement implemented. Moreover, additional challenges that cannot be addressed through legislation, regulation and enforcement alone remain, including effective worker participation, and creating a national culture of safety and tripartism throughout the system (MBIE, 2018).

ACC is another important organisation in the WHS architecture. ACC administers NZ's accident compensation scheme, which is unique internationally. ACC is the sole provider of accident insurance and participation in the scheme is compulsory. It is a universal no-fault scheme, which removes the right to sue except for exemplary damages in some cases. In contrast, workers' compensation schemes in other countries typically cover only workers, and in many cases, exclude certain types of workers, such as the self-employed, those in small businesses and independent contractors (Poland, 2018). In addition to treatment costs, ACC provides income compensation if workers require more than a week off work to recover from an injury, whether their injury occurred at work or not. In other countries, such as Australia, Canada and the United States, injured people are only entitled to income compensation if the injury occurred at work. This reduces the incentives to misreport off-the-job injuries as work-related injuries in NZ (Poland, 2018). As well as providing a range of entitlements to injured people, ACC also undertakes injury prevention promotion. ACC is funded via a combination of levies and government contributions. These include work-related levies collected from employers and the self-employed, employees and via petrol and motor vehicle licence fees, as well as government contributions from general taxation for non-earners.

Overall, there are some unique features of the regulatory framework in NZ. It is, therefore, important to recognise that international findings and experience may not always be directly applicable to the NZ context.

1.4 The data: How to measure WHS outcomes?

Since this overall project quantitatively investigates the relationship between WHS outcomes and a number of relevant future-of-work trends, this subsection will briefly describes the available data. This information is included in this literature review as it is important to have these concepts and measures in mind when considering trends identified in the future-of-work literature, as it will permit identification of what the NZ data can and cannot capture. A full description of the data used is available in Hennecke et al. (2021a; 2021b).

This project uses linked administrative and survey data available in Statistics NZ's Integrated Data Infrastructure (IDI) and Longitudinal Business Database (LBD). These databases provide a rich set of unit-record information on individuals and businesses across the NZ population.

What WHS outcomes and future-of-work trends can be measured with these data? In terms of WHS outcomes, the main measures focus on workplace safety based on ACC injury claims data. These data not

only provide information on the incidence of workplace injuries that can be linked to the characteristics of the individual and the firm/s they work in via the IDI and LBD, it also provides an indication of the severity of the injury via the claim cost detail, such as medical fees paid and the number of compensation days paid to the claimant. Results based on work-related injury claims data are presented in the main report produced as part of this project (see Hennecke et al., 2021a).

Despite its richness, there are some limitations with the ACC claims data. Underreporting and misreporting are potential caveats worth acknowledging. The universal, no-fault nature of ACC means that there are fewer incentives to misreport non-work injuries as workplace injuries than in overseas jurisdictions. Nevertheless, it is still estimated that about a third of workers who report having an injury at work that stops them doing their usual activities for more than a week do not appear to have received any form of accident compensation (including treatment costs) (Poland, 2018). This number is similar to international estimates but is surprisingly high given that NZ has a simple and universal claims system where treatment providers submit the claims rather than the workers.

More broadly, as mentioned above, workplace injuries are only one type of WHS outcome. Therefore, also undertake exploratory analysis to examine the feasibility of using mental health referrals and chronic conditions information in the IDI to create WHS outcomes (see Hennecke et al., 2021b). The mental health data in the IDI is a single national data source of mental health and addiction information that was created with the aim of improving service delivery and health outcomes. While it is a unique and rich source of national mental health data, it is still important to mention its limitations. While we can limit the population of interest to workers, unlike the ACC injury data, we cannot directly identify whether any recorded mental health issue is work-related. Indeed, as will be discussed in Section 6.1 on psychosocial risks, it is extremely difficult to pinpoint the origins of a particular mental health issue (whether work-related or not), as there may be several contributary factors (eg, workplace stress, life events, personal triggers, etc). Similar issues arise in attempting to link chronic conditions with the characteristics of a worker's workplace as it is difficult to identify the origins of these health conditions in the data.

It is also useful to note that this project looks at the direction and magnitude of relationship between WHS outcomes and individual and firm characteristics, but it is not able to establish causality. For example, if the data reveals that firms with performance-pay systems have higher levels of workplace harm relative to firms without those practices, we can quantify the strength of association, but cannot infer that performance pay systems cause workplace harm. It could be that performance pay policies increase workplace harm, and on the other hand it could be because people who are more competitive and less safety conscious are more likely to work in such organisations.

2 Demographic trends present challenges for WHS

With the policy and data context discussed in the previous section in mind, the next sections discuss some main future-of-work trends and the available literature on the links between these and WHS outcomes. This section begins this discussion and focuses on demographic trends. Each subsection ends with an outline of what NZ's integrated data can and cannot tell us about how these factors are linked to WHS outcomes. (See Hennecke, 2021a for a full description of the available data and its strengths and limitations.)

Although demographic trends are often not often explicitly considered under the future-of-work umbrella, it is an important overarching factor that has potentially important implications for WHS. This section considers four main demographic considerations: ageing population, increased workforce participation of women, growth in migration and the high rates of workplace harm among Māori and Pasifika populations.

2.1 The WHS challenges of an ageing population may be exacerbated by the NZ health system's distinction between injury and illness

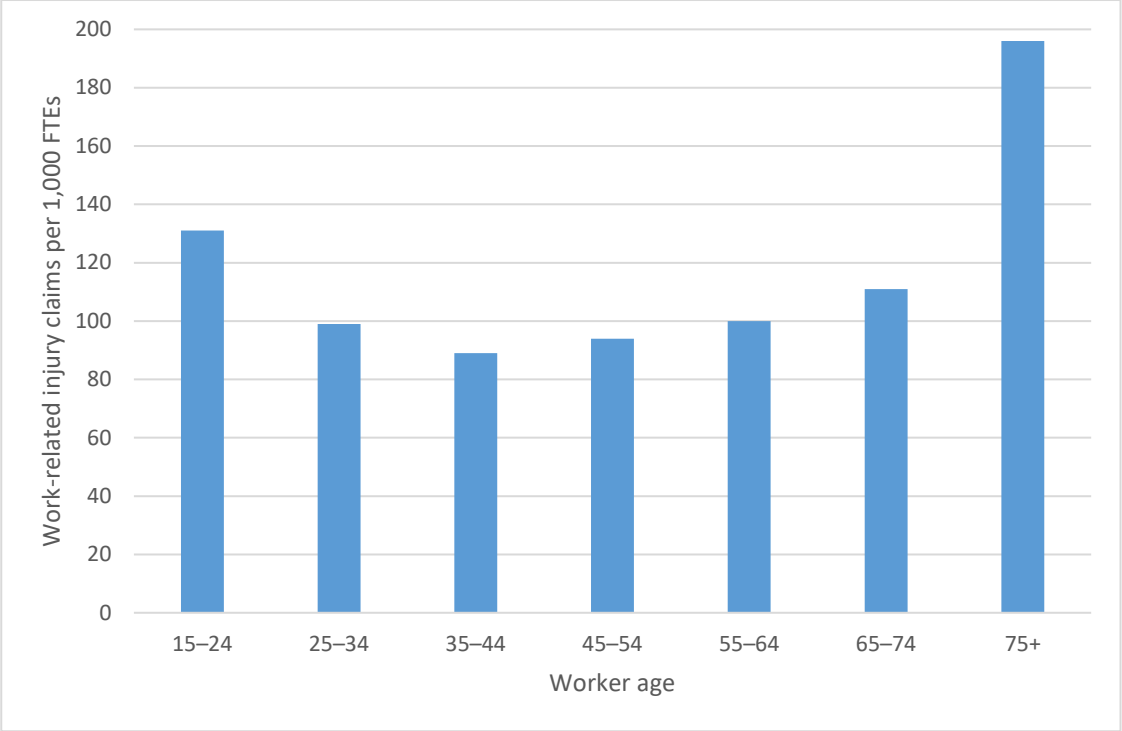
Like many other countries, NZ's population is ageing. According to UN population estimates, NZ's old-age dependency ratio (the number of people aged 65+ per 100 people aged 15-64) has increased from 15.5 in 1980 to 22.4 in 2015 and is projected to reach 39.7 by 2050. Likewise, the median age has gone from 27.9 years in 1980 to 37.3 in 2015 and is projected to increase to 43.7 in 2050 (United Nations, 2019). While NZ is generally following global trends on this front, it is worth recognising that our population remains somewhat younger than other OECD countries. The average median age across OECD countries was 41.3 in 2015 and the old-age dependency ratio was 28.6. This provides the opportunity to examine what is occurring in other countries that have an older population structure to identify and learn from emerging age-related issues.

Turning specifically to workers, NZ's workforce is also ageing as the contribution of young people entering the workforce slows and more people are living and working for longer. The rate of workforce participation in NZ of people aged 65+ has increased dramatically in recent decades rising from 9.0% in 1986 to 24.2% in 2018 (Stats NZ, n.d.).

In NZ, the relationship between work-related injuries and age is not linear, with the highest rates among the youngest and oldest groups of workers (Figure 2). The work-related injury claims rate per 1,000 full-time equivalent employees (FTEs) for those aged 15-24 was 131 in 2018, reducing to 89 for those aged 35-44, and then increasing again for older age groups. The claim rate is 100 for those aged 55-65, 111 for those aged 65-74 and 196 for those aged 75 and over (Figure 2) (Stats NZ, 2018a). However, these bivariate statistics do not provide any information on whether these differences reflect differences in other factors such as industry, occupation or job tenure. (See Hennecke et al., 2021a for multivariate analysis that controls for these kind of factors.)

Although there is some contradicting international literature on the rate of non-fatal injury (Rogers and Waiatrowski, 2005; Salminen, 2004), most studies find that older workers suffer more severe injuries than younger workers, resulting in more time taken off due to injury (Berecki-Gisolf et al., 2012; Farrow and Reynolds, (n.d.); Personick and Windau, 1995; Rogers and Waiatrowski, 2005, Smith and Berecki-Gisolf, 2014). Overall, these international studies suggest that the ageing workforce will increase work-related injuries.

Figure 2 NZ work-related injury claims by age group, 2018



Source: Stats NZ (2018a), Injury statistics – work-related claims: 2018.
Note: 2018 statistics are provisional.

Of course, WHS outcomes extend beyond injury and, likewise, WorkSafe's mandate also extends to work-related illnesses. However, ACC only covers injury and occupational disease (which, as discussed below, has a narrow definition). The OECD has highlighted that the NZ health system distinguishes between 1. injury and occupational disease and 2. other illnesses. As a consequence, the OECD argues that this distinction creates a two-tiered healthcare system where integrated health services and vocational rehabilitation support is prioritised for injury, through ACC, and not illness (OECD, 2018a).

There are two related difficulties in the context of this distinction between illness and injury in NZ's healthcare system. First, illness and injury interact, and second, differentiating between a work and non-work illness is challenging.

In terms of the interaction between illness and injury, the international evidence finds that those with poorer health and comorbidities have a higher likelihood of injury (Biddle & Roberts, 2003; Wren & Mason, 2010). Given generally poorer health and comorbidities are more likely to occur in older people, this relationship between illness and injury is likely to become increasingly relevant as the population ages.

In addition, it is difficult in practice to distinguish between work and non-work related illness as an illness may have multiple potential causes and it is often hard to establish a direct link between working conditions and an illness. ACC only covers occupation diseases (ie, work-related gradual process, disease or infection). This only includes illnesses recognised as occupational diseases where a causal link between the illness and the person's employment is established. ACC cover does not extend to diseases with multiple potential causes, even if one of these causes is work-related (Driscoll et al., 2004). Given these criteria, it is perhaps unsurprising that, based on comparisons of estimates of the burden of occupational disease and ACC claims in NZ, underreporting is an issue (Driscoll et al., 2004).

Although these issues relating to the interaction of illness and injury and the difficulties in differentiating between work-related and non-work illnesses are general ones, they are likely to be exacerbated as the workforce ages. These issues are also particularly relevant to workers' exposure to psychosocial risks and the resulting physiological and mental illnesses.

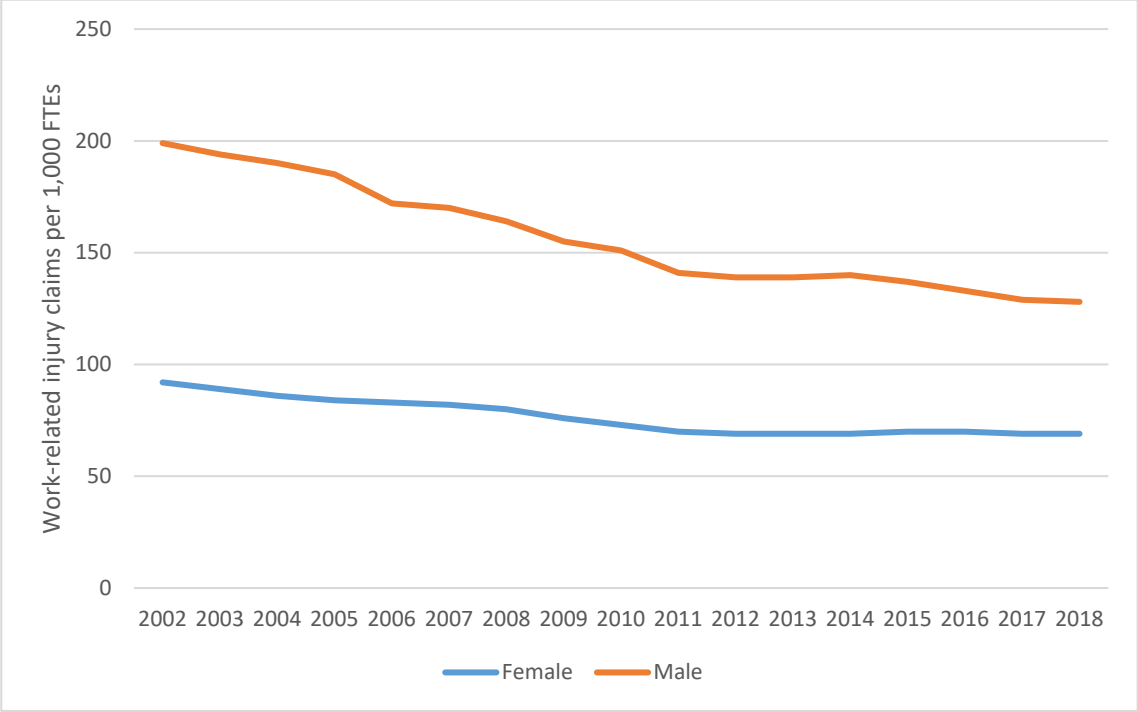
Although the available evidence is limited, there is suggestive evidence that psychosocial risks are lower for older NZ workers than for younger ones. The 2008 Statistics NZ Survey of working Life (SoWL) provided a snapshot of the working conditions of older workers in NZ (Stats NZ, 2008). Older workers (aged 55 and over) reported a lower tendency to experience work-related stress or to be too tired from work to enjoy other things and were more satisfied with their job and work-life balance. The reasons for this are unclear, however, it could perhaps be partly due to factors outside of work, such as lower family and childcare responsibilities or greater financial security, or because they are more likely to work part-time and/or have greater work flexibility than prime-aged workers.

2.2 More women are working, presenting challenges for WHS despite their lower injury rates

Female workforce participation in NZ has increased steadily from 55% to 66% between 1987 and 2019 (New Zealand Productivity Commission, 2019), with large increases seen among 25-34 year olds (Maddock & Genet, 2019).

In NZ, men have a work-related injury claim rate that is almost twice as high as that of women in 2018 (Figure 3). Men's injury claim rate has, however, been decreasing at a faster rate than women's over time (Figure 3). However, these simple cross-sectional statistics do not take into account other factors. For instance, it cannot be inferred from the estimates in Figure 3 whether the aggregate gender differences may be due to differences in industry and/or occupation. For example, evidence for Canada finds that while women have lower rates of workplace harm, this can largely be attributed to differences in industry and occupation (Smith & Mustard, 2004).

Figure 3 NZ work-related injury claims by gender



Source: Statistics NZ, Injury statistics – work-related claims: 2018.
Note: 2018 statistics are provisional.

In the wider economics literature, women are consistently found to be more risk averse on average than men (for example, Borghans et al., 2009), which likely contributes to gender differences in the choice of industry/occupation, but also likely results in gender differences in WHS outcomes even within industry/occupation groups. For example, Khan et al. (2017) finds that women fire service workers are more risk averse and more safety conscious than their male colleagues.

However, international evidence also highlights that women are at greater risk of certain types of injuries, such as upper limb musculoskeletal disorders associated with repetitive strain injuries (Strazdins & Bammer, 2004). This is due to their increased exposure to particular risk factors, such as repetitive work and poor ergonomic equipment. Interestingly, Strazdins & Bammer (2004) also highlights that this is exacerbated by non-work activities, such as less opportunity to relax and exercise. The authors also found that parenthood further heightened this gender difference, with mothers reporting the least time to relax and exercise. The study concludes that the gender-segregation of women into sedentary, repetitive work and the persisting gender imbalance in domestic work at the household-level are interrelated factors that explain gender differences in musculoskeletal disorders (Strazdins & Bammer, 2004).

The rise in women's workforce participation parallels the rise in non-standard work (discussed in more detail below) as women are more likely to engage in certain types of non-standard work, particularly part-time work. They are also more likely to have interrupted work histories, which may be relevant given the negative relationship found internationally between job tenure and workplace injury rates (for example, Breslin & Smith, 2006). Australian research also suggests that part-time workers have less access to participatory management practices in the workplace than full-time workers, which diminishes participation by women (Markey et al., 2002). More generally, women may have less voice in the workplace. For example, in the male-dominated American fire service, Khan et al. (2017) finds that women are taken less seriously than men when they raise safety concerns, which negatively impacts on

women's ability to improve WHS. However, it is unclear if these findings are generalisable to less male-dominated workplaces.

2.3 NZ's high net migration rates and the resulting superdiversity brings WHS challenges

Recent decades have also seen high levels of net migration into NZ. The number of permanent long-term gross migrant arrivals in recent years has been approximately double the number of NZ residents reaching 15, the age that they may legally enter the workforce (New Zealand Productivity Commission, 2019). Over the last four years (prior to the introduction of Covid-19 border restrictions) this has coincided with the highest level of net migration for the past 40 years (New Zealand Productivity Commission, 2019).

Internationally, migrant workers are found to have higher rates of workplace injuries than native-born workers (Schenker, 2010). A variety of explanations could account for this pattern. A range of papers have shown that migrant workers are over-represented in more dangerous industries and occupations (Schenker, 2010; Ahonen et al., 2007; Reid, 2010; Vartia-Väänänen & Pahkin, 2007). However, even within occupational categories, migrants have a higher injury rate (Schenker, 2010). Numerous studies discuss the tendency for migrant workers to work longer hours and at an accelerated work pace than native-born workers (HSE, 2010; Otero & Preibisch, 2010; Hennebry et al., 2015; Basok, 2002). In addition, migrant workers show a willingness to take additional work risks to please their employers (Vartia-Väänänen & Pahkin, 2007; Basok, 2002). Probst & Brubaker (2001) also found that perceptions regarding job insecurity led to lower willingness to adhere to health and safety standards, which resulted in a higher rate of WHS incidents.

NZ's situation is potentially somewhat different than that of many countries as immigration policy focuses on the intake of skilled migrants (Bedford, 2006; Maani & Chen, 2012). This results in a higher relative education level among the migrant population than in many other countries (OECD, 2018b). This should in theory provide a protective effect for health and safety risks among migrant workers in NZ, and may also mean that migrant workers are less likely to work in high-risk industries/occupations in NZ than in other countries. However, international evidence from overseas countries with similar skilled migration policies shows this may not be the case in practice. For example, Smith and Mustard (2008) found for Canada, migrant men experienced twice the rate of work-related injuries (that required medical attention), relative to Canadian-born men (in the first five years in the country). They also found no difference in injury risk between migrant and Canadian-born women.

Turning to the little available NZ evidence on this front, MBIE (2018) provides estimates that indicate immigrants have higher workplace injury rates relative to the NZ-born population. However, these raw differences may be driven by other characteristics of migrants or their workplaces. Migrant workers who are new to the country are also embarking on a new job or (due to restrictions in visa conditions) may engage in more temporary or part-time work. Some migrant workers also only intend to stay in NZ temporarily, lowering their incentives to invest in understanding the NZ WHS regulations and investing in a workplace's safety culture. This, along with language barriers, may contribute to limited understanding and accessing health entitlements and government support by culturally and linguistically diverse workers and employers in the event of workplace harm (Chen, 2018). There are also a multitude of studies that suggests that injury risks are higher for temporary workers or workers who are new to a job (Smith et al., 2010; Grabell et al., 2013; Breslin & Smith, 2006; Morassaei et al., 2013; Picchio & van Ours,

2017). Thus, multivariate analysis using NZ data would shed light on whether migrants have higher work-related injury rates even after controlling for factors such as industry of employment and job tenure.

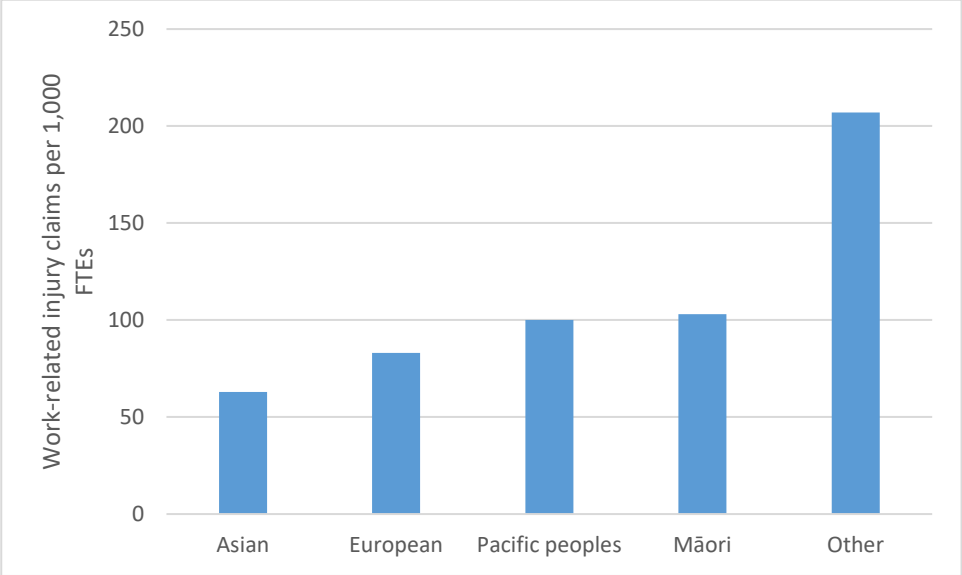
Drawing on the experiences of the UK, Canada and Australia, Chen (2018) discusses the potential issues for WHS stemming from high levels of migration and the resulting superdiversity in detail. These include language barriers leading to a lack of employability and protection from employer reprisal, discrimination and engagement in high-risk sectors, and psychosocial risks associated with overqualified workers,[2] accuracy and comprehensiveness of data collection and the need to redevelop information available to migrants in such a way that it conveys the values and beliefs promoting health and safety within a culturally diverse context.

2.4 Māori and Pacific peoples experience more workplace harm and are a growing share of the population

Māori and Pasifika have higher work-related injuries than Asians and Europeans (Figure 4). The work-related injury claims per 1,000 FTEs for Māori is 103 and 100 for Pacific people compared with 83 for Europeans and 63 for Asian. 'Other' ethnicities, who account for only a small share of the population (less than 3%), have by far the highest injury rate (207) (Figure 4) (Chen, 2018). Higher fertility rates among Māori and Pasifika mean that their share of the NZ population is projected to increase. According to Statistics NZ (2015) the Māori population is projected to increase from 15.6% of the population in 2013 to 19.5% in 2038; and the corresponding figures for Pacific population is 7.8% and 10.9%, respectively.

[2] However, it should be noted that there is not a clear-cut relationship between migration status and qualification and skills mismatch in NZ. While recent migrants have been found to be, on average, overeducated, earlier migrants are, on average undereducated (Poot & Stillman, 2010). Overall, New Zealand is the only OECD country where immigrations are not more likely to be over-qualified than the native-born population (OECD, 2007). Moreover, research using tests of actual skill level (which is correlated with, but does not always exactly match qualification level), has found that NZ migrants are less likely to be overskilled and more likely to be underskilled than the NZ-population population (Adalet McGowan & Andrews, 2017)

Figure 4 Work-related injury claims per 1,000 FTEs by ethnicity, 2017[3]



Source: Chen (2018). Health and safety regulators in a superdiverse context.

As discussed in the context of age and gender, the higher injury rates for particular ethnicities may be because they are over-represented in high-risk industries and occupations. Unfortunately, there is a lack of existing empirical analysis to test this potential reason. Hennecke et al. (2021a) conducts multivariate analysis to take account of these other factors to the extent possible. Future empirical work aimed at understanding the extent to which differences in observable characteristics explain these ethnic gaps in work-related injury rates, and which characteristics are contributing the most, could provide useful insights into how these gaps could be best addressed. It could also be insightful to examine changes in the ethnic gaps over time and to what extent these are explained by changes in observable characteristics.

Effectively addressing these gaps is important in itself, but is even more crucial given the Government's responsibilities towards Māori under the Treaty of Waitangi. To this end, WorkSafe's Maruiti 2025 sets out a strategy to reduce fatalities, serious harm and health impacts on Māori in the workplace. In addition, Puataunofo Come Home Safely initiative is an education programme that delivers tailored health and safety messages to Pasifika workers in English, Samoan and Tongan, through workplace sessions facilitated by WorkSafe inspectors.

[3] Source: Chen (2018). Health and safety regulators in a superdiverse context.

2.5 What the NZ data can (and can't) tell us about the relationship between demographic trends and WHS outcomes?

This subsection outlines the demographic information that is and is not available in the IDI, and discusses some relevant general data limitations. A full discussion is provided in Hennecke et al. (2021a).

Information on WHS outcomes by gender, age and ethnicity (key demographics highlighted above) can be provided in the empirical component of this project. The IDI includes these variables (at the individual-level) and will therefore permit descriptive analysis of demographic patterns in both work-place injury incidence and general measures of severity.

We can also investigate the relationship with WHS outcomes and migration status. The simplest but most complete approach is to distinguish between those who were born in NZ (based on DIA birth records) and those who were not. A more detailed approach would be to use a combination of NZ birth records, border movement and immigration data to determine nationality and approximate date of arrival in NZ. However, this approach would be imperfect due to data limitations. For example, border movement and immigration data are available from 1997 onwards, meaning that there are incomplete records for those who first settled in NZ before 1997.[4]

In terms of ethnicity, IDI data provides ethnicity information that will allow examination of whether ethnic gaps in WHS outcomes are still present after controlling for ethnic differences in other factors such as industry.

One data limitation of the IDI that is worth highlighting is that while the tax data provides information on wages and salaries, and other labour-related data, there is no information regarding hours worked. This means that it is not possible to investigate whether a lower work-related injury rate among women is partly driven by lower exposure due to lower hours in the workplace, nor whether part-time workers have higher injury rates once exposure time and other factors are controlled for. Nonetheless, it will be possible to investigate the role of job tenure and whether young people, women and migrants have, on average, shorter job tenure and whether this is related to their WHS outcomes.

In terms of investigating the relationship between firm-specific information and WHS outcomes, this is available via the LBD. In particular, the Business Operations Survey (BOS) provides information on workplace practices. For example, the 2018 'Changing nature of work' module within BOS collected information on flexible workplace practices such as parental leave provisions and provisions for flexible work. It also has information on whether businesses have policies or practices to address pay gaps, ageing workforce and diverse and inclusive workplaces.

One caveat associated with BOS data is that it is a representative sample of NZ firms with six or more employees.[5] Therefore, BOS does not provide information on small firms. The responses are also self-reported, and generally in a yes/no format, thereby not providing a sense of how policies and practices are implemented within the firm. For example, while two businesses may both respond that they offer working from home arrangements on a formal basis, one business may allow their employees to use this

[4] For future work where migrants are of particular focus, an alternative empirical identification strategy could be to look specifically at NZ-born workers versus recently arrived migrants. This would avoid the issues with inability to identify earlier migrants. This path of investigation is outside of the scope of the current project.

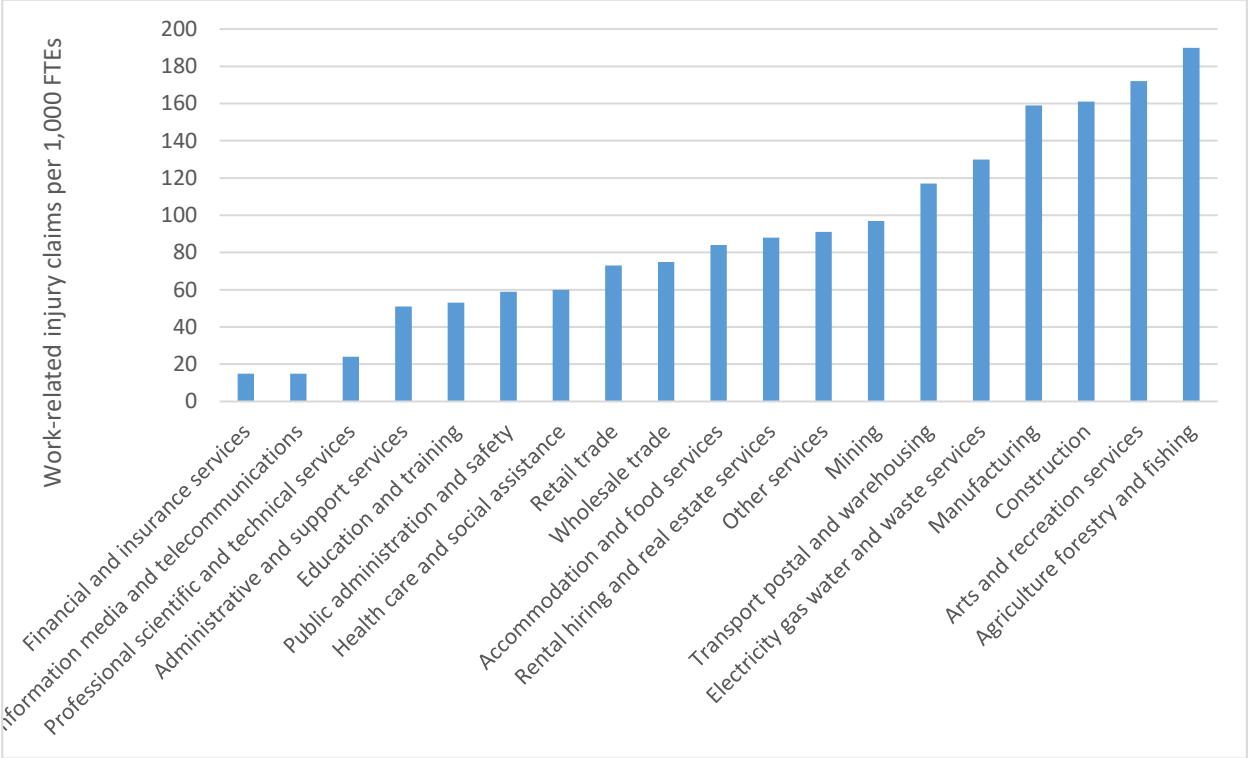
[5] Because of the longitudinal design of BOS, firms with fewer than 6 employees can be present in the data if they met the size threshold when they were chosen to be in the sample.

freely while another may require to have it pre-arranged and formally signed off by a manager. It is also necessary to note that the relevant questions in the 'Changing nature of work' module were only asked in the 2018 BOS, so unfortunately no time series data are available on these variables.

3 Industries with relatively low WHS risks are growing

There are vast differences in work-related injury claims by industry in NZ. In 2018, comparing the two extremes of the distribution: there were 15 work-related injury claims per 1,000 FTEs in the financial and insurance services industry versus 190 in Agriculture, forestry and fishing (Figure 5) (Stats NZ, 2018a).

Figure 5 Work-related injury claim rate by industry, 2018



Source: Stats NZ (2018a), Injury statistics – work-related claims: 2018.
Note: 2018 statistics are provisional.

In NZ, the share of employment in relatively low-risk industries has generally been increasing. The past decade has seen continued declining rates of employment in the primary (agriculture and mining) and goods (manufacturing, construction and utilities) sectors, relative to the rising rates of employment in the services sector. These trends are most evident via a drop in the percentage of the workforce employed in manufacturing (falling from 25.3% in 1976 to 9.8% in 2013); a corresponding rise in health and education (increasing from 12.5% and 19.3% over the same time period); and an increase in the proportion in the professional services sector (comparable figures of from 2.6% to 9.7% respectively) (New Zealand Productivity Commission, 2019).

As in other developed countries, these sector shifts have been driven by both supply-side factors (such as globalisation, along with technological advancements, shifting manufacturing to emerging economy markets), and demand-side factors (such as an increasing need for healthcare services given ageing population trends). These shifts highlights that even in the absence of improving WHS conditions, overall workplace harm is likely to go down over time due to changes in the economy's industrial structure.

The international evidence also highlights differences in WHS risks by industry and that changes in industry mix are changing these risks. For example, Hauke et al. (2020) highlights that musculoskeletal strain is of particular concern in the commerce sector, whereas the major factors for the manufacturing sector are job insecurity and increased demand for mobility and flexibility. They note that the effects of digitalisation across the commerce and manufacturing industries, as well as office-oriented sectors such as public administration, social insurance and health and social services. Technological improvements in the manufacturing industry are leading to fears of job loss due to automation. This transformation from operational roles to monitoring and problem solving introduces risks of more physical inactivity and musculoskeletal strain, while reducing other risks and hazards such as repetitive stress and other injuries associated with the factory floor.

These industry differences highlight that while shifts away from high-risk industries will bring improvements to WHS outcomes overall, they still bring challenges. There is a need to shift attention and resources to addressing issues that are prevalent within growth industries, such as musculoskeletal strain and psychosocial risks. Yet, at the same time, there is a need to continue working to reduce harm in traditionally high-risk industries like forestry. This presents a challenge given resource constraints.

3.1 What the NZ data can (and can't) tell us about the relationship between industry and WHS outcomes?

The IDI and LBD link together individual and firm data, allowing the investigation of the relationship between WHS outcomes and firm characteristics, including industry sector. Further, beyond descriptive bivariate estimates of the relationship between industry type and WHS outcomes, we can utilise industry information to understand the role it plays with respect to demographic differences in WHS outcomes (particularly by age, gender and ethnicity).

It would be ideal to also look at occupation. Individuals in the same occupation can work in different industries, and likewise, individuals in different occupations can work in the same industry. For example, a truck driver and an accountant who are employed by a transport company would both be recorded as working in the transport, storage & warehousing industry, but their roles would have very different WHS risk profiles. Unfortunately, the IDI does not include occupation data at the population-level so it will not be possible to investigate this aspect.

The lack of information on hours worked, as discussed in Section 2.5, may also be relevant. Differences in injury rates by industry may partly reflect differences in the prevalence of part-time work across industries.

4 Changing workplace practices are increasing complexity, which brings challenges for WHS

The future of work is associated with changes in workplace practices. Some of these have been facilitated by technological progress, such as digitalisation giving rise to platform work. Some involve workplace practices to improve the productivity of wellbeing of workers. There has already been a recognition in NZ and other countries that the traditional work model of full-time permanent work and a simple employer-employee relationship does not sufficiently cover the spectrum of modern work models. In particular, following the Australian model, the HSWA 2015 has moved from an employer-employee dichotomy to the use of the broader concepts of a 'Person Conducting a Business or Undertaking (PCBU)' and 'Workers' to capture all types of modern working arrangements.

However, as workplace arrangements move away from the traditional employer-employee relationship, WHS becomes inherently more difficult to manage. Moreover, practices within workplaces, even traditional ones, are becoming more varied as employers increasingly offer flexible working arrangements to boost productivity, attract talent and improve worker wellbeing. These trends also make WHS more difficult to manage.

This section looks at non-standard work, domestic outsourcing and the resulting complexity of working arrangements and new organisational work practices, such as flexible work.

4.1 Non-standard work is not prevalent in NZ, but international evidence points to elevated WHS risks

In recent years, many countries have seen the growth in labour contracts that diverge from the traditional standard of full-time permanent employment. This includes temporary, casual, contract and platform work (ie, work mediated by a digital platform). While these bring advantages in terms of flexibility for both workers and employers, concerns have been voiced about job quality and other potential negative outcomes that may be associated with non-permanent employment. As a consequence, policymakers in many countries are reviewing their labour market settings and regulation in this space. In doing so, they also must ensure policies permit a balance with the flexibility that is afforded by non-standard work (OECD, 2019).

The concerns about non-standard work also extend to NZ policymakers. As such, they are reflected in the range of related forums and activities being undertaken on this front in the public sector. For example, the establishment of the Government's Future of Work Tripartite Forum, the Productivity Commission's Inquiry into Technological Change and the Future of Work, and the Government's consideration of options for strengthening legal protections for contractors.

However, the Productivity Commission's Inquiry highlights that while there are data limitations, it appears that the extent of non-standard work in NZ is low and not showing signs of expanding. Using a series of proxy measures (such as the share of workers holding more than one job, the share of self-employed workers and so forth) they find no evidence that non-standard employment is increasing (New Zealand Productivity Commission, 2019). While only providing an imperfect snapshot, the SoWL 2018 shows that permanent employment is still very much the dominant employment type in NZ (74.2%),

11.7% are self-employed without employees and the remaining 5.8% are employers. Of the 11.7% self-employed without employees, just under half (5.4%) are contractors (Berntsen, 2019).

Platform-mediated work, or 'gig' economy work, is a specific type of non-standard work that has raised concerns internationally with respect to worker protections. While there is a lack of data on how many workers are undertaking gig work, the New Zealand Productivity Commission (2019) recently concluded from available information that the gig economy in NZ likely encompasses a small share of workers. They also indicated that much gig work appears to be done for short periods of time (for example, as an income smoothing mechanism between jobs) and not as a primary source of income.

While current data does not signal an expanding share of the workforce in non-standard employment in NZ, it is important to understand what the relevant WHS considerations with regard to these work patterns may be to future proof policy settings. The international literature highlights that non-standard employment is associated with higher workplace harm. For example, as mentioned elsewhere, research suggests that injury risks are higher for temporary workers and contract workers (Smith et al., 2010; Grabell et al., 2013; Breslin & Smith, 2006; Quinlan et al., 2009; Quinlan et al., 2001; Lippel et al., 2011; Underhill & Quinlan, 2011). Given that a key concern with non-standard work is greater job insecurity, it is also relevant that the international research finds a positive relationship between job insecurity and workplace accidents and injuries (for example, Probst & Brubaker, 2001; Quinlan et al., 2001).

The relationship between self-employment and WHS is also relevant since non-standard employment often involves self-employed contractors. The evidence in this area is mixed. For NZ, a higher rate of work-related fatal injuries for self-employed than employees was found using data from 1985 to 1994 (Feyer et al., 2001). For the United States, fatal injury rates are higher among self-employed workers (US Bureau of Labor Statistics, 2017). However, for Australia, no evidence has been found of an increased work fatality rate in self-employed people compared with employees once differences in industry and occupation are accounted for (Driscoll et al., 2003).

Shift work is also a relevant consideration. Although it does not necessarily fall within the definition of non-standard employment as it could involve full-time, permanent work, it does involve irregular and possibly varying hours which has implications for WHS. In NZ, the Survey of Working Life 2018 reports that over 89% of employed people mainly work during the day, almost 5% work shifts that change from day to day or week to week, 3.5% work mainly in the evening, 1.3% have some other type of work pattern and 1.1% work mainly at night (Stats NZ, 2018b). Furthermore, the Worker Exposure Survey (conducted in NZ between 2004-2006 and 2009-2010) reports that 25.4% of respondents worked irregular hours (ie, started before 7am and/or finished after 8.30pm) (Eng et al., 2018). Unfortunately, there does not appear to be much information on whether these patterns have changed over time.

Shift work involves disruption to the body's internal clock which can result in greater accidents and injuries as well as psychosocial risks (Barger et al., 2009; Berger & Hobbs, 2006; Costa, 2003). There is strong evidence linking shift work with negative health outcomes such as cardiovascular diseases, gastrointestinal and metabolic disorders (eg, type 2 diabetes), but less consistent evidence of links to cancer, mental health and reproduction-related problems (Moreno et al., 2019). Indeed, night work, extended work hours and job strain are associated with elevated levels of stress hormones (cortisol) (Thomas et al., 2009).

NZ's delineation between the ACC system for accidents and the DHB system for illness is relevant here. While a work accident where a contributing factor is a shift worker being fatigued would be covered by ACC, it is not as easy to link a physiological issue to working conditions, and these would generally fall

within the DHB system unless the criteria of being an identified occupational disease and a direct causal link with work exposure are met.

In a similar vein to shift work, long working hours and holding multiple jobs also present potential challenges. The Worker Exposure Survey found that 22% of workers worked more than 48 hours a week, and 9.5% more than 55 hours (Eng et al., 2018). The international research highlights the risks to workers include sleep deprivation, poor recovery from work, decrements in neuro-cognitive and physiological functioning, illnesses, adverse reproductive outcomes and injuries (Caruso, 2006). Empirical evidence confirms that long work hours are associated with higher rates of injuries, and this is not merely because long working hours is more common in higher-risk industries (Dembe et al., 2005). Similarly, multiple job holders have higher work injury rates than single-job holders (Marucci-Wellman et al., 2014). While the Robens approach highlights that all relevant parties have responsibility in managing WHS risks, including workers, this can still present practical difficulties. For example, an employer can only monitor and enforce maximum working hour restrictions within their own business and cannot control if an employee works long hours overall due to a second job as, say, a ride-sharing driver.

One of the concerns around non-standard work is that it diminishes workers' bargaining power by reducing the ability to act collectively. Indeed, in NZ, contractors cannot bargain collectively as doing so would amount to anti-competitive behaviour under the Commerce Act (MBIE, 2019).[6] There is international evidence that unionisation is associated with lower workplace injuries and fatalities (Souza, 2014; Morantz, 2013). More generally, some argue that worker engagement in WHS is generally ineffective in NZ and falls short of the strength of worker representative legislation and levels of engagement in comparable jurisdictions (Harris, 2004; Sisson, 2016).

Finally, when considering whether particular issues raised in international settings are applicable to NZ, it is necessary to keep in mind that the policy backdrop is quite different. In particular, accident compensation and healthcare coverage are not tied to employment status in NZ as they are in most other OECD countries. For example, ACC is a universal system that covers all accidents, whereas most other countries have a worker accident system which is tied to employment status and often does not cover self-employed workers (Poland, 2018).

4.2 Domestic outsourcing: More complicated working arrangements are a challenge for WHS

Domestic outsourcing is related to non-standard work trends such as contracting. But the issue is slightly different. For example, if a bank decides to outsource some of its IT services to a specialist IT firm rather than employing internal staff to undertake those functions, it may still be a permanent, full-time employees who undertakes those functions, but they are now employed by a different business. Thus, while outsourcing may involve an increase in non-standard work, via contracting/subcontracting, this is not always the case. Therefore, outsourcing is discussed here separately from the discussion on non-standard work even though the trends are related.

There is a lack of information on domestic outsourcing in NZ, so it is difficult to know if it is increasing. However, an increasing share of employment in industries such as professional services may partly reflect increased outsourcing. For example, it is argued that the increase in the share of the US workforce

[6] Although the Commerce Commission does have a process through which it can authorise collective bargaining outside employment relationships, but such authorisations are rare (MBIE, 2019).

employed in business service firms from 2% in 1950 to 8% in 2015 reflects growth in domestic outsourcing (Dorn et al., 2018). As mentioned above, in NZ, the percentage of the workforce employed in professional service industries has increased from 2.6% in 1976 to 9.7% in 2013, which could indicate an increase in domestic outsourcing, although it is not definitive evidence.

Greater domestic outsourcing results in more complex working arrangements, which has potentially important implications for WHS. As discussed, this has already been recognised with the introduction of the HSWA 2015. Rather than envisaging a stable, single employer workplace, it recognises the increasing complexity of workplaces comprised of multiple employers and workers, such as via subcontracting arrangements. However, these complex workplace arrangements make the management of WHS risks inherently more difficult. This is supported by numerous empirical studies internationally which have found outsourcing increases the likelihood of injuries and ill health due to poorer training and supervision, lack of familiarity with workplace hazards, pressures to complete tasks more quickly and at lower cost, greater fragmentation leading to a lack of clarity of responsibilities and communication difficulties (Quinlan et al., 2009; Quinlan et al., 2001; Lippel et al., 2011; Underhill & Quinlan, 2011).

While there does not appear to be existing NZ-specific research regarding the relationship between outsourcing and WHS outcomes, survey results highlight that employers do treat employees and contractors differently with respect to WHS. The National Survey of Employers 2018/19 found that while 75% of responding businesses reported that they had health and safety inductions for all new employees, only 53% of businesses using contractors and subcontractors had these inductions for contractors. This is perhaps even more concerning given international evidence that negative consequences of poorer WHS among contractors is not limited to the contractors, but spills over to employees (Underhill & Quinlan, 2011).

4.3 New organisational work practices: A story of unintended consequences for WHS?

So-called new ('innovative' or 'flexible') practices encompass flexible work (e.g. teleworking, flexitime), management practices and work organisation (e.g. total quality management, just-in-time, team work, job rotation), incentive structures (e.g. performance-based pay) and much more. While some practices are designed to increase worker work-life balance and wellbeing, others are designed for firm profitability, and often increase work intensity.

Because new organisational work practices are diverse, it is difficult to generalise the consequences for WHS outcomes. However, the literature suggests that many such practices may have unintended negative consequences for WHS (Kaminski, 2001), while some practices may be associated with better WHS outcomes, at least in some dimensions.

Practices aimed at creating high-performance workplaces are generally associated with worse WHS outcomes. For example, Askenazy & Caroli (2010) using French data finds that new work practices such as quality norms and job rotation are positively associated with higher levels of mental strain and occupational risks including injuries. Askenazy (2001) finds that the adoption of high-performance practices are associated with a large increase in occupation injuries and illnesses in the United States.

The findings on flexible working hours are blurred by differences in what is meant by flexibility across studies. In the literature, 'flexibility' often refers to the ability of the employer to change employee hours depending on factors such as demand levels. From the perspective of employees, these practices

increase the variation in their working hours. Therefore, for clarity, it is useful to use the term 'flexibility' of working hours to refer to practices that are connected with individual discretion and autonomy (eg, choosing earlier or later start times), and 'variability' in hours to refer to business decisions (eg, employers modifying employees' hours in response to changes in demand). It appears that most existing studies look at 'variability'. For example, Askenazy & Caroli (2010) finds that variability increases mental strain and occupational risks. Using UK data, Robinson & Smallman (2006) find that variability of working hours is associated with higher injury and illness levels. One study that examines both variability and flexibility using EU data finds that flexible working time is beneficial to worker health and wellbeing, while high variability is detrimental (Costa et al., 2006). However, a systematic review of studies on flexibility found no or insufficient evidence of health/well-being improvements (Nijp et al., 2012).

Turning to teleworking as one example of a modern practice to examine the possible mechanisms at play. The flexibility that teleworking brings may have a positive effect on workers' wellbeing by reducing commuting time and contributing to work-life balance. On the other hand, flexible work practices like teleworking are part of a move towards an 'always on' work culture whereby workers are available via email and so forth outside of paid work hours as the traditional boundaries between home and work erode (Moore, 2018). It also raises potential ergonomic risks due to improper home work station design and psychosocial risks due to isolation (Montreuil & Lippel, 2003). Empirically, Robinson & Smallman (2006) finds that working from home is associated with lower injury rates but higher illness rates for service sector workers, but finds no statistically significant association for manufacturing workers.

4.4 What the NZ data can (and can't) tell us about the relationship between changing workplace practices and WHS outcomes?

As discussed above, there is unfortunately scant data available on non-standard work and domestic outsourcing/use of contractors in NZ, especially in terms of trends over time. Further, the available data on workers in the IDI does not provide information on their hours worked. Information on employment type (such as permanent, casual, fixed term contractor, etc) is also not available at the population-level (although information on this front is available from the annual Household Labour Force Survey since 2016).

There is also more information at the firm level rather than the individual level. The Business Operations Survey (BOS) 2018 includes information on how many workers in the business are currently employed as permanent employees, fixed-term employees, casual employees and on contract for services. However this does not allow us to see the contract type that a particular worker is on.

The BOS 2018 'Changing nature of work' module also provides useful information on modern workplace practices such as flexible work. The main limitation with this information, as noted earlier, is that it is self-reported and lacks detail on strength of implementation.

5 Technological developments present both challenges and opportunities for WHS

Technological changes affect all aspects of work, from who or what performs particular tasks, how and where tasks are performed and ways in which work is organised. These settings have potential implications for the health and safety of workers (ILO, 2019). As mentioned in the introduction, this means the divide between technological changes and other future-of-work trends is blurry. This section, therefore, focuses on relevant technological trends which are not discussed in the preceding sections, particularly digitalisation, ICT, automation and robotics. For example, although technological changes have allowed the development of digital platforms and gig workers, that particular consequence was more relevant for the organisation of work, and was therefore discussed in Section 4.

5.1 Digitalisation and ICT present opportunities to identify WHS risks but bring some risks

The development, use and communication of digitised information has facilitated some of the trends discussed earlier, such as the 'virtualisation' of work, leading to more teleworking, for example. New risks can also emerge from increased human-machine interfaces, including ergonomic risks that can lead to musculoskeletal injuries.

Digital technology also brings opportunities for monitoring of workers. This presents both risks and opportunities for WHS. Monitoring software, GPS trackers and wearable smart devices pose psychosocial risks by diminishing worker privacy and creating pressure to meet performance targets, which may also increase physical injuries by incentivising workers to prioritise meeting those targets over health and safety considerations. A well-publicised example is Amazon's use of wristbands to track warehouse workers' locations, direct their tasks and send them information about their performance against targets. However, these technologies can also be used to better monitor safety, identify risks and provide real-time feedback to workers (Romero et al., 2018). For example, smart wearables have been developed to monitor worker fatigue and air quality (ILO, 2019). In addition, digitalisation also allows better collection and processing of data to monitor and improve WHS.

Digitalisation and ICT also bring opportunities to disseminate health and safety information and improve workers' health and safety training. For example, via health and safety apps, online training programmes, and virtual and augmented reality training (ILO, 2019).

5.2 Technology provides opportunities to remove people from hazardous situations

Similar to digitalisation, automation and robotics brings opportunities but also presents some risks for WHS. A big advantage for WHS is that they remove workers from hazardous situations. This includes removing people from potentially life-threatening situations such as via the use of bomb-defusing robots. Automation and robotics are also being used increasingly in high injury and fatality sectors, for example, in the forestry sector, to fell trees. It can also reduce worker exposure to relatively low-level risks, for example, by reducing the number of workers undertaking repetitive tasks.

NZ's forestry sector offers a specific example of the potential of technology to remove workers from hazardous situations. This industry is one of WorkSafe's four priority sectors due to the high incidence of injuries and fatalities (WorkSafe, 2016). About half of NZ's forestry harvest comes from steep country forests, and this has been identified as the main impediment to improving safety in forestry (Harrill et al., 2019). Both in NZ and internationally, increased mechanisation via the use of cabbed machines with greater protection for operators in harvesting has reduced injuries and fatalities (WorkSafe, 2016). The drive to reduce worker exposure to risks in forestry is reflected in the efforts of the Forest Growers research, which is a partnership between industry and the government with the vision of "no worker on the slope, no hand on the chainsaw" (Harrill et al., 2019; WorkSafe, 2016). However, mechanisation does not remove all risks as machines can roll, machine operators can develop repetitive strain injuries and face an increased pace of production resulting in fatigue (Harrill et al., 2019; WorkSafe, 2016). Going forward, the trend is towards further removing workers from dangerous situations via the use of autonomous machinery (Harrill et al., 2019). This is also an area where different future-of-work trends interact. In this case, outsourcing can impact the ability and incentives to invest in mechanisation and automation. These require large investments, but harvesting contracts are often short term. However, to support increased mechanisation, forestry owners have been entering into longer-term agreements (up to five years) so that contractors are able to access finance to purchase machinery (WorkSafe, 2016).

A long-standing concern regarding automation is the possibility of workers being displaced. However, the New Zealand Productivity Commission (2019) finds that while there is widespread discussion about technological developments leading to job losses, the data in NZ does not show signs of significant disruption to the labour market. As a consequence, the relevant factor in the context of WHS could be the anxiety caused by the fear of potential job loss, rather than the displacement itself. This job insecurity could present as a psychosocial risk. In addition, displaced workers in NZ face a more significant and immediate drop in income than similarly placed workers in many other OECD countries (New Zealand Productivity Commission, 2019).

5.3 What the NZ data can (and can't) tell us about the relationship between technology and WHS outcomes?

The BOS 'Changing nature of work' module includes some relevant information on firms' adoption of new technologies. This includes a series of questions on automation in the workplace, including to what extent the business has automated certain tasks such as routine physical tasks, data collection and processing, people management and so forth. While this information is self-reported, it represents a unique source of nationally representative data on automation that can be linked to information on WHS outcomes in the IDI.

6 Cross-cutting issues

This section looks at some cross-cutting issues, specifically psychosocial risks and health and safety education and training. While these cross-cutting issues were discussed in relation to other topics in earlier sections, this final section draws some of the relevant considerations and implications together.

6.1 Psychosocial risks: Workers' health is about more than absence of injury

Historically, health and safety has focussed on safety and minimising physical injuries with less attention on psychological wellbeing (WorkSafe, 2019b). However, psychosocial risks are an increasing area of concern. These concerns have been heightened by future-of-work trends including new forms of work organisation, new technologies and demographic changes. As such, most of the preceding sections discussed psychosocial risks. This subsection, therefore, focuses less on the sources of psychosocial risks, but on the possible implications for WHS, and the difficulties of managing it in the workplace context.

The very definition of psychosocial hazards hints at these difficulties. When referring to work, 'psychosocial hazards' refer to the aspects of design and management of work and its social organisation contexts that may have the potential for causing psychological and physical harm (WorkSafe, 2019b). This definition is broad, and "this breadth accurately reflects the complex nature of the relationship between the social environment and health outcomes" (WorkSafe, 2019b, p. 10).

Given the broad definition of psychosocial risks, it is difficult to measure the extent to which workers may be exposed to various hazards. But the Worker Exposure Survey gives a sense of the level of exposure among NZ workers. Some of the relevant results relating to long and irregular work hours have already been discussed in Section 4.1). The Survey also found that almost 15% of respondents indicated they perceived their current job as very or extremely stressful, and a further 42.5% found it moderately stressful (Eng et al., 2018).

Also reflecting the breadth of psychosocial risks, there is much international research on the link between exposure to psychosocial risks and workers' physical and mental health. Earlier sections of this review have discussed a number of potential psychosocial hazards, such as job insecurity, long work hours, and shift work, and their association with worker health and wellbeing outcomes. There are a range of other psychosocial work factors, including psychological demands, social support, reward aspects (such as job promotion), bullying, predictability and demands for responsibility (Niedhammer et al, 2015).

Looking at shift work as a specific example of how complex the relationship array of psychosocial hazards and job stressors given exposures usually occur simultaneously as a result of work schedule characteristics and other occupational conditions. International evidence suggests shift workers are at greater risk of psychosocial issues compared to regular day workers (Fischer et al., 2019). This is partly due to the nature of shift workers' jobs, which are more likely to involve low levels of control, high physical demands, lower support from supervisors and greater levels of over-commitment (Fischer et al., 2019). Workplace violence is another frequently encountered psychosocial stressor for shift workers such as police officers, security guards, drivers and so forth (Fischer et al., 2019). The unsociable hours are also associated with non-work stressors, such as decreased social interaction and negative effects on family life (Arlinghaus et al., 2019; Arlinghaus & Nachreiner, 2016).

One aspect that has not yet been discussed is workplace bullying. Although there is no data on prevalence at the population-level, research suggests that bullying is relatively widespread in NZ workplaces, and higher than equivalent jurisdictions (WorkSafe, 2019b). A meta-review of the international evidence finds that exposure to bullying is associated with job-related, health-related and well-being-related outcomes, such as mental and physical health problems, symptoms of post-traumatic stress, burnout, increased intentions to leave, and reduced job satisfaction and organisational commitment (Nielsen & Einarsen, 2012).

Given the wide range of sources for potential workplace psychosocial risk, it is a difficult area for policy to address. The ACC system remains focussed on physical injuries, as opposed to illness (whether physiological and psychological) even though these may arise from, or be exacerbated by, working conditions. 'Mental injury' will only be considered for ACC compensation if it results from a physical injury, sexual abuse, or exposure to a single traumatic event at work (OECD, 2018a).

The example of bullying also highlights the focus on physical injuries. The risk-based approach in NZ means that cases of work-related mental distress or bullying carry a high burden of evidence for workers. This includes a formal diagnosis from a mental health professional and a paper trail of abusive behaviour before an investigation can be launched by WorkSafe (OECD, 2018a).

Although adverse mental health outcomes is only one possible consequence of exposure to psychosocial hazards, it warrants further discussion in of itself, and also because it illustrates some of the policy issues. A recent OECD report recognises that NZ has a high awareness of mental health, but the policies and institutions to address the challenges are lacking (OECD, 2018a). It concluded that while the reform of the HSAW Act initiated a shift in focus from safety to health at work, it highlighted that implementation of the new legislation and the focus on mental health in the workplace is weak. One recommendation from the report was to "reconsider the strict and adverse distinction…between injury (which is well covered) and illness (which is not well covered), a division coming at a particular cost for people with mental health conditions" (OECD, 2018a p. 13). While a workplace injury is clearly attributable to working conditions, illness (physical and/or psychological) that arises at least in part from working conditions are more difficult to deal with, particularly within the context of the sharp distinction in NZ between ACC and the DHB funded public health services.

6.2 Health and safety training & education: Is it keeping up with changing workplace practices?

The training of health and safety professionals is a potentially important consideration for the effective implementation of WHS measures, and one that is of particular interest to WHS industry groups. A study by the US Institute of Medicine identified that the majority of WHS professions in the US fall within four primary categories: occupational safety, industrial hygiene, occupational medicine and occupational health nursing. They predict that three specialisations are likely to play an increasingly substantial role in WHS: assistance professionals, ergonomists and occupational health psychologists (Institute of Medicine, 2000). In many cases, the number of students graduating with relevant health and safety tertiary degrees in the US were considered to be insufficient for the replacement of existing health and safety staff (Institute of Medicine, 2000).

For NZ, a report by the Health and Safety Association of NZ (HASANZ) estimated a 45% increase in demand of WHS professionals in the workforce from 2019 to 2029. This figure is a combination of the projected employment growth and the desired increase in the proportion of WHS professionals to

workers (HASANZ, 2019). Current and expected staffing shortages discovered by this report are health and safety generalists, occupational hygienists, hazardous substance professionals, occupational health nurses[7], and human factors/ergonomics professionals.[8]

While there is little empirical attention focused on the effect of WHS education on workplace incidents, Vanderkruk (1999) found that the introduction of qualified WHS officers was associated with improved statistics with respect to: risk management; manual handling procedures; identification and management of hazardous substances; and improved employee engagement through the election and support of workplace health and safety representatives. On the other hand, Robinson & Smallman (2006) finds little association between WHS management (WHS committees, union or employee WHS representatives, WHS training etc.) and injury and illness rates. It should however be noted that it is somewhat difficult to interpret any observed relationship between injury rates and qualified WHS officers as causal as their presence may lower the actual injury rate but increase the reported injury rate as they may raise awareness of rights and obligations among workers (Robinson & Smallman, 2006).

The Institute of Medicine (2000) report also commented that the narrow focus of health and safety training (studying primarily fixed-site manufacturing industries) would be exacerbated by changing workplace practices. Several areas of increasing importance are mentioned: behavioural health, work organization, risk communication, management, team learning, workforce diversity, information systems, prevention interventions and evaluation methods.

As well as the consideration of specialist WHS professionals, the World Health Organisation encourages education of WHS at the primary, secondary and higher education levels (WHO, 2013). Younger workers are at high risk of workplace injuries (Lindholm et al, 2019). Part of the explanation for this is lack of accumulated exposure to WHS policies and practices. Improving WHS education at these levels would increase familiarity with WHS from an early age and could potentially help reduce the high rates of workplace harm among young people (Lindholm et al. 2019; Holte and Kjestveit, 2012). Znajmiecka-Sikora and Boczkowska (2012) propose that key skills developed through education include understanding of legal regulations, occupational risk assessment and management, work psychology, and the development of working methods to enact changes that may encounter management pushback.

[7] The primary concern for ongoing provision of occupational health nursing services is that two thirds of occupational health nurses are over 50. As a result, the workforce and expertise may diminish rapidly as these nurses enter retirement (HASANZ, 2019).

[8] While the shortage of HFE professionals in New Zealand is similar other comparable countries, increasing recognition of the importance of HFE professionals is expected to drive demand in New Zealand, exacerbating this shortage (HASANZ, 2019).

7 Conclusion

This report examined the international and New Zealand literature to inform the question: What are the possible implications of future-of-work trends for workplace health and safety (WHS) in NZ? This literature review was the first step in a project undertaken by the NZ Work Research Institute (AUT) for WorkSafe which focused on providing empirical evidence to inform the above question.

The future of work involves a confluence of several meta-trends. These include technological advances involving new production processes and products; as well as rise of the sharing economy. These trends facilitate and interrelate with changes in workplaces practices, such as increases in non-standard work and flexible working arrangements. Importantly, these changes are occurring against a backdrop of broader demographic, economic and environmental shifts, which are also influencing work patterns. These shifts include population ageing, increased diversity, globalisation, climate change and a growing importance of services in the economy.

Looking first at demographic changes, like many other countries, NZ's workforce is ageing. Most international studies find that the number and severity of workplace injuries suffered by older workers is greater, which suggests that the ageing workforce will increase work-related injuries.

Another demographic trend is the increase in female labour force participation in NZ. While women have lower rates of workplace injuries than men, existing international evidence suggests that this largely reflects differences in industry and occupation. However, women are at greater risk of certain types of injuries, particularly musculoskeletal injuries.

The high share of migrants in the NZ workforce is another demographic trend which presents challenges for WHS. Internationally and in NZ, migrant workers are found to have higher rates of workplace injuries than native-born workers, even in countries like NZ where migrants are relatively high skilled. However, international evidence suggests that this is partly reflects differences in industry of employment and occupation.

Māori and Pasifika workers also have higher rates of work-related injuries than other ethnic groups in NZ. This could reflect, among other factors, an over-representation in high-risk industries and occupations. Effectively addressing these gaps is important in itself, but is even more crucial given the Government's responsibilities towards Māori under the Treaty of Waitangi.

As well as demographic changes, NZ is experiencing structural changes. As a result, the share of employment in relatively low-risk service industries has generally been increasing while the share of employment in higher-risk industries such as agriculture and manufacturing has been falling. While this is conducive to reductions in workplace harm, it still presents challenges due to the need to continue working to reduce harm in traditionally high-risk industries while simultaneously devoting resources to addressing issues that are prevalent within growth industries, such as musculoskeletal strain.

The future of work is also associated with changes in workplace practices. In recent years, many countries have seen the growth in non-standard work such as temporary, casual, contract and digital-platform work. However, in NZ, existing evidence suggests that the extent of non-standard work in NZ is low and not showing signs of expanding. Nevertheless, it is important to understand what the relevant WHS considerations may be. The international literature highlights that non-standard employment is associated with higher workplace harm.

Domestic outsourcing is a related trend that increases the complexity of workplace arrangements and may reduce incentives for workers to prioritise WHS. Indeed, international evidence highlights that outsourcing is associated with a higher likelihood of injuries and ill health.

New organisational work practices encompass flexible work (eg, flexitime, teleworking), management practices and work organisation (eg, total quality management, team work, job rotation), incentive structures (eg, performance-based pay) and much more. The diversity of these practices make it difficult to generalise the consequences for WHS outcomes. However, the international literature suggests that practices aimed at creating high-performance workplaces are generally associated with worse WHS outcomes. Even for practices that are aimed more at improving worker wellbeing, such as flexible working arrangements, are not universally found to be positive for WHS in the empirical literature.

Many of these new work practices, such as the 'virtualisation' of work, are facilitated by technological developments. Indeed, technological changes affect all aspects of work, from who or what performs particular tasks, how and where tasks are performed and ways in which work is organised.

Technology provides opportunities to remove workers from high-risk situations. NZ's forestry sector offers a specific example of the ability of technology to remove workers from potentially hazardous situations. The increasing use of cabbed machines to fell trees offers greater protection for operators and has reduced injuries and fatalities. Going forward, the trend is towards further removing workers from high-risk situations via the use of autonomous machinery.

Psychosocial risks highlight that workers' health is about more than the absence of injury. Concerns about psychosocial risks have been heightened by future-of-work trends including new forms of work organisation, new technologies and demographic changes. The international research on the link between exposure to psychosocial risks and workers' physical and mental health is broad, covering risks discussed under the umbrella of changing workplace practices, such as job insecurity, long hours and shift work, as well as psychosocial work factors such as social support, psychological demands and bullying.

The training of health and safety professionals is a potentially important consideration for the effective implement of WHS measures. Although the empirical evidence in this area is not strong, international research suggests that the introduction of qualified WHS officers is associated with improved WHS outcomes.

References

Adalet McGowan, M., & Andrews, D. (2017). *Skills mismatch, productivity and policies: Evidence from the second wave of PIAAC.* OECD Economic Department Working Papers, (1403).

Ahonen, E., Benavides, F., & Benach, J., (2007). Immigrant populations, work and health—A systematic literature review, *Scandinavian Journal of Work Environment & Health 33*, 96–104.

Arlinghaus, A., Bohle, P., Iskra-Golec, I., Jansen, N., Jay, S. & Rotenberg, L. (2019). Working time society consensus statements: Evidence-based effects of shift work and non-standard working hours on workers, family and community. *Industrial Health*, *57*(2), 184-200.

Arlinghaus, A., & Nachreiner, F. (2016). Unusual and unsocial? Effects of shift work and other unusual working times on social participation. *In* Barnes-Farrell J., Bohle P. (eds) *Social and Family Issues in Shift Work and Non Standard Working Hours*. Springer, Cham

Askenazy, P. (2001). Innovative workplace practices and occupational injuries and illnesses in the United States. *Economic and Industrial Democracy*, *22*, 485-516.

Askenazy, P., & Caroli, E. (2010). Innovative work practices, information technologies, and working conditions: Evidence from France. *Industrial Relations*, *49*(4), 544-565.

Barger, L. K., Lockley, S. W., Rajaratnam, S. M. W., & Landrigan, C.P. (2009). Neurobehavioral, health, and safety consequences associated with shift work in safety-sensitive professions. *Current Neurology and Neuroscience Reports*, *9*(2), 155-164.

Basok, T. (2002). *Tortillas and Tomatoes. Mexican Transmigrant Harvesters in Canada.* Montréal: McGill-Queen's University Press. https://www.jstor.org/stable/j.ctt8174r

Bedford, R. (2006). Skilled migration in and out of New Zealand: Immigrants, workers, students and emigrants.

Berecki-Gisolf, J., Clay, F. J., Collie, A., & McClure, R. J. (2012). The impact of aging on work disability and return to work: insights from workers' compensation claim records. *Journal of occupational and environmental medicine*, *54*(3), 318-327.

Berger, A. M., & Hobbs, B. B. (2006). Impact of shift work on the health and safety of nurses and patients. *Clinical journal of oncology nursing*, *10*(4).

Berntsen (2019). *The changing nature of work: Strengths and shortcomings of New Zealand's benefits and protections for workers in non-standard employment.* https://www.fulbright.org.nz/wp-content/uploads/2019/08/L-Berntsen-AxfordFellow2019-Report-JULY2019.pdf

Biddle, J., & Roberts, K. (2003). Claiming Behavior in Workers' Compensation. *The Journal of Risk and Insurance*, *70*(4), 759-780. doi:10.2307/3519939

Borghans, L., Heckman, J. J., Golsteyn, B. H. H., & Meijers, H. (2009). Gender differences in risk aversion and ambiguity aversion. *Journal of the European Economic Association*, *7*(2-3), 649-658.

Breslin, F. C., & Smith, P. (2006). Trial by fire: A multivariate examination of the relation between job tenure and work injuries. *Occupational & Environmental Medicine*, *63*(1), 27-32.

Caruso, C. C. (2006). Possible broad impacts of long work hours. *Industrial Health*, *44*, 531-536

Chen, M. (2018). *Health and safety regulators in a superdiverse context: Review of challenges and lessons from the United Kingdom, Canada, and Australia.* Worksafe New Zealand. https://worksafe.govt.nz/research/health-and-safety-regulators-in-a-superdiverse-context/

Conway, P. (2018). Can the Kiwi fly? Achieving productivity lift-off in New Zealand. *International Productivity Monitor*, *34*, 40-63.

Costa, G. (2003). Shift work and occupational medicine: an overview. *Occupational Medicine*, *53*(2), 83–88. https://doi.org/10.1093/occmed/kqg045

Costa, G. (2006). Flexibility of working hours in the 24-hour society. *La Medicina del lavoro,* 97(2), 280-287.

Dembe, A. E., Erickson, J. B., Delbos, R. G., & Banks, S. M. (2005). The impact of overtime and long work hours on occupational injuries and illnesses: new evidence from the United States. *Occupational and environmental medicine*, *62*(9), 588-597.

Dorn, D., Schmieder, J.F. & Spletzer, J.R. (2018). *Domestic outsourcing in the United States*. https://www.dol.gov/sites/dolgov/files/OASP/legacy/files/Domestic-Outsourcing-in-the-United-States.pdf

Driscoll T., Mannetje A., Dryson E., Feyer A-M., Gander P., McCracken S., Pearce N., & Wagstaffe M. (2004). *The burden of occupational disease and injury in New Zealand: Technical Report.* NOHSAC: Wellington, http://psm-dm.otago.ac.nz/ipru/ReportsPDFs/OR057.pdf

Driscoll, T. R., Healey, S., Mitchell, R. J., Mandryk, J. A., Hendrie, A. L., & Hull, B. P. (2003). Are the self-employed at higher risk of fatal work-related injury? *Safety science*, *41*(6), 503-515.

Eng, A., Barnes, L., Mannetje, A., McLean, D., & Laird, I., (2018). *WorkSafe Request for Proposals: Worker Exposure Survey Report. Part 1: Results from two large New Zealand workforce surveys conducted in 2004-2006 and 2009-2010.* Centre for Public Health Research. Massey University. https://worksafe.govt.nz/dmsdocument/5441-worker-exposure-survey-report-part-1

Farrow, A., & Reynolds, F. (n.d.) *Post-retirement age workers and health and safety.* Brunel University, Uxbridge, Middlesex, School of Health Sciences and Social Care. Retrieved 22/01/2020 from https://www.iosh.com/media/1528/post-retirement-age-workers-and-health-and-safety-full-report.pdf

Feyer, A. M., Langley, J., Howard, M., Horsburgh, S., Wright, C., Alsop, J., & Cryer, C. (2001). The work-related fatal injury study: numbers, rates and trends of work-related fatal injuries in New Zealand 1985-1994. *New Zealand Medical Journal*, *114*(1124), 6.

Fischer, F. M., Silva-Costa, A., Griep, R. H., Smolensky, M. H., Bohle, P., & Rotenberg, L. (2019). Working Time Society consensus statements: Psychosocial stressors relevant to the health and wellbeing of night and shift workers. *Industrial health*, 57(2), 175–183. https://doi.org/10.2486/indhealth.SW-3

Gallagher, C., & Underhill, E. (2012). Managing work health and safety: recent developments and future directions. *Asia Pacific Journal of Human Resources*, *50*(2), 227-244.

Grabell, M., Pierce, O., & Larson, J. (2013). *Temporary Work, Lasting Harm.* ProPublica.

Harrill, H., Visser, R., & Raymond, K. (2019). New Zealand Cable Logging 2008–2018: a Period of Change. *Current Forestry Reports*, *5*(3), 114-123.

Harris, P. (2004). From health and safety to employee participation? The impact of the New Zealand Health and Safety Employment Amendment Act (2002). *International Employment Relations Review*, *10*(1), 1-12.

Hauke, A., Flaspöler, E., & Reinert, D. (2020). Proactive prevention in occupational safety and health: how to identify tomorrow's prevention priorities and preventive measures. *International Journal of Occupational Safety and Ergonomics*, *26*(1), 181-193.

Health and Safety Association New Zealand (HASANZ), (2019) Building the professions. HASANZ Health and Safety Workforce Pipeline Report. https://www.hasanz.org.nz/site_files/11371/upload_files/Buildingtheprofessions-HASANZHealthandSafetyWorkforcePipelineReport(1)(1).pdf?dl=1

Health and Safety Executive (HSE), (2010). *Protecting migrant workers*. Health and Safety Executive www.hse.gov.uk/migrantworkers/employer/ protecting.pdf

Hennebry, J., McLaughlin, J., Preibisch, K. (2015). *Changing Workplaces Review, Ministry of Labour*. Addressing agricultural migrant worker protection.

Hennecke, J., Meehan, L. & Pacheco, G. (2021a). *Workplace safety and the future of work in* NZ. NZ Work Research Institute.

Hennecke, J., Meehan, L. & Pacheco, G. (2021b). *Workplace health and safety and the future of work in* NZ*: Supplementary report*. NZ Work Research Institute.

Holte, K. A., & Kjestveit, K. (2012). Young workers in the construction industry and initial OSH-training when entering work life. *Work*, *41*(Supplement 1), 4137-4141.

Institute of Medicine (2000). *Safe Work in the 21st Century: Education and Training Needs for the Next Decade's Occupational Safety and Health Personnel*. Committee to Assess Training Needs for Occupational Safety and Health Personnel in the United States, Board on Health Sciences Policy. https://www.ncbi.nlm.nih.gov/books/NBK225534/pdf/Bookshelf_NBK225534.pdf

International Labour Organization (ILO). (2019). *Safety and health at the heart of the future of work - Building on 100 years of experience.* https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms_686645.pdf

Kaminski, M. (2001). Unintended consequences: organizational practices and their impact on workplace safety and productivity. *Journal of occupational health psychology*, *6*(2), 127.

Khan, Y. A., Davis, A. L & Taylor, J. A. (2017). Ladders and lifting: How gender affects safety behaviors in the fire service. *Journal of Workplace Behavioral Health*, *32*(3), 206-225.

Lindholm, M., Väyrynen, S., & Reiman, A. (2019). Findings and views on occupational safety and health teaching at universities. *Work*, (Preprint), 1-11.

Lippel, K., Ellen, M., Ron, S., Werhun, N., Agnieszka, K., Liz, M., ... & Pugliese, D. (2011). Legal protections governing the occupational safety and health and workers' compensation of temporary employment agency workers in Canada: reflections on regulatory effectiveness. *Policy and practice in Health and safety*, *9*(2), 69-90.

Maani, S., & Chen, Y. (2012). Impacts of a high-skilled immigration policy and immigrant occupational attainment on domestic wages. *Australian Journal of Labour Economics*, *15*(2), 101.

Maddock, T., & Genet, T. (2019, March 8). *The Productivity Commission's Tim Maddock and Terry Genet analyse NZ's labour market ahead of an inquiry into technological disruption and the future of work.* https://www.interest.co.nz/opinion/98536/productivity-commissions-tim-maddock-and%C2%A0terry-genet-analyse-nzs-labour-market-ahead

Markey, R., Hodgkinson, A., & Kowalczyk, J. (2002). Gender, part-time employment and employee participation in Australian workplaces. *Employee Relations*, *24*(2), 129-150.

Marucci-Wellman, H. R., Willetts, J. L., Lin, T. C., Brennan, M. J., & Verma, S. K. (2014). Work in multiple jobs and the risk of injury in the US working population. *American journal of public health*, *104*(1), 134-142.

Ministry of Business, Innovation and Employment (MBIE) (2018). *Health and Safety at Work Strategy 2018-2018: Supporting background information for consultation.* https://www.mbie.govt.nz/dmsdocument/4306-health-and-safety-at-work-strategy-consultation-supporting-information

MBIE (2019). *Better protections for contractors: Discussion document for public feedback*. https://www.mbie.govt.nz/assets/better-protections-for-contractors-discussion-document-for-public-feedback.pdf

Montreuil, S., & Lippel, K. (2003). Telework and occupational health: a Quebec empirical study and regulatory implications. *Safety Science*, *41*(4), 339-358.

Moore, P.V. (2018). *The threat of physical and psychosocial violence and harassment in digitalized work.* International Labour Organization. http://www.oit.org/wcmsp5/groups/public/---ed_dialogue/---actrav/documents/publication/wcms_617062.pdf

Morantz, A.D. (2013). Coal mine safety: Do unions make a difference? *ILR Review*. *66*(1) https://doi.org/10.1177/001979391306600104

Morassaei, S., Breslin, F. C., Shen, M., & Smith, P. M. (2013). Examining job tenure and lost-time claim rates in Ontario, Canada, over a 10-year period, 1999–2008. *Occupational and Environmental Medicine*, *70*(3), 171-178.

Moreno, C.R.C., Marqueze, E.C., Sargent, C., Wright, K.P. Jr., Ferguson, S.A., & Tucker, P. (2019). Working time society consensus statements: Evidence-based effects of shift work on physical and mental health. *Industrial Health*, *57*: 139-157.

New Zealand Productivity Commission (2019). *Employment, labour markets and income: Draft report 2 November 2019 Technological change and the future of work.* https://www.productivity.govt.nz/assets/Documents/437c9e3982/Draft-report-2-Employment-labour-markets-and-income-v3.pdf

Niedhammer, I., Lesuffleur, T., Algava, E & Chastang, J.F. (2015). Classic and emergent psychosocial work factors and mental health. *Occupational Medicine*, *65*(2): 126-134.

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

Nijp, H., Beckers, D. G., Geurts, S., Tucker, P. T., & Kompier, M. A. (2012). Systematic review on the association between employee worktime control and work-non-work balance, health and well-being, and job-related outcomes. *Scandinavian Journal of Work, Environment & Health*, 299-313.

OECD (2007), *International Migration Outlook 2007*. OECD Publishing, Paris, https://doi-org.ezproxy.aut.ac.nz/10.1787/migr_outlook-2007-en.

OECD (2018a), *Mental Health and Work: New Zealand, Mental Health and Work*. OECD Publishing, Paris, https://doi.org/10.1787/9789264307315-en.

OECD (2018b), *Skills on the Move: Migrants in the Survey of Adult Skills.* OECD Skills Studies, OECD Publishing, Paris. https://doi.org/10.1787/9789264307353-en

OECD (2019), *Policy Responses to New Forms of Work*. OECD Publishing, Paris. https://doi.org/10.1787/0763f1b7-en

Otero, Gerardo and Kerry Preibisch. 2010. Farmworker Health and Safety: Challenges for British Columbia. Vancouver, BC: WorkSafeBC

Peace, C., Mabin, V & Cordery, C. (2017). Due diligence: a panacea for health and safety risk governance? *Policy and Practice in Health and Safety*, *15*(1), 19-37, DOI: 10.1080/14773996.2016.1275497

Personick, M., & Windau, J. (1995) *Characteristics of older workers' injuries. In: US Department of Labor. Fatal workplace injuries in 1993: a collection of data analysis.* Washington, DC: US Department of Labor.

Picchio, M., & Van Ours, J. C. (2017). Temporary jobs and the severity of workplace accidents. *Journal of safety research*, *61*, 41-51.

Poland, M. (2018). *The determinants of injury compensation claims in a universal claims environment.* University of Otago Doctor of Philosophy thesis.

Poot, J., & Stillman, S. (2010). *The importance of heterogeneity when examining immigrant education-occupation mismatch: evidence from New Zealand*. Centre for Research and Analysis of Migration. https://motu.nz/assets/Documents/our-work/population-and-labour/migration/The-Importance-of-Heterogeneity-when-Examining-Immigrant-Education-Occupation-Mismatch-Evidence-from-New-Zealand.pdf

Probst, T.M. & Brubaker, T.L. (2001). The effects of job insecurity on employee safety outcomes: cross-sectional and longitudinal explorations. *Journal of Occupational Health Psychology*, *6*(2), 139-159.

Quinlan, M., Johnstone, R., and M McNamara (2009) Australian health and safety inspectors' perceptions and actions in relation to changed work arrangements. *Journal of Industrial Relations, 51*(4), 557–573.

Quinlan, M., Mayhew, C., & Bohle, P. (2001). The global expansion of precarious employment, work disorganization, and consequences for occupational health: A review of recent research. *International Journal of Health Services 31*(2), 335–414.

Reid, A., (2010). Migrant workers, *Ethnicity & Health*, *15*, 436–437.

Robens, A. (1972). *Safety and health at work: report of the Committee*, 1970-72 (Vol. 1). HM Stationery Office.

Robinson, A. M., & Smallman, C. (2006). The contemporary British workplace: a safer and healthier place?. *Work, Employment and Society*, *20*(1), 87-107.

Rogers, E., & Wiatrowksi, W. J. (2005). Injuries, illnesses, and fatalities among older workers. *Monthly Labor Review*, *128*, 24.

Romero D., Mattsson S., Fast-Berglund Å., Wuest T., Gorecky D. & Stahre J. (2018). Digitalizing occupational health, safety and productivity for the Operator 4.0. In: Moon I., Lee G., Park J., Kiritsis D. & von Cieminski G. (eds) *Advances in Production Management Systems. Smart Manufacturing for Industry 4.0.* APMS 2018. IFIP Advances in Information and Communication Technology, vol 536. Springer, Cham

Salminen, S. (2004). Have young workers more injuries than older ones? An international literature review. *Journal of safety research*, 35(5), 513-521.

Schenker, M. (2010). A global perspective of migration and occupational health, *American Journal of Industrial Medicine,* 53, 329–337.

Sherriff, B. & Tooma, M. (2010) *Understanding the Model Work Health and Safety Act.* CCH Australia Limited.

Sissons, (2016). A bad day at the sausage factory: The Health and Safety at Work Act 2015. *New Zealand Journal of Employment Relations*, *41*(2), 58-70.

Smith, C. K., Silverstein, B. A., Bonauto, D. K., Adams, D., & Fan, Z. J. (2010). Temporary workers in Washington state. *American journal of industrial medicine*, *53*(2), 135-145.

Smith, P. M., & Berecki-Gisolf, J. (2014). Age, occupational demands and the risk of serious work injury. *Occupational medicine*, *64*(8), 571-576.

Smith, P. M., & Mustard, C. A. (2004). Examining the associations between physical work demands and work injury rates between men and women in Ontario, 1990-2000. *Occupational and Environmental Medicine*, *61*, 750-756.

Smith, P.M & Mustard, C.A. (2008). Comparing the risk of work-related injuries between immigrants to Canada and Canadian-born labour market participants. *Occupational and Environmental Medicine*, *66* 361-367. doi:10.1136/oem.2007.038646

Souza, K., Cantley, L. F., Slade, M. D., Eisen, E. A., Christiani, D., & Cullen, M. R. (2014). Individual-level and plant-level predictors of acute, traumatic occupational injuries in a manufacturing cohort. *Occupational and Environmental Medicine*, *71*(7), 477-483.

Stats NZ (2008). *Survey of Working Life: March 2008 quarter.* http://archive.stats.govt.nz/browse_for_stats/income-and-work/employment_and_unemployment/SurveyOfWorkingLife_HOTPMar08qtr.aspx

Stats NZ (2015). *IDI Data Dictionary: Programme for the integration of mental health data* (October 2015 edition). Available from www.stats.govt.nz.

Stats NZ (2018a) *Injury Statistics – work-related claims: 2018.* https://www.stats.govt.nz/information-releases/injury-statistics-work-related-claims-2018

Stats NZ (2018b) *Survey of working life: 2018*. https://www.stats.govt.nz/reports/survey-of-working-life-2018

StatsNZ (n.d.) *Table: Labour Force Status by Sex by Age Group (Annual-Dec).* Household Labour Force Survey – HLF. Retrieved 31/01/2020, from http://archive.stats.govt.nz/infoshare/ViewTable.aspx?pxID=aa71d98f-dcc2-4bfd-a986-23e5f3cf3ea8

Strazdins, L., & Bammer, G. (2004). Women, work and musculoskeletal health. *Social science & medicine*, *58*(6), 997-1005.

Thomas, C., Hertzman, C., & Power, C. (2009). Night work, long working hours, psychosocial work stress and cortisol secretion in mid-life: evidence from a British birth cohort. *Occupational and environmental medicine*, *66*(12), 824-831.

Underhill, E., & Quinlan, M. (2011). How precarious employment affects health and safety at work: the case of temporary agency workers. *Industrial Relations*, *66*(3), 397-421.

United Nations (2019) *World Population Prospects. Department of Economic and Social Affairs Population Dynamics.* https://population.un.org/wpp/DataQuery/

US Bureau of Labor Statistics (2017). *Fatal occupational injuries in 2016 (Charts)*. Current population survey, Census of fatal occupational injuries. https://www.bls.gov/iif/oshwc/cfoi/cfch0015.pdf.

Vanderkruk, R. (1999). Workplace health and safety officers: a Queensland success story. *Journal of Occupational Health and Safety, Australia and New Zealand*, *15*(6), 557.

Vartia-Väänänen, M., Pahkin, K. (2007). *Literature Study on Migrants. Luxembourg: European Agency for Safety and Health at Work*. European Risk Observatory.

WorkSafe (2016). *"Well, I think there has been a lot of changes" Changes in health and safety in the forestry sector*. https://worksafe.govt.nz/dmsdocument/1301-well-i-think-there-has-been-a-lot-of-changes-changes-in-health-and-safety-in-the-forestry-sector

WorkSafe (2017). *Towards 2020 – Progress towards the 2020 work-related injury reduction target – November 2017*. https://worksafe.govt.nz/dmsdocument/4272-towards-2020-progress-towards-the-2020-work-related-injury-reduction-target-november-2017

WorkSafe (2019a). *Work-related health estimates: Work-related health deaths and hospitalisations estimates, and update of the ACC work-related health claims figures*. https://data-centre-public.s3.ap-southeast-2.amazonaws.com/ZZ1W4ndKyxDv9yNbAPGNU7aa7erC3YWKhxUXl5hk.pdf

WorkSafe (2019b). *Psychosocial hazards in work environments and effective approaches for managing them*. https://worksafe.govt.nz/dmsdocument/5417-psychosocial-hazards-in-work-environments-and-effective-approaches-for-managing-them

WorkSafe (2020). *Data Centre: Fatalities.* https://data.worksafe.govt.nz/graph/summary/fatalities

World Health Organization (WHO) (2013). *WHO global plan of action on workers health* (2008-2017). https://www.who.int/occupational_health/WHO_health_assembly_en_web.pdf?ua=1

Wren, J. & Mason, J. (2010). *Selected health co-morbidity Effects on ACC Injury Treatment Utilisation and Costs?* ACC, Governance Policy and Research. Wellington, New Zealand.

Znajmiecka-Sikora, M., & Boczkowska, K. (2012). The process of education of OSH services and organization development. *International Advances in Economic Research*, 18(3), 321-330.

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