

Healthy Working Lives Research Group
School of Public Health and Preventive Medicine

Developing a leading indicators questionnaire to identify Victorian workers at increased risk of work-related harm

Summary report

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Erratum

An earlier version of this document dated 11 February 2022 contained a minor inaccuracy in the Key Messages, which has been corrected in this version.

KEY MESSAGES

- By analysing the responses of 2053 Victorian workers to a questionnaire on the leading indicators of workplace health and safety (WHS) conducted in late 2021, we estimate that between 25% and 36% of workers are at high-risk for future workplace injury or illness. The estimates vary depending on which of five validated leading indicator measures included in the questionnaire were used to assess risk.
- Workers were more likely to be rated as high-risk if they held multiple jobs or worked for multiple employers, reported weekly household income below \$1500, worked for a Government employer, or worked in the education and training or retail trade industries.
- Workers were more likely to be rated as low to moderate risk if they were a business owner; worked for a single employer; worked in the professional, scientific and technical services industry; or had higher levels of education.
- The study was conducted in late 2021 when many Victorian workers were being directed to work from home if possible. At the time data were collected, 44% of workers indicated they were mainly working from home. Those working from home were more likely to be rated as low to moderate risk than those working from their employer's worksite.
- Data on lagging indicators were also collected to compare to leading indicator risk. 19% percent of workers reported a physical injury in the past 12 months, 24% reported a mental injury, and 18% reported a near miss in their workplace.
- Two leading indicator measures showed very strong statistical relationships with lagging indicators and were applicable to all workers. Workers rated as high-risk on the Occupational Health and Safety Vulnerability Measure (OHS-VM) were 2.9 times more likely to report a physical injury than workers rated as low to moderate risk. Workers rated as high-risk on the Psychosocial Job Quality Index (PJQI) measure were 3.7 times more likely to report a mental injury than workers rated as low to moderate risk.
- On the basis of the present study and pending further validation, a refined questionnaire is proposed focusing on the OHS-VM and the PJQI. The refined questionnaire may be used by WorkSafe Victoria to target prevention activities to the most vulnerable groups. For example, WHS education and training initiatives focused on workers with multiple jobs/employers may reduce risk of future injury in this cohort.
- Longitudinal data collection using the leading indicator measures will contribute valuable information for WorkSafe Victoria's efforts to monitor the Victorian workforce for changes in working conditions, employment relationships, industries or social characteristics that may change risk of future work-related injury or illness.

Leading Indicators of Workplace Health and Safety



2053

Victorian workers completed a leading indicators survey in late 2021



The survey included **5** measures of WHS leading indicators



Workers were from a broad array of jobs, industries and social backgrounds



**25%
to
36%**

The percentage of Victorian workers rated as being at high risk for future workplace injury or illness, depending on which measure was used.

SOME CHARACTERISTICS OF HIGH-RISK WORKERS AND WORKPLACES



Household income
Under \$1500 per
week



Multiple jobs or
employers



Government
workers



Education and
Training industry



Retail Trade
industry



24%

Reported a mental injury
in the past 12 months



19%

Reported a physical injury
in the past 12 months



18%

Reported a near miss in
the past 12 months

Collecting leading indicator data on a regular basis can help WorkSafe Victoria to:

1. Identify high-risk groups of workers and workplaces

2. Monitor changes in workforce risks for work-related harm over time

3. Target WHS prevention activities to areas of greatest need

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EXECUTIVE SUMMARY

What are leading indicators and how can they be used?

Leading indicators are aspects of workplace activities that contribute to risk of future injury or illness. They include exposure to hazards, workplace policies and procedures, employee awareness and engagement in health and safety, workplace safety culture and psychosocial relationships at work. Measurement of leading indicators focuses on things that lead to increased risk of injury or illness, so that these can be monitored or acted upon prior to the injury or illness occurring.

Leading indicator measures provide information that can support improvements in future work health and safety (WHS) performance. Knowing that certain groups of workers, or types of workplaces, are higher risk for future injury or illness allows regulators and employers to put in place preventive strategies to reduce these risks, and hence reduce the number of future injuries and illnesses.

What did this project involve?

WorkSafe Victoria with Monash University and Roy Morgan co-designed a questionnaire to assess five existing measures of leading indicators of WHS. The questionnaire included five leading indicator measures selected through a literature review and expert input, as well as items relating to workplace and worker characteristics, and worker report of lagging indicators such as experience of physical or mental injury in the past 12 months.

During October and November 2021, a total of 2053 Victorian workers completed the questionnaire via telephone or online survey methods. This report presents the findings of statistical analyses conducted on questionnaire data. The analyses were designed to identify appropriate leading indicator measures and propose a refined version of the questionnaire that can be used in future to identify characteristics of workers and workplaces at higher risk of future work-related injury or illness.

Who were the study participants?

Study participants were Victorian workers who were currently employed for at least 1 hour of paid work per week, aged 15 years and above, working in Victoria, and able to complete the questionnaire in English. There was no upper age limit. The sample was 50.4% female, with 51.4% aged between 25 and 44 years. 57.4% were university educated, 7.9% reported a disability, 22.9% were born outside Australia, 57.2% worked at least 35 hours per week, 42.5% worked for large employers (with 200+ employees), 78.1% had been in their current job for at least 12 months, and 67.7% reported having a permanent employment contract. The industry and occupation distribution of workers was broadly similar to the Victorian workforce.

Which workers and workplaces are highest risk on the leading indicator measures?

The proportion of Victorian workers rated as being at high-risk for future workplace injury or illness varied between 25% and 36%, depending on the leading indicator measure used to assess risk. Multiple worker, job and workplace characteristics were statistically associated with risk ratings on the leading indicator measures. Females were more likely to report psychosocial risk and males more likely to report physical health risks.

Workers were more likely to be rated as high-risk if they:

- held multiple jobs or worked for multiple employers,
- reported weekly household income below \$1500,
- worked for a Government employer,
- worked in the education and training or retail trade industries, or
- predominantly worked at the worksite of their employer.

Workers were more likely to be rated as low to moderate risk if they:

- were a business owner;
- worked for a single employer;
- worked in professional, scientific and technical services industry; or
- had higher levels of education.

Are the leading indicator measures related to actual injury and illness (lagging indicators)?

The questionnaire asked workers to report any work-related physical or mental injury, or any workplace near-miss over the past twelve months. Twenty-four percent (24%) of workers reported a mental injury in the past 12 months, 19% reported a physical injury and 18% reported a near miss in their workplace. The most commonly reported mental injuries were stress (19.1%) and anxiety (17.6%). The most commonly reported physical injuries were musculoskeletal disorders such as back/neck pain (7.4%) and shoulder/limb pain (7.0%), followed by cuts, bruising, crushing or amputation (6.1%).

All five of the leading indicator measures included in the questionnaire showed positive and statistically significant associations with these lagging indicators. This means that those rated as high-risk on the leading indicator measures were more likely to also report work-related physical injury, mental injury or workplace near-misses over the previous twelve months.

The Occupational Health and Safety – Vulnerability Measure (OHS-VM) demonstrated the strongest relationship with self-reported physical injury and near-miss outcomes. People rated as high-risk on this scale were 2.9 times more likely to report a physical injury in the past 12 months, than people rated as low to moderate risk. The Psychosocial Safety Climate (PSC-12) demonstrated the strongest relationship with self-reported mental injury (although the PSC-12 was not able to be asked of sole traders). People rated as high-risk on this scale were 4.0 times more likely to report a mental injury in the past 12 months, than people rated as low to moderate risk. Of measures that were able to be asked to all participants, the Psychosocial Job Quality Index (PJQI) demonstrated the strongest relationships with self-reported mental injury. People rated as high-risk on this scale were 3.7 times more likely to report a mental injury in the past 12 months, than people rated as low to moderate risk.

Study strengths and limitations

The study involved a large sample of workers with diverse characteristics. It assessed multiple leading indicator measures, as well as a diverse number of worker and workplace characteristics. All leading indicator measures were strongly associated with self-reported physical and mental injury and workplace near misses. Statistical analysis demonstrated that the leading indicators added unique predictive value over and above other known demographic and workplace predictors of injury and illness.

The data were cross-sectional, meaning that leading indicators and injury information were collected at the same time. Ideally injury information would be collected *after* the leading indicators questionnaire to properly assess the leading indicators' ability to predict future injury or illness. The sample demographic and work characteristics differed from the Victorian workforce, for example by having a higher proportion of females and an average higher level of education. Data analysis included statistical adjustments on key variables to account for these differences.

Data were collected as Victoria was re-opening following the extended COVID-19 lockdown during winter/spring 2021, and thus the working circumstances, and the associated risks to worker health and safety, likely differ from those observed under other circumstances. For example, nearly half (44.0%) of participants reported that their primary working location over the past week had been their home, with 41.3% reporting their primary working location being the worksite of their employer. We note that WHS risks are likely to differ in home-based working environments from other environments, and thus the findings of this study should not be generalized to reflect pre-COVID or potentially future COVID "normal" circumstances.

Longitudinal data collection would be valuable to determine whether scores on leading indicator measures predict future/late workplace injury or illness; whether the leading indicator measures are reliable and assess the same thing every time they are administered; and how the questionnaire can be used in groups of 'hard to reach' workers, such as those who don't speak English.

How can a leading indicator questionnaire be used by WorkSafe?

Monash has made recommendations for refining the leading indicator questionnaire for future use, in order to ensure that the effort and costs involved in future data collection provide the greatest value. This involves focusing on the two leading indicator measures on which most workers completed the measure, the strongest associations with lagging indicators were observed, and which identified a distinct group of workers as being at risk. These are the OHS-VM and the PJQI. These two measures focus on physical and psychosocial WHS risks, respectively, and thus are complementary.

Overall, the study findings suggest that a leading indicator questionnaire has value for assessing and monitoring workplace risks to the health and safety of Victorian workers. While further validation studies are advised, the proposed refined questionnaire may be used by WorkSafe Victoria to target prevention activities to the most vulnerable groups. For example, the study identified that workers with multiple jobs or working for multiple employers were at higher risk on the leading indicator measures. It may be possible to reduce WHS risk in these workers via initiatives such as education and training on managing health and safety in diverse settings for the workers or their employers, via incentives to encourage WHS training among these workers, or by focusing regulatory resources (inspections etc..) on those industries employing people who are more likely to work multiple jobs. The survey could be used to complement the existing suite of tools in WorkSafe initiatives, such as the WorkWell Program, to build comprehensive understanding of WHS across Victoria. Furthermore, the data could be used to inform targeted regulatory activities such as the revision or development of targeted inspector training and educational material for employers in managing the key safety risks in the workforce.

Regular use of the questionnaire will contribute to WorkSafe Victoria's efforts to monitor the Victorian workforce for changes in working conditions, employment relationships, industries or social characteristics that may change the risk of future work-related injury or illness. For example, measuring the psychosocial characteristics of workplaces on an annual basis would allow WorkSafe to answer questions such as "Are workplace psychosocial interactions changing in ways that place workers at greater risk of mental injury?"

BACKGROUND AND PURPOSE

Leading indicators have been characterised as “aspects of workplace activities that can be used to improve workplace health and safety (WHS) outcomes prior to an unwanted outcome occurring. They are a signal and monitor of what is being done on an ongoing basis to prevent worker illness and injury[1].

Measurement of workplace leading indicators focuses on those aspects of a person’s job or workplace that lead to increased risk of injury or illness, so that these can be monitored or acted upon prior to the injury or illness occurring. Leading indicators thus provide information on how to improve future WHS performance.

WorkSafe Victoria (WorkSafe) appointed Monash University to support development of a leading indicators questionnaire that will enable WorkSafe to identify Victorian workers exposed to risks that lead to work-related harm. It is expected that routine use of the questionnaire will:

- enable WorkSafe to identify sectors or cohorts where workers are at increased risk of work-related harm,
- provide a new source of data that can help WorkSafe to design new or modified solutions and regulatory approaches to prevent or reduce risk of future work-related harm, and
- build insights into changes in the workplace risks faced by Victorian workers, through longitudinal data collection.

PROJECT OBJECTIVES

The aim of the leading indicators project is to develop a questionnaire that enables WorkSafe to identify characteristics of workers and workplaces that are at higher risk of work-related harm.

The project had several objectives, including to:

1. Develop a pilot leading indicators questionnaire using existing validated leading indicator measures.
2. Test the proposed leading indicator questionnaire with a sample of diverse Victorian workers to validate the measures and survey design.
3. Provide WorkSafe with a final leading indicators questionnaire for future data collection, including recommendations for its application and further validation.

The first objective was addressed in earlier phases of the project. This report is focused on the second and third objectives.

RESEARCH METHODS

QUESTIONNAIRE DEVELOPMENT

In Phase 1 of the project, a draft leading indicators questionnaire was developed, using the methods described in the first report from this project [2]. In brief, a four-stage approach was taken to develop the draft questionnaire.

1. We identified potential leading indicator measures using a rapid systematic literature review and expert recommendations;
2. We short-listed and prioritised leading indicator measures by applying a set of occupational health surveillance criteria to the identified measures;

3. We identified lagging indicator measures, and items on worker and workplace characteristics, through review of prior leading indicator survey data analysis, review of standardised national survey items, and via expert input; and
4. We integrated information from the prior three stages to develop a draft (word version) questionnaire.

QUESTIONNAIRE REFINEMENT

In Phase 2 of the project, led by Roy Morgan and WorkSafe, the survey underwent a process of refinement and revision. This was an iterative process, carried out in consultation with the WorkSafe project working group to ensure that the questionnaire appropriately captured respondents with characteristics considered important by WorkSafe, including gender diverse workers, Aboriginal and Torres Strait Islander workers, culturally and linguistically diverse workers and workers with disability.

Roy Morgan completed 20 cognitive interviews of approximately one hour in length. Thirteen interviews were conducted via a video call, simulating an online interview. Seven interviews were conducted by telephone, simulating Computer Assisted Telephone Interview (CATI). Through this process the questionnaire was revised by removing items considered unsuitable, such as questions asking about workplace management that were not relevant to sole traders. The questionnaire was also refined to ensure they were appropriate for use for Victorian workers such as providing greater clarity around what was meant by a 'workplace', at a time when workplaces may have included home as well as onsite. Other refinements included reducing the length of the questionnaire by removing concepts which overlapped or were deemed to be of a lower priority. Questions that were considered most relevant and were widely understood were retained in the final questionnaire. Further information is available in the Roy Morgan technical report from Phase 2 [3].

The final study questionnaire included three main types of items, including questions on (1) worker and workplace characteristics; (2) lagging indicators; and (3) the five leading indicator measures. An overview of the items included in the final questionnaire is provided at Table 1.

Table 1. Overview of measures included in the final questionnaire.

Measures	Brief description of items included in questionnaire
Worker and workplace characteristics	Personal characteristics: Age, gender, Aboriginal or Torres Strait Islander status, education, country of birth, citizenship status Household characteristics: Language spoken at home, household income, household composition, residential location Workplace and employer characteristics: size of workplace, industry, location, employer type, employer size Job characteristics: job tenure, occupation, type of contract
Lagging indicators	Workplace mental or physical injury and illness in the last 12 months and the nature of injury/illness Near-misses in the workplace Time off work due to injury or illness. Worker observed injury/illness to co-workers.
Leading indicators	Five leading indicator measures were included: 1. Psychosocial Job Quality Index (PJQI) [4]

	2. Organisational Performance Metric – Monash University (OPM-MU) [5] 3. Occupational Health and Safety Vulnerability Scale (OHS-VM) [6] 4. Neal & Griffin Safety Climate Subscale (NG-SCS) [7] 5. Psychosocial Safety Climate (PSC-12) [8]
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WORKER ELIGIBILITY CRITERIA

The questionnaire was administered to a sample of Victorian workers. Respondents were eligible to be included if they were:

- currently employed for at least 1 hour of paid work per week,
- aged 15 years and above, and
- working in Victoria.

Respondents were excluded if they were retired, studying but not working, under 15 years or unable to complete the survey for example because of communication problems (e.g., English language proficiency). There was no upper age limit.

DATA COLLECTION

The questionnaire was administered via two methods: (1) Computer-Assisted Telephone Interviewing (CATI); or (2) an Online / web-based survey. Further information on each of these methods is available in the Roy Morgan technical report [3]. Data were collected between 6 October 2021 and 3 November 2021, during which Victorian workers in non-essential business were being directed to work from home. There was an easing of working from home directions across the state of Victoria during this period, with double-vaccinated workers in “non-essential” jobs able to return to work from 29th October, but still encouraged to work from home if possible.

Participation in the survey was voluntary. Consent was sought from all respondents (or their parental guardians if under 18 years) prior to data collection. The Roy Morgan technical report includes more detail on data collection [3].

DATA ANALYSIS

At the completion of data collection, Roy Morgan provided to Monash a dataset containing complete questionnaire responses for a sample of 2053 workers. Monash conducted data analysis in four stages:

1. Data preparation. This involved calculating the high and low risk categories on each of the five leading indicator scales (details for each scale are presented with their results) and preparing other data items for use in analysis. These other preparations included, for instance combining industries with small sample sizes into a single group, and inspecting and converting other data items to appropriate categories for use in analyses (e.g., ensuring age was grouped in 10-year age bands)
2. Descriptive statistics. We calculated frequencies, percentages, measures of central tendency such as means and medians and measures of variance such as standard deviation and interquartile ranges. These statistics were used to characterise the sample, and to explore outcomes on the leading indicators scales at a group level. Where possible, sample data have been compared with Victorian labour force data to examine how well the sample represents the state labour force.

3. Chi-square analysis. We determined the statistical associations between worker, workplace and employer characteristics with risk categories on each of the five leading indicator measures using Chi-square analysis. The purpose of this analysis is to identify the characteristics of workers, their jobs, industries and workplaces that are associated with higher risk on the leading indicator scales.
4. Logistic regression models. We conducted multivariable logistic regression to examine the association between leading indicators and lagging indicators (measures of actual injury, illness or near misses). The purpose of this analysis was to examine the validity of the leading indicator measures. We would expect workers at higher risk on leading indicator measures (those more at risk for injury or illness) to also be more likely to report actually injury, illness or near misses.

As the purpose of this study was not to estimate the population prevalence of leading or incidence of lagging indicators, data in this report is presented without the use of survey weights. Note however that our analysis comparing the relationship between leading and lagging indicators does include adjustments for factors known to influence workplace injury or illness, including age, gender, occupation, industry, employer size and type.

QUESTIONNAIRE REFINEMENT

WorkSafe requested that Monash make recommendations for refining the leading indicator questionnaire for potential future use, in order to ensure that the effort and costs involved in future data collection provide the greatest value. To formulate recommendations, we assessed the performance of the leading indicator scales on the following criteria:

1. The completeness of responses on each leading indicator measure. A higher percentage completeness indicates a more universally applicable measure.
2. The extent to which worker, job and workplace characteristics were associated with scores on the leading indicator measures. The more characteristics a leading indicator measure is related to, the more useful the measure will be in identifying workers or workplaces for preventive interventions.
3. The strength of the relationship between the leading indicator risk scores and lagging indicators. Stronger associations suggest that the leading indicator measure has superior ability to differentiate between people who experience workplace injury or illness.
4. The extent of overlap in the worker and workplace characteristics identified as high-risk on the leading indicator measures. Less overlap is preferable. Acknowledging that the leading indicator measures assess similar concepts, the best use of survey time may be in measures that identify different groups of workers and workplaces experiencing different types of risks (e.g., psychosocial risks, physical hazard exposure risks).

RESULTS

SECTION 1: DATA OBSERVATIONS

In preparing the data for analysis, we observed a number of features that have implications for analysis and data interpretation. The main observations are as follows:

1. **Missing data on three leading indicator measures.** Three measures were not administered to sole traders - the OPM-MU, NG-SCS and PSC-12. The items in these leading indicator measures refer to management or workplace policies and practices. Cognitive testing of the questionnaire identified that it was not considered appropriate to administer these items to this group of workers. There were a total of 207 sole traders included in the study sample. For the PSC-12 measure, 148 workers (8% of respondents) responded 'don't know' or 'not applicable' to at least 4 of the 12 items in the measure. We considered this level to be too high to accurately estimate an 'average' response from the remaining 8 items that were completed, and these responses were also excluded from analysis.
2. **Differences between telephone and online survey responses.** There were differences between workers who completed the questionnaire by phone interview (600 responses) to those who completed the questionnaire online (1453 responses). A larger proportion of telephone responses were completed by workers aged over 45 years, while a larger proportion of online survey completions were by workers aged under 45 years. Online respondents were twice as likely to report being of Aboriginal and Torres Strait Islander status (2.6 vs. 1.2%), but also over three times as likely to choose 'don't know / prefer not to say' than telephone participants (5.4% vs. 1.5%). Workers who were classified as having a profound or severe core activity limitation were more than twice as common in the online sample (9.6%) than the phone sample (3.7%). Workers from public administration and safety and health care social assistance industries were more common in the telephone sample, whereas workers from retail trade and accommodation and food services were more common in the online sample. Workers with a bachelor's degree were overrepresented in the online sample, workers with an advanced diploma or who did not complete high school were overrepresented in phone sample.
3. **Reporting of disability status.** We observed a nearly 10 times higher than expected number of participants who were classified as having a 'profound or severe core limitation' in the study sample, than in the Victorian working population. While the same set of questions were used, there were differences between the way these questions were asked in the census and this leading indicator survey that may have affected responses. Specifically, in the census a statement was given, with examples. In the leading indicator questionnaire, the same statement was given, but without examples. It is likely that without the examples, people in the study sample interpreted the question more broadly and this contributed to the higher estimate of respondents with a profound or severe core limitation.
4. **Small samples of Aboriginal and Torres Strait Islander and non-binary gender workers.** There was a total of 45 workers who reported being Aboriginal or Torres Strait Islander. While this was a larger percentage (2.2%) than reported in the Victorian working population at the 2016 census (0.6%), it was considered too small a sample size to reliably report results on leading indicators by Aboriginal and Torres Strait Islander status. Aboriginal and Torres Strait Islander results are still reported in descriptive tables, and included in regression analyses, but should not be considered as reliable estimates of leading and lagging outcomes for the Aboriginal and Torres Strait Islander working population. Similarly, there were 16 workers who reported identifying as a non-binary gender. This sample size is too small to derive any conclusions about non-binary workers, although results are reported and included in analyses.

SECTION 2: WORKER AND WORKPLACE CHARACTERISTICS TESTED

A total of 2053 Victorian workers completed the survey including workers from a wide range of workplaces. We have included detailed data tables in Appendix B, and summarise the main findings in the following sections.

Worker characteristics

The study sample represented a diverse cross section of the Victorian workforce in terms of personal characteristics. There were some differences between the study sample and the Victorian workforce as noted below.

- There were 1035 (50.4%) female, 1002 (48.4%) male and 16 (0.8%) non-binary participants. The Victorian workforce has a slightly higher proportion of male workers (52.6%).
- A larger than expected group of 25 to 44-year old participants were recruited (51.4% of sample, 45.9% of workforce) with smaller groups of workers aged 45-54 years (17.9% of sample, 21.3% of workforce).
- The study sample had higher levels of education than the Victorian workforce, with 57.4% reporting a bachelors or postgraduate degree, compared with 34.3% of the state workforce.
- A smaller proportion of the study sample were born outside Australia (22.9%) compared with the Victorian workforce (30.8%)
- A larger proportion of the study sample reported Aboriginal or Torres Strait Islander status (2.2%) than the Victorian workforce (0.6%).
- A larger proportion of people reporting disability (7.9%) compared with the Victorian workforce (0.8% in census data), noting the differences in the way this question was posed as described in Section 1.
- Finally, most participants completed the survey online (70.8%) compared with over the telephone (29.2%), and these two subsamples differed on a number of characteristics. Telephone participants were significantly older, less likely to have bachelor or post-graduate degrees, less likely to be of Aboriginal and Torres Strait Islander status, and less likely to report a profound or severe core activity limitation (i.e., a disability) than online participants. The industry profile of the two sub-groups was also significantly different.

Industry mix

Substantial groups of workers were recruited from all of the major industry categories, providing sufficient data for analysis of leading indicator outcomes by industry sector. However, the distribution of workers across different industry sectors differed significantly from that in the Victorian workforce, with higher proportions in the Healthcare and Social Assistance; Education and Training; Professional, Scientific and Technical; and Financial and Insurance Service industries, as well as lower proportions of respondents in the Construction; Manufacturing; and Accommodation and Food Service industries.

Job, Workplace and Employer characteristics

It was not possible to compare the job, workplace and employer characteristics of the sample to the Victorian workforce data as benchmark data do not exist. Appendix B provides a summary of the recruited sample across key characteristics, which have been summarized below.

- The majority of study participants reported working for a single employer (79.7%), with the next largest group being sole traders (10.1%) followed by people working for multiple employers (8.5%). A smaller group were business owners (4.3%). The vast majority of participants reporting having only one job (93.5%).
- Occupation was coded to the Australian New Zealand Standard Classification of Occupations (ANZSCO). The most common occupational category was Professionals (34.6%), followed by

Managers (15.2%), Clerical and Administrative Workers (12.5%) and then Community and Personal Service workers (9.5%).

- The majority of the study sample reported working 35 or more hours in the week before the survey in their main job (57.2%), 26.0% reported working between 15 and 34 hours in the past week, and 10.3% between 1 and 14 hours.
- Reflecting the timing of the survey as Victoria was emerging from the winter/spring 2021 COVID-19 lockdown, 44.0% of participants reported that their main worksite was at their home. A slightly smaller group of 41.3% reported their main worksite as that of their employer, with 10.6% reporting another worksite such as a vehicle, a co-working space or a public space (e.g., library).
- A large minority of participants reported working for large (200+ employees) employers (42.5%) while 22.4% reported working for medium sized (20 to 199 employees), with 28.2 reporting working for an organization with 19 or fewer employees.
- Permanent employment contracts were most commonly reported (67.7%) followed by casual (11.9%) and fixed term for more than 1 year (7.0%).
- More than three quarters of participants (78.1%) reported more than 12 months in their current main job, with the remainder reporting less than 12 months tenure.

SECTION 3: RISK RATINGS ON FIVE LEADING INDICATOR MEASURES

The calculation of risk scores for each of the leading indicators measures was slightly different. The proportion of Victorian workers rated as being at high-risk for future workplace injury or illness varied between 25% and 36%, depending on the leading indicator measure used to assess risk.

Leading Indicator Measure	Percent at High-Risk of Work-Related Harm
Psychosocial Job Quality Index	26.4%
Organisational Performance Metric – MU	26.1%
Occupational Health and Safety Vulnerability Measure	36.5%
Neil and Griffin Safety Climate Subscale	25.5%
Psychosocial Safety Climate Scale:	26.7%

The following section presents more detailed statistics for each of the five leading indicator measures included in the survey. Specifically, we report the number and percentage of participants who were rated as high risk on the measures, or low to moderate risk. For each leading indicator measure, we also report the characteristics of workers and workplaces that indicate workers are more likely to be exposed to risks that may lead to work-related harm

Psychosocial Job Quality Index (PJQI)

The PJQI has four subscales each assessing a different dimension of psychosocial job quality. These are then combined to determine overall psychosocial risk. For the high job demands subscale, a higher score indicates higher risk (i.e., more job demands). On the remaining subscales, a lower score indicates higher risk (e.g., low job security, low job control). Two fifths of workers were not considered to be high-risk for any of the PJQI subscales, while around a third were at risk for one PJQI subscale. Just over a quarter of workers were high risk on two or more PJQI subscales. These workers were classified as being at high risk overall for the PJQI. This subsequent grouping was used for all further analysis of the PJQI (Figure 1).

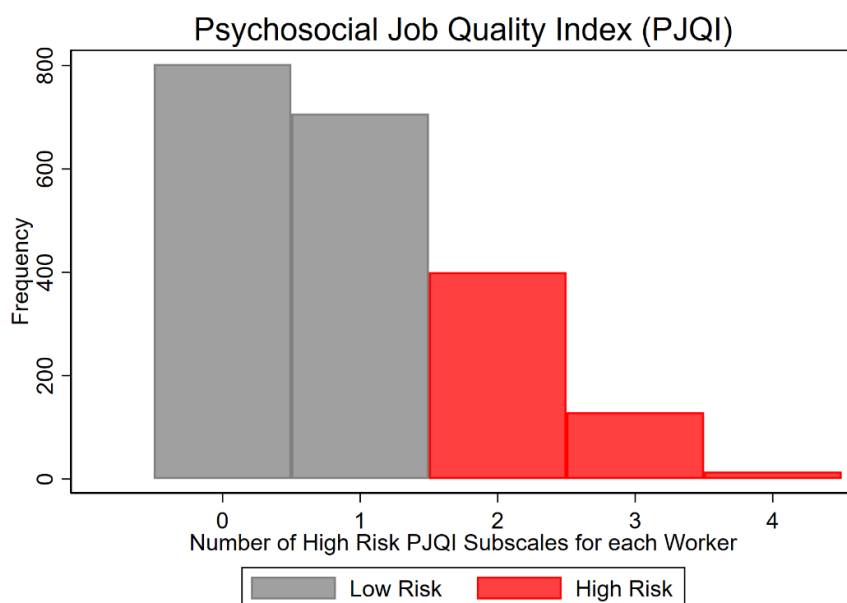


Figure 1. Distribution of risk scores on the Psychosocial Job Quality Index.

Chi-square analysis comparing PJQI risk scores with worker and workplace characteristics showed that workers with the following characteristics were more likely to be exposed to risks that may lead to work-related harm:

- Female gender
- Working in the Education and Training Industry
- Weekly household income less than \$1500
- Working from employer's worksite
- Working for a Government employer
- Employment contract fixed term, less than 1 year.

Business owners, workers completing at least a high school education, and those in the professional, scientific and technical services industry were statistically less likely to be rated as high-risk on the PJQI. These findings are broadly consistent with risks for workplace psychosocial harm reported in the research literature and thus our analysis provides face validity for the measure.

Organisational Performance Metric – Monash University (OPM-MU)

The OPM-MU has a single scale with a total score ranging from 8 to 40, as it contains eight separate items scored on a scale of 1 to 5. A lower score indicates higher overall risk. Figure 2 below presents a summary of the distribution of scores for the study sample, with the red section indicating the portion of the sample consider to be high-risk (scores of 26 or lower).

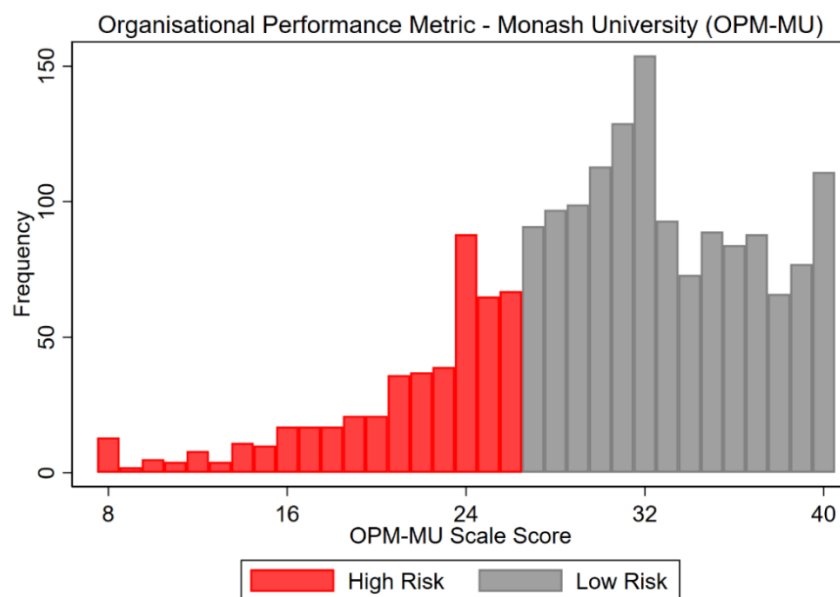


Figure 2. Distribution of scores on the Organisational Performance Metric – Monash University

Chi-square analysis comparing OPM-MU risk scores with worker and workplace characteristics showed that workers with the following characteristics were more likely to be exposed to risks that may lead to work-related harm:

- Female gender
- Weekly household income less than \$1500
- Working for a Government employer

Occupational Health and Safety Vulnerability Measure (OHS-VM)

The OHS-VM has four subscales that are combined to determine overall level of vulnerability. The first scale assesses exposure to workplace hazards, and the second, third and fourth subscales assess three types of resources that if they are present may reduce the effect of being exposed to hazards: OHS policies and procedures, OHS awareness and OHS empowerment.

A worker is considered to have inadequate access to these resources if they disagree or strongly disagree with one or more of the statements in these last three subscales, which are combined into an overall assessment of OHS Resource Adequacy. An overall vulnerability score is calculated by combining the Hazard Exposure and OHS Resources scores. A worker is considered most vulnerable to injury and illness when exposed to hazards in the workplace in combination with inadequate OHS resources. Figure 3 below presents the number of respondents reporting neither hazard exposure or inadequate resources (score of 0), one or either of hazard exposure or inadequate resources (score of 1) and both hazard exposure and inadequate resources (score of 2).

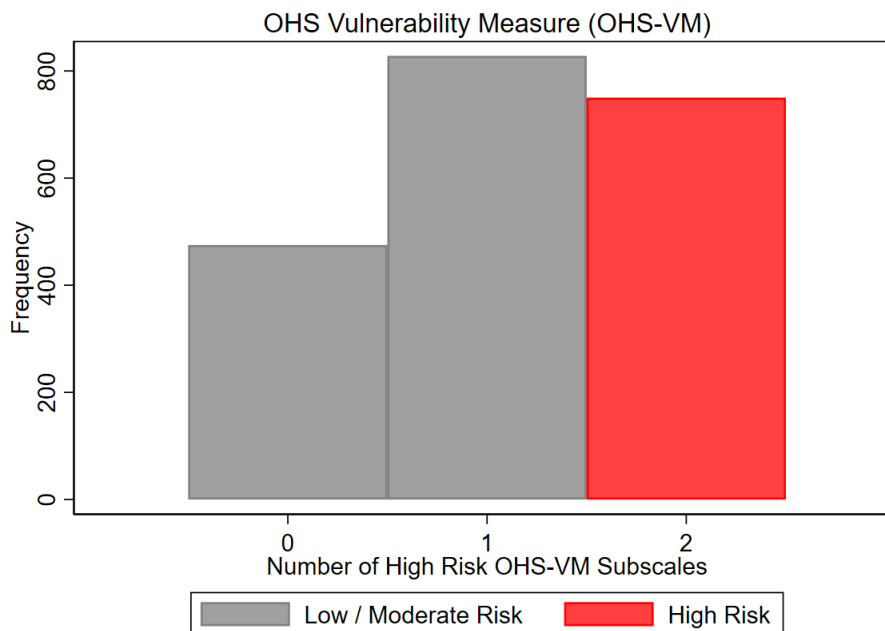


Figure 3. Distribution of risk scores on the OHS Vulnerability Measure.

Chi-square analysis comparing OHS-VM risk scores with worker and workplace characteristics showed that workers with the following characteristics were more likely to be exposed to risks that may lead to work-related harm:

- Male gender
- Age less than 35 years
- Being born in Australia
- Aboriginal or Torres Strait Islander status
- Working in the Retail Trade industry
- Reporting a profound or severe disability
- Weekly household income less than \$1500
- Working for multiple employers
- Occupation as a Technical and Trade Worker

- Working under 15 hours per week
- Working from employer's worksite
- Having two or more jobs

People working for a single employer, a large employer (200+ employees), in a professional occupation, workers with a tertiary education, a permanent employment contract, and those in the professional, scientific and technical services industry were statistically less likely to be rated as high-risk on the OHS-VM. These findings are broadly consistent with risks for workplace psychosocial harm reported in the research literature and thus our analysis provides face validity for the measure.

Neal and Griffin Safety Climate Subscale (NG-SCS)

The Neal and Griffin Safety Climate Subscale has three items each of which is rated on a 1 (strongly disagree) to 5 (strongly agree) scale, and produces an overall score ranging from 3 to 15. A higher score indicates a better safety climate in the workplace. Figure 4 below presents a summary of the distribution of scores for the study sample, with the red section indicating the portion of the sample consider to be high-risk (scores of 10 or lower).

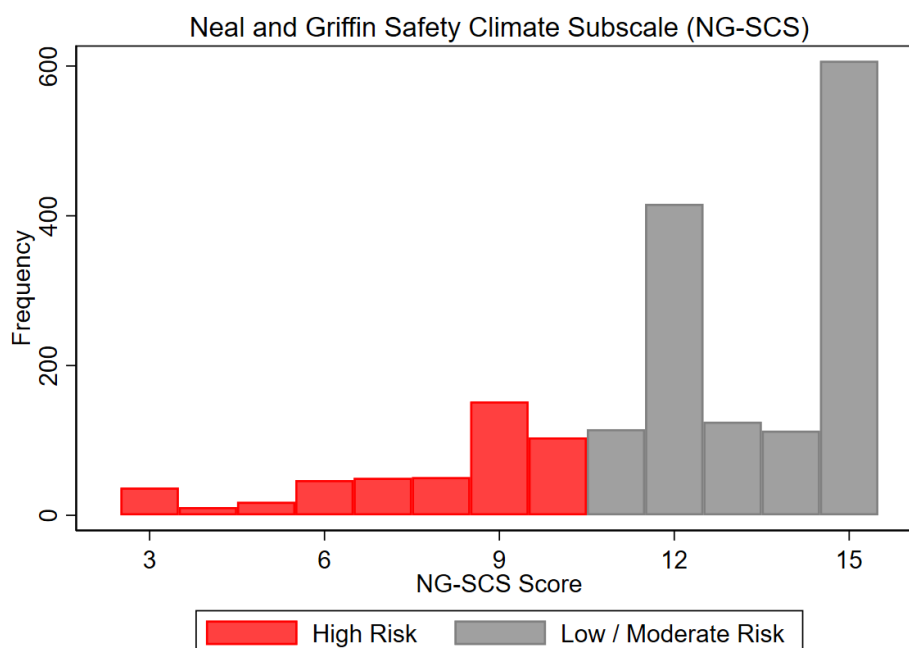


Figure 4. Distribution of scores on the Neal and Griffin Safety Climate subscale

Chi-square analysis comparing NG-SCS risk scores with worker and workplace characteristics showed that workers with the following characteristics were more likely to be exposed to risks that may lead to work-related harm:

- Weekly household income less than \$1500
- Working for multiple employers
- Having two or more jobs

People working for a large employer (200+ employees) were statistically less likely to be rated as high-risk on the NG-SCS.

Psychosocial Safety Climate (PSC-12)

The Psychosocial Safety Climate (PSC-12) is a twelve item scale each of which is rated on a 1 (strongly disagree) to 5 (strongly agree) scale, and produces an overall score ranging from 12 to 60. A higher score indicates a better psychosocial safety climate in the workplace.

The PSC-12 has four risk categories based on participant's responses. In the study sample two-thirds of participants were in the Low risk group with a further 6.7% in the Medium risk group. For further analysis in this study the High and Very High Risk groups were combined, into a single high risk group. The Medium and Low Risk groups were also combined into a single group low/moderate risk group. This approach was used to ensure the approach to reporting high/low risk was consistent across the leading indicators scales included in the study. Figure 5 below presents a summary of the distribution of scores for the study sample, with the red section indicating the portion of the sample consider to be high-risk (scores of 36 or lower).

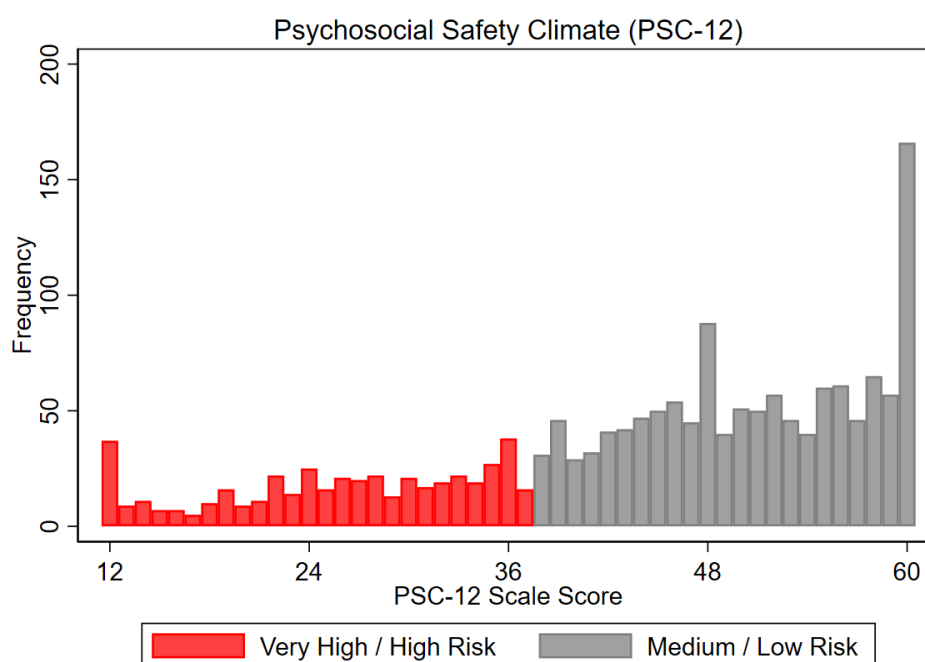


Figure 5. Distribution of scores on the Psychosocial Safety Climate scale

Chi-square analysis comparing PSC-12 risk scores with worker and workplace characteristics showed that workers with the following characteristics were more likely to be exposed to risks that may lead to work-related harm:

- Age over 35 years
- Working in the Education and Training Industry
- Working for a large employer (200+ employees)
- Working for a Government employer
- Job tenure greater than 12 months.

Business owners, and those in the professional, scientific and technical services industry were statistically less likely to be rated as high-risk on the PSC-12.

Summary – Characteristics of high risk jobs, workers and workplaces

Across the leading indicator measures, there was some consistency in the job, worker and workplace characteristics associated with higher risk of work-related harm and these are broadly consistent with the findings of previous studies [4-7], providing evidence of the face validity of the leading indicator measures assessed in this study:

- People whose household income was less than \$1500 per week were more likely to be rated as high risk on four of the leading indicator measures.
- Female workers were more likely to be rated as high-risk on the PJQI and the OPM-MU, whereas male workers were more likely to be considered high risk on the OHS-VM.
- Workers in the education and training industry were more likely to be rated as high risk on the PJQI and PSC-12, whereas those working in retail trade were more likely to be rated as high risk on the OHS-VM.
- Victorians working for government organisations were more likely to be rated as high risk on three of the five measures, the PJQI, the OPM-MU and the PSC-12.
- People working two or more jobs were more likely to be rated as high-risk on two of the measures.
- Those working for multiple employers were more likely to be rated as at risk on the OHS-VM, NG-SCS and OPM-MU.

SECTION 4: FREQUENCY OF LAGGING INDICATORS

Lagging indicators are measures of actual injury or illness, or events in the workplace that present a risk to worker health and safety. These are the things we typically measure but are attempting to prevent. This section presents the number of workers who reported physical injury, mental injury or workplace near-misses in the past 12 months, which we consider to be three important lagging indicators. We then examine the statistical relationship between scores on the leading indicator scales and these lagging indicators. A significant statistical relationship indicates that scores on the leading indicator measures are associated with worker reports of injury, illness or near misses. This is an initial but important step towards validation of the leading indicator measures as indicators of WHS risk.

Workers were asked if they had experienced a work-related physical or mental injury or illness in the past 12 months in their main job (yes/no question). If they answered yes, they were then asked a multi-choice question to indicate the type(s) of injury or illness.

Nearly one in five (19.1%) of Victorian workers in the study reported at least one work-related physical injury or illness in the past 12 months (Table 6). Almost one in four (24.9%) reported at least one work-related mental injury or illness. In addition to physical and mental injury, a total of 377 workers (18.4%) reported a near-miss in their main job over the past 12 months. All injuries are self-reported by the worker, and may not necessary have been diagnosed by a health professional. Workers were asked to report only injuries sustained at a worker's main job and that required time off work or medical treatment.

Table 6. Frequency and percentage of self-reported physical injury, mental injury or near miss in the past 12 months

Lagging Indicators	Frequency	Percentage
Physical injury / illness	393	19.1
Mental injury / illness	512	24.9
Near miss	377	18.4

Table 7 presents a breakdown of the types of physical conditions reported. The most commonly reported physical conditions were back or neck pain (7.4% of workers); arm, leg or shoulder pain (7.0%); cuts, bruising, crushing or amputation (6.1%); and muscle, tendon or ligament tears (3.6%). Other injuries and physical illnesses were less commonly reported, and included traumatic injury including fractures, dislocation and burns, as well as diseases such as respiratory disease, cancer, cardiovascular disease.

Table 7. Frequency and percentage of physical injury due to working in main job in the past 12 months.

Type of Physical Injury or Illness	Frequency	Percentage
Musculoskeletal injury (any)	272	13.2
Back or neck pain	151	7.4
Arm, leg or shoulder pain	143	7.0
Muscle, tendon or ligament tears	73	3.6
Joint pain/arthritis	53	2.6
Fracture	23	1.1
Dislocation	<10	0.4
Some other Musculoskeletal Injury	<10	0.2
Other injuries or illnesses		
Cuts, bruising, crushing or amputation	126	6.1
Burns	47	2.3
Eye or ear or nervous system disease	23	1.1
Skin disease	21	1.0
Injury to nerves or spinal cord	18	0.9
Digestive or Gut disease	17	0.8
Brain or head injury	13	0.6
Respiratory / Lung disease	13	0.6
Infection or parasites	12	0.6
Circulatory or Cardiovascular or Blood disease	10	0.5
Cancer	<10	<0.5
Intracranial Injuries	<10	<0.5
Any other diseases, injuries or illnesses	16	0.8

Note: Musculoskeletal injuries are listed separately as a specific question was asked about musculoskeletal conditions in the survey. Workers were able to report more than one type of physical injury or illness.

Table 8 presents a breakdown of the types of mental injury and illnesses reported. The most commonly reported mental injury was stress (19.1%) followed by anxiety (17.6%) and depression (10.6%). Less commonly reported were post-traumatic stress disorder, adjustment disorder and other mental health injury or illness.

Table 8. Frequency and percentage of mental injury or illness due to working in main job in the past 12 months.

Type of Mental Injury or Illness	Frequency	Percentage
Any mental health injury / illness	512	24.9
Stress	392	19.1
Anxiety	362	17.6
Depression	217	10.6
Post-traumatic stress disorder (PTSD)	50	2.4
Adjustment disorder	37	1.8
Other mental health injury / illness	31	1.5

Note: Workers were able to report more than one type of mental injury or illness.

SECTION 5: RELATIONSHIP BETWEEN LEADING AND LAGGING INDICATORS

Figures 8 to 10 below display the percentage of workers in the high-risk and low-to moderate-risk categories who reported physical injury, mental injury or near-misses in the past twelve months. Overall the figures show that a higher percentage of workers rated as 'high-risk' on the leading indicators measures (red bars) reported these lagging indicators in the past twelve months, than workers rated as 'low-risk'. This pattern is observed on all three lagging indicator measures: physical injury, mental injury and near-misses.

These figures also show that some leading indicator measures are better able to differentiate workers who report physical injury, while others are better at differentiating those who report mental injury. For example, 31% of workers rated as high risk on the OHS-VM also reported a physical injury or illness in the past 12 months, compared with 12% rated as low-risk (Figure 8). In contrast, for the PJQI these percentages were 27% (high risk) and 16% (low risk) for the physical injury outcome.

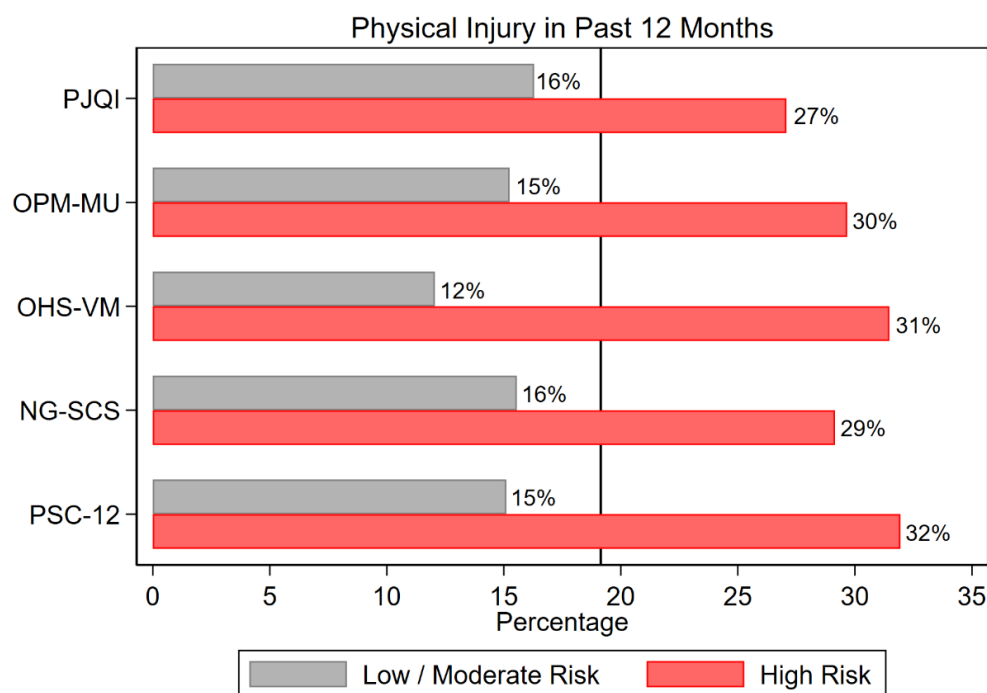


Figure 8. Percentage of workers in the low/moderate and high risk groups on each leading indicator scale reporting a physical injury in the past 12 months. Note: the overall prevalence of physical injury in the study was 19% (indicated by the black line in the figure).

For the mental injury lagging indicator, the PSC-12 showed the strongest ability to differentiate between groups, with 49% of those rated high risk reporting a mental injury in the past 12 months, compared to 19% of those rated as low risk. The PJQI also demonstrated a large differentiation, with 44% of those rated as high-risk reporting a mental injury or illness in the past 12 months, compared to 18% of those rated as low-risk (Figure 9). In contrast, to physical injury, the ability of the OHS-VM to differentiate people reporting a mental injury was less impressive.

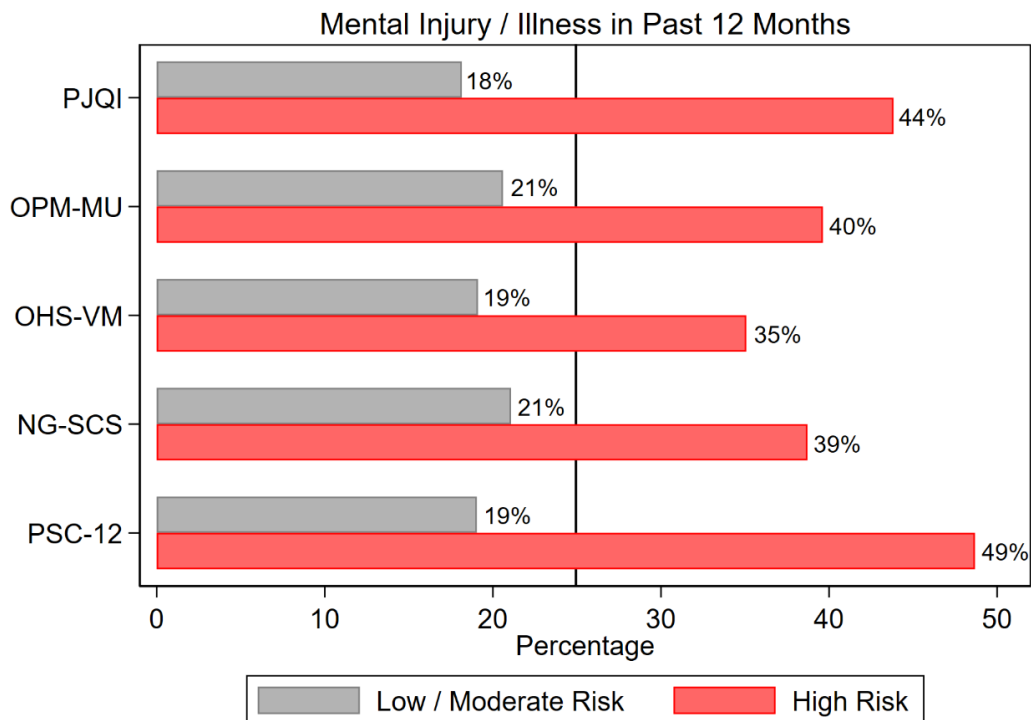


Figure 9. Percentage of workers in the low/moderate and high risk groups on each leading indicator scale reporting a mental injury in the past 12 months. Note: the overall prevalence of mental injury in the study was 25% (indicated by the black line in the figure).

For near-misses the OHS-VM showed the best ability to differentiate workers reporting a near miss in the past 12 months from those who did not report a near miss. On this scale, 32% of those rated as high risk also reported a physical injury or illness in the past 12 months, compared with 11% rated as low to moderate risk (Figure 10).

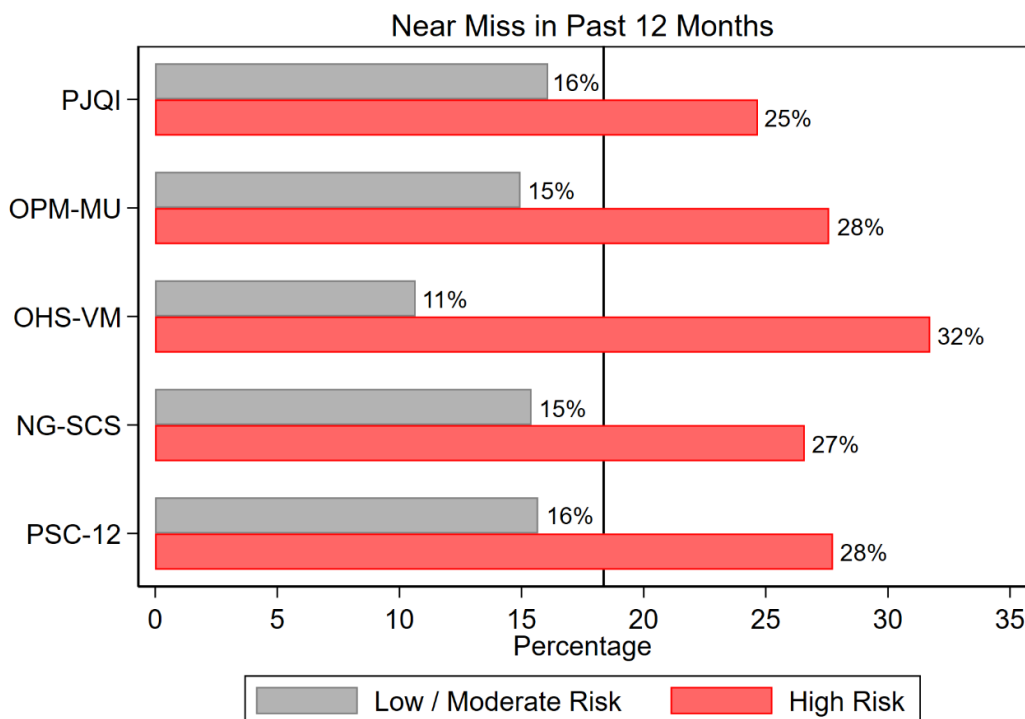


Figure 10. Percentage of workers in the low/moderate and high risk groups on each leading indicator scale reporting a near miss in the past 12 months. Note: the overall prevalence of a near miss in the study was 18% (indicated by the black line in the figure).

Odds of injury based on leading indicator score

The data presented in the preceding section are descriptive only. To determine if the differences in injury and near-miss reporting were statistically significant, and how big these differences are, we conducted binary logistic regression analysis. These regression models examined the association between risk category on the leading indicator measures and whether workers reported injury or near miss in the past 12 months. For these analyses, higher odds ratios indicate a stronger statistical association between the leading indicator risk category and whether a worker reported an injury or near miss. We report adjusted odds ratios, which means that our statistical estimates take into account the worker and workplace characteristics, in this case the workers age, gender, industry, occupation, employer size, and employer type.

The outcomes of these models are presented in the following 3 figures (Figures 11 to 13). Note that the X-axis on these graphs is a logarithmic scale.

All of the leading indicator measures were statistically significantly associated with whether workers reported a physical injury or illness in the past 12 months (Figure 11). Of the five leading indicator scales, the odds ratios were largest for the OHS-VM. This indicates that workers rated as high-risk on this scale had 2.87 times the odds of also reporting a physical injury or illness in the past 12 months, compared to workers rated as low-risk. Adjusted odds ratios on the other four leading indicators scales ranged from 1.88 for the PJQI to 2.69 for the PSC-12.

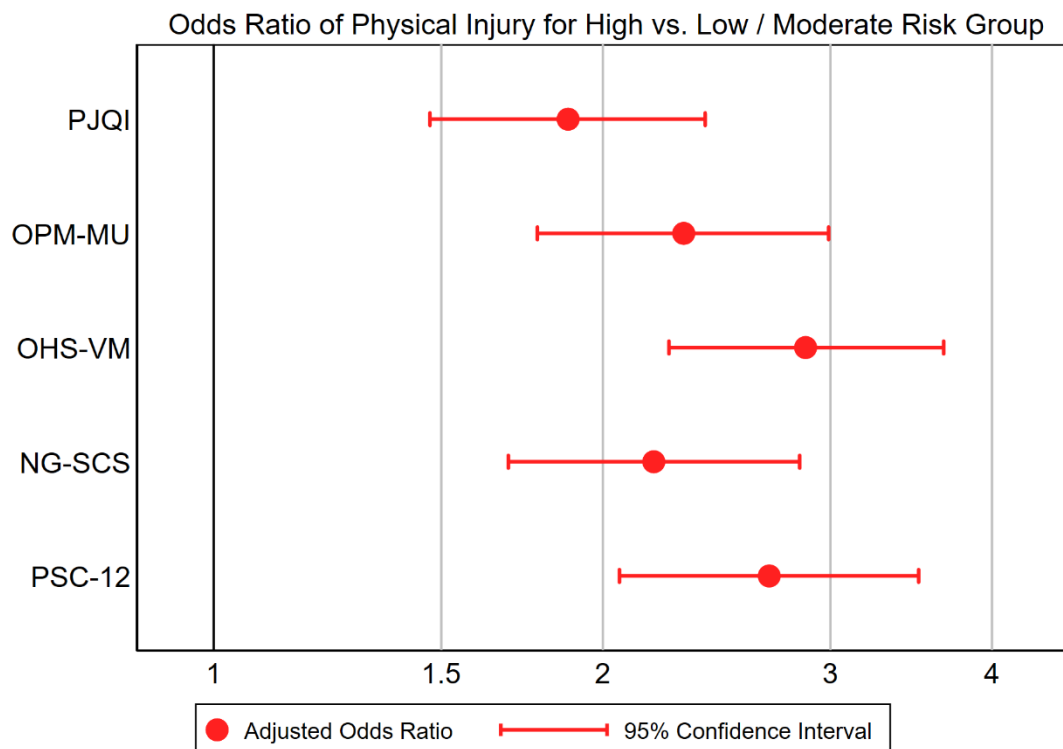


Figure 11. Odds of workers rated as high risk reporting a physical injury or illness compared to workers rated as low to moderate risk on each leading indicator measure. Note: Results are presented for regression models adjusted for age, gender, occupation, industry, employer size and employer type.

A different pattern is observed for the mental injury lagging indicator. All of the leading indicator measures were statistically significantly associated with whether workers reported a mental injury or illness in the past 12 months (Figure 12).

After adjusting for age, gender, industry, occupation, employer size, and employer type, the odds ratios were largest for the PSC-12 (3.98, 95% CI 3.11,5.10) followed closely by the PJQI (3.71, 95% CI 2.94,4.66), while the NG-SCS recorded the lowest adjusted odds ratio (2.43, 95% CI 1.91,3.08), followed by the OPM-MU and the OHS-VS.

These findings indicate that workers rated as high-risk on the PSC-12 scale had four times the odds of also reporting a mental injury or illness in the past 12 months, compared to workers rated as low-risk.

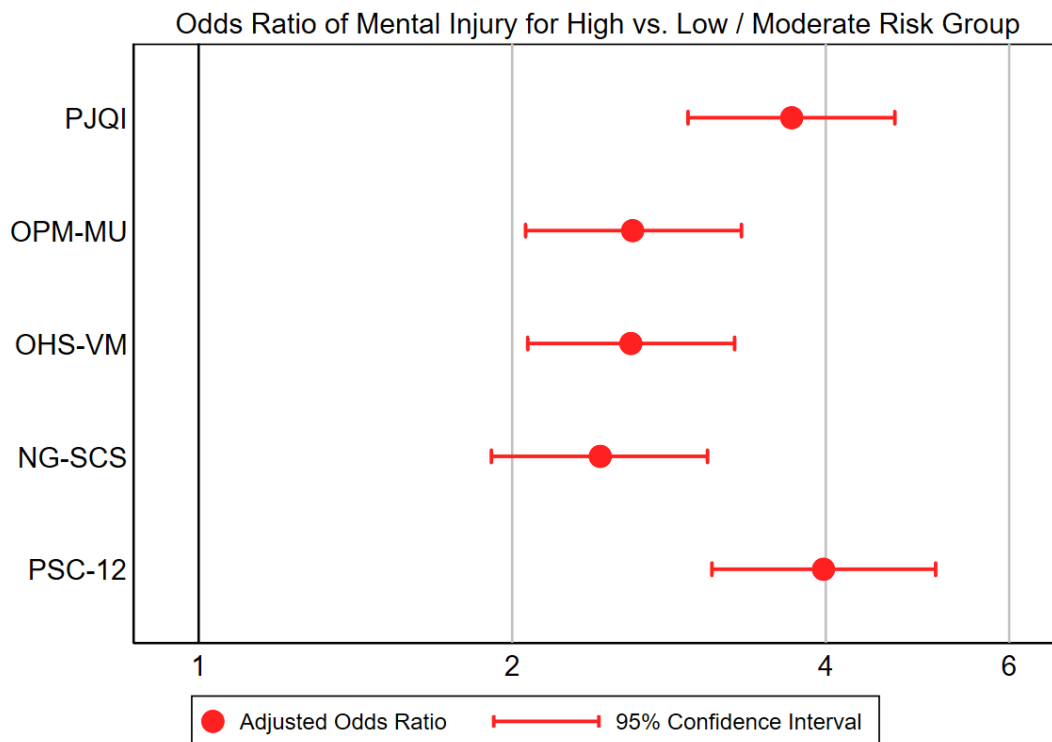


Figure 12. Odds of workers rated as high risk reporting a mental injury or illness compared to workers rated as low to moderate risk on each leading indicator measure. Note: Results are presented for regression models adjusted for age, gender, occupation, industry, employer size and employer type.

The results for the near-miss lagging indicator more closely resembles that observed for physical injury, however in this instance the OHS-VM has a clearer advantage over the other leading indicator scales. Once again, all of the leading indicator measures were statistically significantly associated with whether workers reported a mental injury or illness in the past 12 months (Figure 13).

Of the five leading indicator scales, the adjusted odds ratios were largest for the OHS-VM (3.01, 95% CI 2.34, 3.87). This indicates that workers rated as high-risk on this scale had three times the odds of also reporting a near miss in the past 12 months, compared to workers rated as low-risk. After adjusting for age, gender, industry, occupation, employer size, and employer type, the odds ratios on the other four leading indicator measures ranged from 1.78 for the PJQI to 2.22 for the OPM-MU.

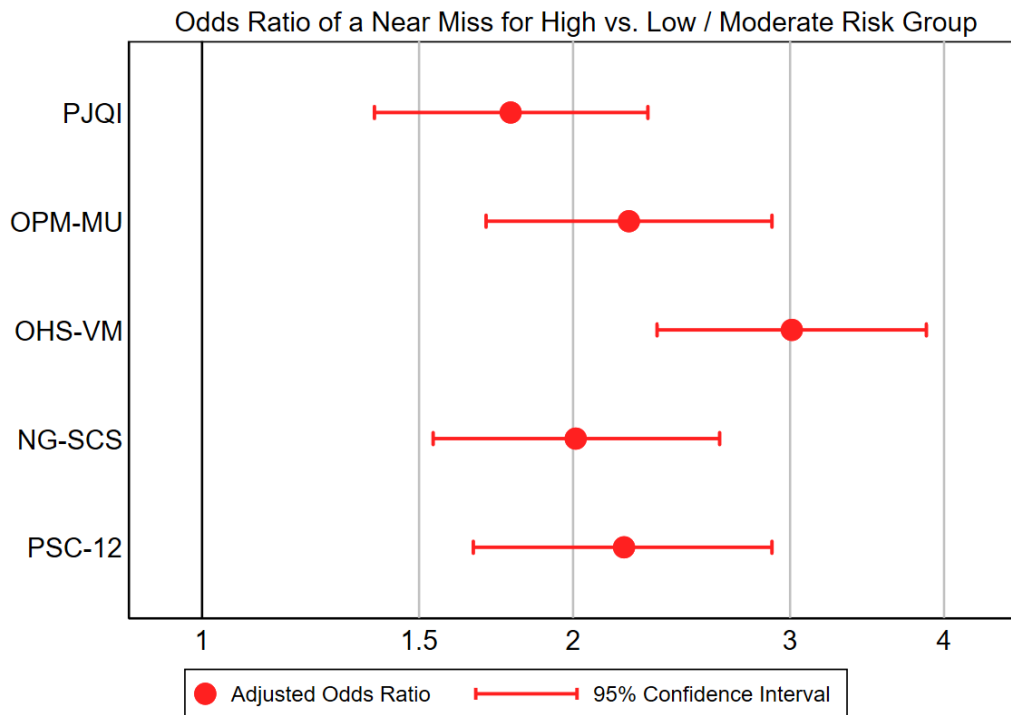


Figure 13. Odds of workers rated as high risk reporting a near miss compared to workers rated as low to moderate risk on each leading indicator measure. Note: Results are presented for regression models adjusted for age, gender, occupation, industry, employer size and employer type.

REVISING THE QUESTIONNAIRE

WorkSafe requested that Monash make recommendations for refining the leading indicator questionnaire for potential future use, in order to ensure that the effort and costs involved in future data collection provide the greatest value. We have provided a revised questionnaire at Appendix C. The changes proposed below have resulted in a ~30% reduction in the number of items (questions) contained in the questionnaire.

Leading indicators

We assessed the performance of the leading indicator measures in this study on four criteria, including:

1. the percent of workers completing that measure,
2. the breadth of associations with worker and job characteristics,
3. the strength of association with lagging indicators, and
4. whether the measure identified a distinct group of workers as being at risk (relative to other measures).

A summary of these comparisons is provided in the table below. Cells in dark green indicate a high rating on each criterion, cells in light green a moderate rating, and cells in grey a low rating.

The PJQI and OHS-VM were the only leading indicator measures completed by 100% of workers in the study sample. The other measures all contained items/questions that were not appropriate for use with sole-traders, a sub-group which comprised 10% of the study sample. On the PSC-12 data from a further 7% of the sample was not able to be used in analysis as participants provided don't know / not applicable responses.

The OHS-VM displayed the greatest number of associations with worker and job characteristics, followed by the PJQI and PSC-12. The strongest associations with the lagging indicators were observed on the OHS-VM for physical injury and near-misses, and the PJQI and PSC-12 for mental injury. Finally, the OHS-VM identified the most distinct group of high-risk workers, displaying the least overlap with the other leading indicator scales, followed by the PJQI (Appendix B).

Measure	Percent workers completing measure (higher % is better)	Association with worker and job characteristics	Association with lagging Indicators	Overlap in high-risk groups (less overlap is better)
PJQI	100%	Some	Strong (mental injury)	64% to 72%
OPM-MU	90%	Few	Moderate	68% to 86%
OHS-VM	100%	Many	Strong (physical injury & near miss)	61% to 68%
NG-SCS	90%	Few	Moderate	66% to 86%
PSC-12	83%	Some	Strong (mental injury)	66% to 80%

Based on this assessment, we recommend inclusion of the PJQI and the OHS-VM for future application of the questionnaire, as these two measures displayed the best performance on these criteria.

Demographic items and lagging indicators

We have also reviewed items contained in the two other sections of the questionnaire, being the lagging indicators and the socio-demographic (worker and workplace characteristics) questions.

For these questions we re-assessed the wording and response scales of the items, respondent completion rates and the results of our statistical analysis to identify improvements to administration and potential to reduce item length. We have suggested revisions to the following items:

- Data on disability status was collected in a way that did not enable comparison with the labour force. We have suggested modification to this item to make it consistent with benchmark questions and enable more accurate comparison with workforce data.
- The question 'If all of a sudden you need to access \$2000 for something important, could the money be obtained within a week?' is recommended for removal. While financial reserves may be related to a worker's willingness to work in sub-optimal conditions, this question may not have as much utility for WorkSafe in targeting workers and workplaces as the question asking about household income.
- The lagging indicator 'To what extent has your health limited your ability to perform your normal work duties or to work your normal hours', is recommend for removal. This question is more about general health than work-related health. Inclusion may depend on WorkSafe's interest in understanding less serious injuries or illnesses and health problems that may not result in time loss.
- The lagging indicator 'Do you ever worry that you will end up getting injured or ill doing your current job'. This question does not report an actual outcome (eg. an injury, illness, or near miss occurring). This type of concern about getting injured or ill at work is also measured in the leading indicator scales.

Questionnaire administration

There are many points to consider in the administration of any survey. In order to outline the issues for consideration in any future administration of the questionnaire, we reviewed the recruited sample and the technical report provided by Roy Morgan. We make the following observations

Response mode

The survey was conducted using a mixed response mode, with most respondents completing an online survey but a substantial portion also completing the questionnaire via telephone. This was a practical decision to ensure that sufficient responses were obtained within the study timeframe and budget, and to ensure that a diverse sample of workers were included in the study, including groups who are more likely to respond in one mode than another.

Time and resource constraints are likely to be encountered in any future administration of the survey. We also understand that WorkSafe aims to include diverse groups of workers in any future questionnaire, and thus a mixed response mode would seem to be appropriate in future. It is important to note that choice of response mode introduces selection bias (i.e., some people are more likely to respond in one mode or another) and response bias (i.e., when scores on items differ based on the mode of response). It is possible to adjust for these with analytical techniques such as statistical adjustment and weighting.

Sample recruitment

Budgetary considerations for future survey delivery should consider whether funds need to be spent specifically to recruit target populations that are harder to engage, and smaller groups that are of specific interest to WorkSafe. Some groups of workers, such as younger workers, are more easily engaged online, and can be recruited at less cost.

In order to engage a more diverse group of workers in future studies, WorkSafe should consider offering the questionnaire in languages other than English. Workers not able to complete the questionnaire in English were effectively excluded from the current study, as alternative language versions were not available. This will have time and cost implications that need to be considered.

We also note that some target groups of interest such as non-binary and Aboriginal and Torres Strait Islander workers were not collected in a large enough number to enable analysis. Specific strategies to target these groups may be required in future to obtain a useful sample size. Strategies such as targeted advertising and/or incentives may be required. Engaging with organisations that represent or advocate for these groups in the workplace could also help increase participation. WorkSafe making clear that they have specific interest in assessing the risk of these groups as well as having buy-in from organisations that these workers trust may increase not only participation but may help workers feel more comfortable disclosing their ethnicity or gender identity. Survey mode may also affect likelihood of completion and/or disclosure, in our sample a higher percentage of Aboriginal and Torres Strait Islander and non-binary individuals participated online compared to on the telephone. Expert advice from a social / market research company would be valuable to inform these targeting strategies.

Licensing the leading indicator measures

The two leading indicator measures we have recommended for use in future questionnaire have been developed and validated using with specific wording and response options. Changes to any elements of these measures would require further testing to ensure they remain valid for their intended purpose.

We also note that the OHS-VM is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License (CC BY-NC-ND 4.0: <http://creativecommons.org/licenses/by-nc-nd/4.0/>).

This means that non-commercial use of this measure is authorised on the following conditions:

- Attribution – Licensees will be required to give appropriate credit to the Institute of Work and Health (as creator of the original OHS-VM).
- Non-commercial – Licensees will only be able to use the OHS-VM for non-commercial purposes.
- No-derivatives – If a licensee remixes, transforms or builds upon the OHS-VM the licensee will not be able to distribute that derivative of the OHS-VM

For this study we received permission to use the OHS-VM from its developer, the Institute of Work and Health in Toronto. In any future questionnaire WorkSafe is advised to seek permission to use the OHS-VM under the same licensing conditions.

The PJQI was developed as part of the Household Income and Labour Dynamics in Australia (HILDA) survey led by the Melbourne Institute of Applied Economic and Social Research at the University of Melbourne. While the PJQI is freely available for use in research projects such as this, WorkSafe is advised to review any licensing conditions associated with use of the PJQI required by HILDA and the Melbourne Institute.

SUMMARY OF FINDINGS

This study tested a questionnaire containing five measures of WHS leading indicators, designed by WorkSafe in collaboration with Monash University and Roy Morgan, in a large sample of Victorian workers with diverse personal, job and workplace characteristics. The primary purpose of the questionnaire tested in this study is to identify the characteristics of workers and workplaces exposed to risks that may lead to work-related harm. The outcome of this study is that two of the measures appear to be most suitable for future use in a refined questionnaire for the specific purposes of identifying at-risk workers. However, we recommend further validation and testing of the refined questionnaire as an important next step.

The questionnaire included five different leading indicator measures that had been previously described in the research literature. Across these measures, 25% to 36% of workers were rated as being at high-risk for workplace injury or illness, with the remainder rated as low to moderate risk.

Multiple worker, job and workplace characteristics were statistically associated with high risk ratings on the leading indicator measures. Females were more likely to report psychosocial risk and males more likely to report physical health risks.

Workers were more likely to be rated as high-risk if they:

- held multiple jobs or worked for multiple employers,
- reported weekly household income below \$1500,
- worked for a Government employer,
- worked in the education and training or retail trade industries, or
- predominantly worked at the worksite of their employer.

Workers were more likely to be rated as low to moderate risk if they:

- were a business owner;
- worked for a single employer;
- worked in professional, scientific and technical services industry; or
- had higher levels of education.

The questionnaire also collected data on lagging indicators of WHS. For this report we analysed the data relating to whether workers reported experiencing a physical injury, mental injury or workplace near-miss over the past twelve months. Within the study sample:

- 19% of workers reported a physical injury in the past 12 months
- 24% reported a mental injury, and
- 18% reported a near miss in their workplace.

The most commonly reported physical injuries were musculoskeletal disorders such as back/neck pain (7.4%) and shoulder/limb pain (7.0%), followed by cuts, bruising, crushing or amputation (6.1%); with fewer workers reporting other physical injuries in the past twelve months. The most commonly reported mental injuries were stress (19.1%) and anxiety (17.6%), with fewer workers reporting depression (10.6%) or other mental injury/illness in the past twelve months.

Scores on all of the leading indicator measures showed positive and statistically significant associations with lagging indicators. This means that those rated as high-risk on the leading indicator measures were more likely to also report work-related physical injury, mental injury or workplace near-misses over the previous twelve

months. Some leading indicator measures displayed stronger association with lagging indicators than others. Specifically:

- The OHS-VM demonstrated the strongest relationship with self-reported physical injury. People rated as high-risk on this scale were 2.9 times more likely to report a physical injury in the past 12 months, than people rated as low to moderate risk.
- The PJQI demonstrated the strongest relationships with self-reported mental injury. People rated as high-risk on this scale were 4.0 times more likely to report a mental injury in the past 12 months, than people rated as low to moderate risk.
- The OHS-VM also demonstrated the strongest relationship with near misses in the workplaces. People rated as high-risk on this scale were 3.0 times more likely to report a near miss in the past 12 months, than people rated as low to moderate risk.

STRENGTHS AND LIMITATIONS

Strengths of the study include the large sample of 2053 Victorian workers with a diverse range of social, demographic, job and workplace characteristics. The leading indicator questionnaire was developed using a robust approach that involved review of existing evidence and research literature, input from experts and intended end-users of the research. The questionnaire was refined through an iterative approach that included multiple rounds of feedback and refinement between Roy Morgan, WorkSafe and Monash University and incorporated insights from early test administration.

Monash received only completed surveys for analysis, which means that we are unable to perform analysis of participant response rate (i.e., what proportion of the people invited to participate did take part), or survey completion rates (i.e., how many of the people who took part completed the survey), which are two important measures of the appropriateness of surveys. This meant that it was not also possible for Monash to compare the characteristics of those who refused or who did not complete the survey with those who completed the survey. Such analysis may provide insights into what people are more likely to refuse or produce incomplete responses. In their study technical report, Roy Morgan reports a response rate on the CATI survey of 2% from all calls made or 7.8% from calls that were answered, and a crude response rate of 4.8% for the online Roy Morgan sample. In summary, most potential respondents contacted did not participate.

Study participants represent a diverse cross-section of the Victorian workforce. The sample was broadly representative of the Victorian labour force, and therefore the results are likely broadly representative of the population. However, there are a number of differences between the study sample and the Victorian workforce in age and gender distribution, education, cultural background, disability status and industry. This means that some workers and workplaces were underrepresented. Some target groups of interest such as non-binary and Aboriginal and Torres Strait Islander workers were not collected in a large enough number to enable analysis. Data on disability status was collected in a way that did not enable comparison with the labour force. Injury and illness were all self-reported, and so reported conditions may not have been medically diagnosed.

The study data is from a single survey which means that it was not possible to determine the test-retest reliability of the questionnaire. This requires a second administration of the questionnaire with the same participants. Because this is a cross-sectional study, lagging indicator data were collected retrospectively (i.e., people were asked to think about injury or illness in the *previous* 12 months). Further validation studies with prospective collection of lagging indicator data (i.e., at 3, 6 or 12 months after the leading indicators questionnaire data are collected) would be required to further validate the predictive ability of the questionnaire (see next steps section).

It should also be noted that data were collected as Victoria was re-opening following the extended COVID-19 lockdown during winter/spring 2021, and thus the working circumstances, and the associated risks to worker

health and safety, likely differ from those observed under other circumstances. Nearly half (44.0%) of the study sample reported that their primary working location over the past week had been their home, with 41.3% reporting their primary working location being the worksite of their employer. This reflects the disruptive nature of the COVID-19 restrictions and working from home directives in place within Victoria during the period in which data was collected. We note that risks to WHS are likely to differ in home-based working environments from other environments, and thus the findings of this study should not be generalized to reflect pre-COVID or potentially future COVID “normal” circumstances.

RECOMMENDATIONS FOR FUTURE VALIDATION AND USE

This study has been an initial testing and validation study of a questionnaire including five measures of WHS leading indicators. It has demonstrated that it is feasible to survey a large sample of Victorian workers using such a questionnaire. We tested assessed five measures of leading indicators, and on the basis of our analysis have recommended two of the measures for future use in a survey for the specific purpose of identifying at-risk workers and workplaces. Prior to adoption of the refined questionnaire, there are a number of further steps in the validation process that would be valuable. These include, for example:

1. Determining the ability of the revised leading indicator questionnaire to predict future workplace injury or illness. As the primary goal of questionnaire is to predict future injury or illness, research that involves collection of leading indicator data in a sample and then following that sample over time, would help to address this important question. This would also enable WorkSafe to test the predictive value of the questionnaire, and in which workers and workplaces the questionnaire works best. This study would also enable refinement of the way in which high and low risk categories are defined on the leading indicator measures, so that the ‘cut-point’ applied has the optimal predictive ability. Some of the measures used in this study have been included in such validation studies in other jurisdictions (e.g., the OHS-VM was used in a similar study in Canada), and these studies provide a template for a similar initiative in Victoria.
2. Determining whether the leading indicator measures are reliable. It is important that the leading indicator measures assess the same thing every time they are used. This is because unexpected variation in scores means the measures will be less valuable in monitoring trends and changes in WHS leading indicators over time in the Victorian workforce, which we understand as their intended use by WorkSafe. The most appropriate way of evaluating reliability is to administer the leading indicator measures to the same sample of workers at two different points in time (test-retest reliability).
3. Determining if and how the questionnaire can be used in groups of ‘hard to reach’ workers or workplaces. We note that the sample recruited for this study had an over-representation of workers in some categories and an under-representation in others (e.g., in some industry sectors). Some parts of the workforce are hard to reach, for example people whose English language fluency is low. These groups may also face unique risks to their health and safety at work. Studies to understand if and how the questionnaire can be used in such groups may be helpful to form a more complete picture of WHS risk across the Victorian workforce.
4. Determining how use of leading indicator data can inform WHS prevention activities such as targeting of compliance and enforcement activity, or education and awareness campaigns. Ultimately, we understand that WorkSafe may wish to use data from the leading indicator questionnaire to inform WHS regulatory activity. For example, the data from this tool could be used to inform the revision and/or development of targeted inspector training and educational material for employers in managing the key risks. The use of the leading indicator data in informing prevention activities could also be evaluated to assess how it is communicated and used by the WHS regulator, how it influences

regulatory activity, and the impacts of the activities. There are a number of research and evaluation designs that may be applied to assess this including prospective and retrospective assessment.

5. The leading indicators questionnaire could be used to complement the existing suite of tools in WorkSafe prevention initiatives, such as the WorkWell Program, and to inform and support other data collection activities. WorkSafe could use the leading indicators questionnaire to inform its prevention approaches and to contribute to comprehensive understanding of WHS across Victoria.
6. Communication of WHS leading indicator data. The results from the leading indicators questionnaire can be used to inform WHS activity in workplaces and by workers. It would be valuable to understand how this information can best be communicated to these key target audiences, and what sort of information, or method of presentation, is most likely to lead to positive changes in WHS attitudes and behavior.

In addition to these observations of potential next steps, if a follow-up were to occur it would have three main benefits:

1. It would allow WorkSafe to determine with much greater accuracy the ability of the leading indicator survey to predict later workplace injury or illness (see the first item under next steps above).
2. It would allow WorkSafe to test the reliability of the leading indicators survey (i.e., the extent to which they measure the same thing over time). See the second item under next steps above.
3. Because the first survey was conducted when a lot of Victorians were working remotely (>40% of the sample), and assuming that more people are back in their usual workplace during 2022, it would potentially allow WorkSafe to test the different WHS risks in home vs other workplace environments. This is sort of a 'natural experiment' that might be possible, and would potentially provide a lot of useful information on differences in risks for injury and illnesses depending on where people are working. There is very little quality information on this available at the moment, so these data would be of great value, particularly given expectations that working from home will remain common for years to come.

REFERENCES

1. Government of Alberta., *Leading indicators for workplace health and safety: A user guide*. 2015: Edmonton, Alberta.
2. McKimmie, A., et al., *Leading indicators to identify Victorian workers at risk of work-related harm*. 2021, Healthy Working Lives Research Group, Monash University: Melbourne, Victoria.
3. Roy Morgan, *Leading Indicators Research: Technical Report (Released November 2021)*. 2021, Roy Morgan: Melbourne.
4. Butterworth, P., et al., *The psychosocial quality of work determines whether employment has benefits for mental health: results from a longitudinal national household panel survey*. *Occup Environ Med*, 2011. **68**(11): p. 806-12.
5. Shea, T., et al., *Leading indicators of occupational health and safety: An employee and workplace level validation study*. . *Safety Science*, 2016. **85**: p. 293-304.
6. Smith, P.M., et al., *The development of a conceptual model and self-reported measure of occupational health and safety vulnerability*. *Accid Anal Prev*, 2015. **82**: p. 234-43.
7. Neal, A. and M.A. Griffin, *A Study of the Lagged Relationships Among Safety Climate, Safety Motivation, Safety Behavior, and Accidents at the Individual and Group Levels*. *Journal of Applied Psychology*, 2006. **91**: p. 946-953.
8. Zadow, A.J., et al., *Psychosocial safety climate, emotional exhaustion, and work injuries in healthcare workplaces*. *Stress Health*, 2017. **33**(5): p. 558-569.

APPENDICES

APPENDIX A. LEADING INDICATOR MEASURES USED IN THE SURVEY

Please note that a complete version of the proposed revised questionnaire is provided at Appendix C. This appendix only presents the items contained in the five leading indicator measures.

Psychosocial Job Quality Index

A. Job demands and complexity

1. My job is more stressful than I had ever imagined.
 2. My job is complex and difficult.
 3. My job often requires me to learn new skills.
 4. I use many of my skills and abilities in my current job.
-

B. Job control

1. I have a lot of freedom to decide how I do my own work.
 2. I have a lot of say about what happens on my job.
 3. I have a lot of freedom to decide when I do my work.
-

C. Job security

1. I have a secure future in my job.
 2. The company I work for will still be in business 5 years from now.
 3. I worry about the future of my job.
-

D. Effort reward fairness

1. I get paid fairly for the things I do in my job.
-

OPM – Monash University

1. Formal OHS audits at regular intervals are a normal part of our workplace.
 2. Everyone at this workplace values ongoing OHS improvement in this workplace.
 3. This workplace considers health and safety at least as important as production and quality in the way work is done.
 4. Workers and supervisors have the information they need to work safely.
 5. Employees are always involved in decisions affecting their health and safety.
 6. Those in charge of OHS have the authority to make the changes they have identified as necessary.
 7. Those who act safely receive positive recognition.
 8. Everyone has the resources and or equipment they need to complete their work safely.
-

OHS Vulnerability Measure

A. Exposure to hazards

1. Have to manually lift, carry, or push items heavier than 20 kg at least 10 times a day
2. Have to do repetitive movements with your hands or wrists (packing, sorting, assembling, cleaning, pulling, pushing, and typing) for at least 3 hours during the day.
3. Have to perform work tasks, or use work methods that you are not familiar with.
4. Interact with hazardous substances such as chemicals, flammable liquids, and gases.
5. Have to work in a bent, twisted, or awkward posture.
6. Work at a height that is 2 metres or more above the ground or floor.
7. Work in noise levels that are so high that you have to raise your voice when talking to people less than 1 metre away.
8. Have you been bullied or harassed at work?
9. Have to stand for more than 2 hours in a row.

B. OHS policies and procedures (PP)

1. Everyone receives the necessary H&S training when starting a job, changing jobs or using a new technique.
2. There is regular communication between employees and management about safety issues.
3. Systems are in place to identify, prevent, and deal with hazards at work.
4. There is an active and effective health and safety committee, and or health and safety representative.
5. Incidents and accidents are investigated quickly in order to improve workplace health and safety.
6. Communication about workplace health and safety procedures is done in a way I can understand.
7. This workplace considers health and safety at least as important as production and quality in the way work is done.

C. OHS awareness (AW)

1. I am clear about my rights and responsibilities in relation to workplace health and safety.
2. I am clear about my employer's rights and responsibilities in relation to workplace health and safety.
3. I know how to perform my job in a safe manner.
4. If I became aware of a health or safety hazard at my workplace, I know who (at my workplace) I would report it to.
5. I have the knowledge to assist in responding to any health and safety concerns at my workplace.
6. I know what the necessary precautions are that I should take while doing my job.

D. OHS empowerment (EM)

1. I feel free to voice concerns or make suggestions about workplace health and safety at my job.
 2. If I notice a workplace hazard, I would point it out to management.
 3. I know that I can stop work if I think something is unsafe and management will not give me a hard time.
 4. If my work environment was unsafe, I would not say anything and hope that the situation eventually improves (responses required here are agree and strongly agree so as to maintain the same meaning as the other outcomes).
 5. I have enough time to complete my work tasks safely.
-

Psychosocial safety climate (PSC-12)

1. In my workplace senior management acts quickly to correct problems/issues that affect employees' psychological health.
 2. Senior management acts decisively when a concern of an employees' psychological status is raised.
 3. Senior management show support for stress prevention through involvement and commitment.
 4. Psychological well-being of staff is a priority for this organisation.
 5. Senior management clearly considers the psychological health of employees to be of great importance.
 6. Senior management considers employee psychological health to be as important as productivity.
 7. There is good communication here about psychological safety issues which affect me.
 8. Information about workplace psychological well-being is always brought to my attention by my manager/supervisor.
 9. My contributions to resolving occupational health and safety concerns in the organisation are listened to.
 10. Participation and consultation in psychological health and safety occurs with employees', unions and health and safety representatives in my workplace.
 11. Employees are encouraged to become involved in psychological safety and health matters.
 12. In my organisation, the prevention of stress involves all levels of the organisation.
-

Neil & Griffin Safety Climate Subscale

1. Management places a strong emphasis on workplace health and safety
 2. Safety is given a high priority by management
 3. Management considers safety to be important
-

APPENDIX B: DATA TABLES

Supplementary Table 1. Worker characteristics and benchmark data from Victorian working population

Worker characteristics	Survey Data		Victorian Benchmark	
	Frequency	Percent	Expected Frequency	Percent
Total N respondents	2,053	100		
Gender				
Male	1002	48.8	1080	52.6
Female	1035	50.4	973	47.4
Non-binary	16	0.8	Not reported	Not reported
Chi ² p-value				0.03
Age (years)				
15-24	246	12.0	286	13.9
25-34	536	26.1	489	23.8
35-44	520	25.3	454	22.1
45-54	368	17.9	437	21.3
55-64	299	14.6	301	14.6
≥65	84	4.1	85	4.2
Chi ² p-value				0.01
Highest level of education				
Postgraduate degree	596	29.0	225	10.9
Bachelor degree	583	28.4	459	22.4
Advanced diploma and diploma	246	12.0	236	11.5
Certificate III and IV	254	12.4	371	18.1
Completed high school	221	10.8	347	16.9
Did not complete high school	140	6.8	309	15.0
Don't know / Prefer not to say	13	0.6	105	5.1
Chi ² p-value				<0.001
Country of Birth				
Australia	1576	76.8	1391	67.8
Outside Australia	471	22.9	631	30.8
Prefer not to say / Not stated	6	0.3	30	1.4
Chi ² p-value				<0.001
Aboriginal or Torres Strait Islander Status				
Non-Indigenous	1921	93.6	2030	98.9
Aboriginal or Torres Strait Islander	45	2.2	12	0.6
Don't know / Prefer not to say	87	4.2	11	0.6

Chi ² p-value				<0.001
Industry				
Health care and social assistance	291	14.2	257	12.5
Retail trade	202	9.8	210	10.2
Education and training	275	13.4	178	8.6
Construction	121	5.6	171	8.3
Professional, scientific and technical	200	9.7	163	8.0
Manufacturing	113	5.5	160	7.8
Accommodation and food service	87	4.2	135	6.6
Public administration and safety	106	5.2	108	5.3
Financial and insurance services	116	5.7	80	3.9
Other	542	26.4	590	28.7
Chi ² p-value				<0.001
Disability Status				
No profound or severe core activity limitation	1891	92.1	2012	98.0
Profound or severe core activity limitation	162	7.9	16	0.8
Not stated	0	0.0	25	1.2
Chi ² p-value				<0.001
Household income (in the last week)				
Household income less than \$1500	789	38.4	Not reported	Not reported
Household income at least \$1500	917	44.7	Not reported	Not reported
Don't know / Prefer not to say	347	16.9	Not reported	Not reported

Supplementary Table 2. Workplace and Job Characteristics of Study Participants

Workplace and Job Characteristics	Frequency	%
Current Work Situation (more than one response allowed)		
Own a business with employees	89	4.3
Work for myself (sole trader)	207	10.1
Work for one employer	1637	79.7
Work for multiple employers	174	8.5
Work for a labour hire employer	28	1.4
Some other arrangement	13	0.6
Occupation		
Managers	312	15.2
Professionals	710	34.6
Technicians and Trades Workers	169	8.2
Community and Personal Service Workers	195	9.5
Clerical and Administrative Workers	256	12.5
Sales Workers	143	7
Machinery Operators and Drivers	75	3.7
Labourers	113	5.5
Unable to code / Not stated	80	3.9
Number of hours worked (in the last week at main job)		
<1	134	6.5
1-14	211	10.3
15-34	533	26
35+	1175	57.2
Location of work (in the last week)		
At the worksite of your employer	847	41.3
At your home	903	44
Other	217	10.6
Did not work in main job in last week	86	4.2
Employer Size		
1-4	258	12.6
5-19	321	15.6
20-199	460	22.4
200+	874	42.6
Don't know	140	6.8
Employer Type		
Government organisation	476	23.2

Private, for profit organisation	1302	63.4
Not-for-profit organisation	201	9.8
Other	74	3.6
Employment Contract		
Permanent	1390	67.7
Fixed term, 1 year or more	144	7
Fixed term, less than 1 year	68	3.3
Temporary	26	1.3
Casual	244	11.9
None – I don't have an employment contract in my main job	166	8.1
Don't know	15	0.7
Time working in current role		
Less than 12 months	449	21.9
12 months or more	1604	78.1
Number of jobs worked		
One	1919	93.5
Two	90	4.4
Three or more	44	2.1

Supplementary Table 3. Percentage of workers classified as high risk on each leading indicator measure, by demographic characteristics

	Leading Indicator Measure				
	PJQI	OPM-MU	OHS-VM	NG-SCS	PSC-12
Overall percentage classified as high risk	26.4	26.1	36.5	25.5	26.7
Gender					
Male	23.6	23.2	39.8	24.2	24.0
Female	29.3	28.7	33.3	26.7	29.1
Non-binary	25.0	37.5	37.5	18.8	33.3
Chi ² p-value	0.01	0.02	0.01	0.37	0.05
Age (years)					
15-24	19.5	29.3	55.3	27.9	17.7
25-34	27.8	23.5	40.5	28.2	23.1
35-44	26.9	27.2	33.1	24.1	28.5
45-54	29.3	28.9	31.5	26.4	35.2
55-64	27.1	23.1	30.1	20.8	29.2
≥65	20.2	25.5	22.6	18.2	19.6
Chi ² p-value	0.08	0.33	<0.001	0.16	<0.001
Highest level of education					
Postgraduate degree	28.7	27.3	30.0	25.6	28.3
Bachelor degree	24.5	24.6	32.8	25.0	24.4
Advanced diploma and diploma	26.4	25.1	38.6	24.2	27.6
Certificate III and IV	31.9	27.6	50.4	26.7	31.4
Completed high school	19.9	24.1	38.9	22.1	20.0
Did not complete high school	26.8	26.8	45.1	28.5	28.3
Don't know / Prefer not to say	9.1	66.7	63.6	77.8	71.4
Chi ² p-value	0.04	0.87	<0.001	0.83	0.12
Country of Birth					
Australia	26.9	26.4	37.8	25.5	26.8
Outside Australia	24.6	25.1	32.7	25.1	26.1
Prefer not to say / Not stated	50.0	40.0	0.0	40.0	66.7
Chi ² p-value	0.33	0.60	0.04	0.87	0.76
Language spoken at home					
English only	26.5	26.4	36.5	25.4	27.1
Language other than English	26.3	24.9	36.8	25.7	25.4
Chi ² p-value	0.92	0.56	0.92	0.90	0.53
Aboriginal or Torres Strait Islander Status					

Non-Indigenous	26.8	25.4	35.2	24.7	26.6
Aboriginal or Torres Strait Islander	15.6	34.1	60.0	31.8	23.8
Don't know / Prefer not to say	25.3	37.5	54.0	37.5	32.4
Chi ² p-value	0.09	0.19	0.001	0.28	0.69
Industry					
Health care and social assistance	31.3	27.1	44.3	27.1	31.5
Retail trade	24.8	31.4	51.0	26.1	20.6
Education and training	32.7	25.0	26.9	27.0	33.8
Construction	28.1	23.3	47.1	22.3	22.3
Professional, scientific and technical	19.5	25.0	21.0	22.2	16.3
Manufacturing	23.0	18.8	42.5	26.7	30.8
Accommodation and food service	32.2	28.4	48.3	25.9	20.8
Public administration and safety	24.5	32.0	27.4	23.3	36.7
Financial and insurance services	16.4	22.2	21.6	28.7	18.0
Other	25.8	25.8	37.1	24.7	27.2
Chi ² p-value	0.01	0.41	<0.001	0.95	<0.001
Disability Status					
No profound or severe core activity limitation	26.4	25.9	34.8	25.1	26.8
Profound or severe core activity limitation	27.2	29.0	56.8	30.4	25.8
Chi ² p-value	0.83	0.42	<0.001	0.16	0.79

Supplementary Table 4. Odds Ratios with 95% confidence intervals for a worker in the high risk group experiencing a physical or mental injury or illness or a near miss in the past 12 months.

Leading Indicator Scale	Physical Injury / Illness	Mental Injury / Illness	Near Miss
PJQI (unadjusted)	1.91 (1.51, 2.41)	3.52 (2.84, 4.36)	1.71 (1.35, 2.17)
PJQI (adjusted)	1.88 (1.47, 2.40)	3.71 (2.95, 4.66)	1.78 (1.38, 2.30)
PJQI (adjusted + survey mode)	1.88 (1.47, 2.40)	3.70 (2.95, 4.65)	1.81 (1.40, 2.34)
OPM-MU (unadjusted)	2.34 (1.84, 3.00)	2.53 (2.02, 3.17)	2.17 (1.69, 2.78)
OPM-MU (adjusted)	2.31 (1.78, 2.99)	2.61 (2.06, 3.32)	2.22 (1.70, 2.90)
OPM-MU (adjusted + survey mode)	2.32 (1.79, 3.00)	2.60 (2.05, 3.31)	2.27 (1.74, 2.97)
OHS-VM (unadjusted)	3.35 (2.67, 4.21)	2.29 (1.86, 2.80)	3.89 (3.08, 4.92)
OHS-VM (adjusted)	2.87 (2.25, 3.67)	2.60 (2.07, 3.27)	3.01 (2.34, 3.87)
OHS-VM (adjusted + survey mode)	2.87 (2.25, 3.67)	2.61 (2.08, 3.28)	3.03 (2.36, 3.90)
NG-SCS (unadjusted)	2.23 (1.75, 2.86)	2.37 (1.89, 2.97)	1.99 (1.55, 2.56)
NG-SCS (adjusted)	2.19 (1.69, 2.84)	2.43 (1.91, 3.08)	2.01 (1.54, 2.63)
NG-SCS (adjusted + survey mode)	2.20 (1.70, 2.84)	2.42 (1.91, 3.08)	2.04 (1.56, 2.67)
PSC-12 (unadjusted)	2.64 (2.05, 3.39)	4.03 (3.20, 5.08)	2.07 (1.60, 2.67)
PSC-12 (adjusted)	2.69 (2.06, 3.51)	3.98 (3.11, 5.10)	2.20 (1.66, 2.90)
PSC-12 (adjusted + survey mode)	2.69 (2.06, 3.51)	4.03 (3.14, 5.17)	2.20 (1.67, 2.90)

Note: Unadjusted odds ratios are from regression models with only the leading indicator scale. Adjusted odds ratios are from regression models that include age, gender, industry occupation, employer size, and employer type. Adjusted + survey mode models are the same as adjusted models, but with the addition of an additional variable for survey delivery mode (phone or online).

Supplementary Table 5. Percentage of workers who were classified into the same category (high or low risk) for each combination of leading indicator scales.

Leading Indicator Scale	PJQI	OPM-MU	OHS-VM	NG-SCS	PSC-12
PJQI	100.0				
OPM-MU	70.3	100.0			
OHS-VM	63.7	68.1	100.0		
NG-SCS	69.7	86.1	66.0	100.0	
PSC-12	72.1	80.1	66.4	80.0	100.0

APPENDIX C. FINAL QUESTIONNAIRE

The proposed revised questionnaire is provided as a separate word document titled “Appendix C_Leading Indicators Questionnaire_REVISED_clean.docx”

In that document we have preserved the Computer Assisted Telephone Interview (CATI) introductory script and CATI programming notes provided by Roy Morgan to facilitate future use of the questionnaire with similar survey provider.

If requested, we can also provide a MS word version of the questionnaire with changes tracked from the prior version, to illustrate the specific revisions and deletions we are recommending.