NATIONAL CENTRE FOR FARMER HEALTH

Towards Developing a Metric for Farm Safety Culture

A final report with recommendations for government and industry to consider in effectively measuring farm safety culture on an ongoing basis, as part of the *Measuring a culture of safety on farms* project by the National Centre for Farmer Health (NCFH), Hamilton 2022.

Measuring a culture of safety on farms project.

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Glossary of terms

AMOSCC

AMOSSC is an acronym that stands for the Agriculture Measure of Safety Culture/Climate (AMOSCC). This is a methodology or a construct, which is designed to measure farm safety culture/climate for Victorian farms.

Delphi process

The Delphi process or technique is a well-established approach to answering a research question through the identification of a consensus view across subject experts. It allows for reflection among participants, who are able to nuance and reconsider their opinion based on the anonymised opinions of others.

Field work

Field work is a globally recognised term used in a wide range of disciplines to describe activities outdoors. For this review of literature, with its application to Victorian farming, field work implies paddock-based operations.

Indicators / measures

Indicators, or measures, are the knowable elements that are relatable to safety. Safety research tends to focus on individual indicators and measures to contribute to new knowledge in specific research fields.

Lag indicator

Lag or lagging indicators are signs or measures that become apparent only after the event, incident or a shift in attitude or behaviour (ie. culture) has taken place. Lagging indicators of occupational health and safety include fatalities, injuries and illness which are caused by imperfect workplace systems. These post-event incidents are used to measure farm safety culture retrospectively.

Leading indicators

A leading indicator is any measurable or observable variable of interest that predicts a change or movement in a trend, or phenomena before it occurs. Leading indicators of occupational health and safety can be defined as measures of positive steps that organisations take that may prevent an OHS incident from occurring. In relation to farming accidents leading indicators are broad and include multitudes of factors which are associated with, or are precursors to, farming fatalities, injury and illness. Leading indicators are the signs and signals of farm safety culture.

OPM-MU

The Organisational Performance Metric-Monash University (OPM-MU) is a short, practical tool for measuring OHS leading indicators. The OPM-MU has been validated for use in a variety of Australian work environments. The data generates a better understanding of both organisational and industry-wide safety culture.

Safety climate

Safety climate is defined as a safety ethic within an organisation, experienced by individuals and what influences and is influenced by cultures. Safety climate can be explained through the workers' experience of the organisational factors and as an antecedent of systems safety.

Safety culture

Safety culture is defined as what forms the environment within which individual safety attitudes develop and persist and safety behaviours are promoted. Safety culture is referred more to the overall organisational, community and company-level beliefs and attitudes rather than a point in time or employees' perception.

EXECUTIVE SUMMARY

Agriculture continually ranks among the most hazardous industries whether in Victoria, Australia or internationally. Repeated research has consistently found that farmers and agricultural workers are at very high risk for fatal and non-fatal injuries. Moreover, as most farms are family owned and operated family members are also at risk of death or injury. Yet whilst research has repeatedly confirmed a high rate of injury and death the contribution of farm safety culture to the risk of injury is unclear.

Safety culture is the environment within which individual safety attitudes develop and persist and safety behaviours are promoted. Farms have long grappled with the home, family and workplace divide. Whilst fatalities and injury data provide indicators into the physical cause and outcome of such incidents they provide little information or understanding of the farm safety culture that these indicators reflect. Workplace health and illness records also provide little data as the culture of self or family employed people is to seldom report or attribute occupational illness. These factors contribute to the difficulty in measuring the culture of safety on farms.

This report is the second, and final report that builds on the literature review *Measuring a culture of safety on farms: a review of the grey and peer literature(1)*. It presents the findings from review which was undertaken to address how can we best measure and monitor the current and future culture of safety on Victoria's farms. Specifically, this report identifies some of gaps that need to be adequately addressed to measure and monitor safety culture on farms, and looks at places where measurement needs to take place to capture a meaningful metric. This project, and this final report, relied upon a triangulated approach incorporating the following three key elements: a literature search, the socio-ecological model (SEM) and the insights of an Expert Reference Group.

Findings

- There is a gap between on the ground farm safety culture and the broader industry with a notable and stark demarcation between what happens on the farm and the broader industry, community, government and policy level. This demarcation was particularly evident in the grey and peer reviewed literature and the audiences for which they were intended. In essence, this gap reflects the reality of on the ground farm level resources to 'help farmers' reduce risks and hazards and the broader concern of the culture of safety on farms and the specific industry. The value of these 'on ground' resources is debatable —few were ever measured or reported against even as safety or hazard awareness tools.
- A well-accepted, validated and trusted measuring tool is needed to measure and monitor the culture of safety of farms. Despite reviewing the literature and identifying key leading indicators

there was a lack of a validated, measuring tool to be used across agricultural industries, individual farm workplaces, and the broader community.

- Coordination and bipartisan political will is required to improve the evaluation and measurement processes of the numerous government funded agricultural health and safety programs. Whilst they may be well intentioned and supported there is a lack of central data collection and coordination and measurement of farm safety culture is non-existent or haphazard. Use of an agreed metric should be a requirement of any funded program and with centralised data collection.
- The culture of safety of farms is not just about farms. What happens on farms often occurs in a vacuum— it is largely invisible until there is a reportable injury, illness or death. Using the socioecological model, responsibility for the culture of safety of farms was noted to be very farm-focussed with little contribution from the broader safety community, organisations, government, health and agribusiness. The intersectoral contributors to farm safety culture such as agricultural/ agribusiness, community, health, trusted farm advisors, legislators and education sectors (primary, secondary, VET) are often missing or not clearly connected. Given the high injury and fatality rate a more responsive and coordinated approach is required from the broader community as highlighted in this report. Farm safety culture measurement must be grounded in a supportive industry and with strong multi-sectoral collaboration.
- Data is missing: Current methods for considering the culture of safety on farms predominantly uses lag indicators through a variety of registries that collect workplace fatalities and injury data. These are retrospective indicators and are helpful to inform how or why people are killed or injured. In Victoria, injury data is collected from larger Emergency Departments across the state and is an important data set. However, the current data does not utilise data from the smaller regional health services, where agricultural industries, farmers and agricultural workers are most likely. The extent and effect of this data gap is unknown. Yet just as metropolitan injury research would not rely on rural and regional data, efforts must be made to prioritise and broaden rural and regional data health and injury collection.

These findings mean there is an exciting opportunity to develop a collaborative and world leading approach to measure the culture of safety of farms that builds on Agriculture Victoria's and the National Centre for Farmer Health existing networks and datasets. To measure and monitor the current and future safety culture on Victoria's farms requires measurement to be prioritised and addressed across all levels of the social ecological model, with a responsible group delegated to oversee the implementation of the following recommendations. Using this governance approach would not only improve how we understand farm safety culture and changes over times but improve ways to intervene at various levels.

Recommendations:

Short Term (0 – 2 years)

1. To measure the culture of safety on farms a reliable, validated and widely accepted measuring tool is needed. Following extensive consideration of leading farm safety culture indicators locally and internationally, the research team proposes that Monash University's OPM-MU, in addition to other indicators and measures, is the most appropriate metric to measure farm safety culture. This short, eight question, validated survey has been utilised with significant numbers in Australia, and in the opinion of these authors out-performs any other metrics found in the research process. We recommend the OPM- MU is adopted as an agreed metric to provide wide spread uptake to measure farm safety culture across industries. The OPM-MU is licensed under the creative commons enabling the questionnaire to be used. Discussion has already occurred for some very minor wording amendments if required.
2. Immediately incorporate the OPM-MU into existing programs (such as Regional Wellbeing Survey, and Victorian Farmers Federation Making Our Farms Safer project) to quickly provide ground level farm safety culture data and a base for longitudinal data.
3. Continue to use fatality and injury data such as Victorian Injury Surveillance Unit (VISU), but that a concerted effort and resourcing is made to expand the data collection to areas not currently collected. A successful model that can be repeated and transferred is the Rural Acute Hospital Data Register (RAHDaR) so that populations with higher numbers of farmers and agricultural workers are included in the injury data.

Medium Term: (1.5-3 years)

1. Embed the OPM-MU survey into Livestock Farm Monitor, Dairy Farm Monitor, Best Wool/Best Lamb and Better Beef Networks and other existing groups to collect and measure farm safety culture. The authors recommend using these established groups to connect with a cross-section of farmers who are already engaged with Agriculture Victoria, reducing the need to re-create farming groups to participate in the OPM-MU. Liaise with interstate groups such as RHSA.
2. Improve farm safety education: Culture is built all around us and from early ages. There are few primary and secondary level education programs in Australia that specifically focus on farm safety and those that exist are not well connected or coordinated with a common safety culture purpose. We recommend mapping current school programs, and incorporate a farm safety culture measurement.
3. Address and grow the farm safety culture competence of trusted farm advisors. Trusted farm advisors (stock agents, rural finance officers, vets, financial counsellors, agronomists, shearing

contractors etc.) are well placed to assist with farm safety culture and measurement of same but lack the necessary knowledge and capacity to do so. We propose a short course for trusted farm advisors. This course will introduce the concept that farm safety culture is the industry's responsibility and across the SEM, i.e. not just individual farmers. Training sessions provide an opportunity to both introduce and administer the OPM-MU with trusted farm advisors and understand the culture of farm safety in the broader industry.

4. Improve the quality of farming injury data collected in Emergency Department (ED) staff and close data collection gaps. We propose a short training session for ED and Urgent Care Centre (UCCs) staff across Victoria (particularly rural and regional areas). This session is for staff to recognise the importance of the farm injury data collected and how it informs our understanding. We would also recommend partnering with the Rural Acute Hospital Data Register (RAHDaR) to increase the data uptake in regional south west health services and all UCCs, which are the key entry point to medical facilities that service smaller rural and remote farming districts. This method would work towards capturing more accurate farming accident data. According to Peck et al, RAHDaR captures as much as 35% more data than currently available via the government-reported dataset.
5. Farm safety culture should be represented in the Level IV OHS unit that is delivered nationally. The current level four unit, which is compulsory, should be superseded (AHCWHS401 Maintain work health and safety processes) by developing and adopting a revised competency under the AHC package such as "Develop and maintain a workplace safety culture".

Longer term: (3-6 years)

These actions are proposed as projects to measure farm safety culture in a more mature context and rely on the short and medium term actions.

1. Higher Degrees by Research: Our literature search showed minimal evidence of validated and published evidence of how to measure farm safety culture. The NCFH proposes two PhDs to contribute to new knowledge by continuing the farm safety culture research and refining the effective measurement techniques. We recommend higher degrees by research as below:
    - Using the baseline data OPM-MU and the current industry surveys to measure farm safety culture and farm safety culture maturity and identify improvements (or not) as a result of implementation of these reports recommendations.
    - Research the integration and effectiveness of the OPM-MU by trusted advisors in making farms safer. The project includes a control group (non-OPM-MU advisors) and an intervention group (advisors using the OPM-MU to facilitate farm safety discussions) to identify how farm

safety and farm safety culture is discussed, symbolised, imitated and represented within these farmer-advisor inter-relationships.

2. Evaluate the role of company directors and statutory authorities in farm safety culture and consider any cultural shift needed to acknowledge that safety culture needs to be owned by the industry. Currently many industry bodies focus on consumer food safety and markets and very little on producer safety.
3. Whilst inroads are being made in measuring the impact of postgraduate education in Agricultural Health and Medicine, there is little evidence to suggest that farm safety, safety culture and safety communication are currently incorporated in Victoria Bachelor-level Agricultural and Veterinary sciences. These tertiary qualifications are a pathway for many agricultural professionals working as trusted advisors in the areas of agribusiness, agronomy, crop science, animal health and production, research and private consultancy. Addressing the gap in working knowledge and understanding of farm safety culture at a tertiary level will enhance the leadership, skill and confidence with graduates. Inclusion of farm safety culture content in existing curriculum and during placements and with measurement utilising the OPM- MU would complement—if not enhance—current graduate learning outcomes (GLOs) and provide measurement of safety culture from this cohort.

Reversing the trend of farm fatalities, injuries and illness means farm safety culture must be on everyone's agenda —individuals, families, industry, health, general practitioners, agribusiness, policy and government and it must be measured. Just as farm safety culture does not occur in vacuum, neither will its improvement.

INTRODUCTION

Measuring farm safety culture, whilst a relatively new metric, has traditionally relied upon lag indicators to compare cross-industry health and safety standards. In 2020, the agriculture, forestry and fishing industry recorded the highest fatality rate with 13.1 fatalities per 100,000 workers nationally. While this is very similar to the 5 year average of 12.9 fatalities per 100,000 workers, it is an increase of 39% since 2019 (2).

Fatalities, emergency department presentations, hospital admissions, and days not working due to accidents all contribute to generating the data that is used to inform policy makers and regulators. This data drives action and whilst retrospective, it continues to be an important measure of farm safety culture.

There are however particular challenges that are associated with collecting accurate injury data in rural and regional areas.

According to the Victorian Injury Surveillance Unit (VISU) at least 372,809 injury cases presented to Victorian Emergency Departments, 85.0% of which were unintentional (n=317,037) (3). The *Hospital Treated Injury Victoria* report showed 128,227 injury cases were then admitted to Victorian hospitals in 2019/20, of which 90.9% were unintentional (n=116,496)(3). The VISU results show that on average, and for all age groups, there has been a modelled annual change rate over 10 years of +3.8% for hospital treated injury admissions, possibly indicating increased seriousness, but no statistical difference in the change for ED presentations over this same time period.

These results may provide some insight into emergency presentations and hospital admissions from farming injuries, however the challenges and laggard nature of accessing this data means that the findings are only somewhat indicative for measuring farm safety culture. The selection of a suitable population denominator is also problematic in calculating these rates per population, as the reporting of family members, employees and children is missing. In 2018, Henley (4) highlighted that the Australian Bureau of Statistics (ABS) reported there were 93,300 farming families in Australia in 2012, and almost half (48%) of these comprised a couple living by themselves, while for those families living with children, the average family size was 4 people. However, this information was insufficient to calculate meaningful rates using farming populations as a denominator (4). In addition to this, an unknown number of people visit farms and thereby experience some level of exposure to risks associated with such an environment (4).

The Victorian Injury Surveillance Unit (VISU) analyse and interpret injury data across the state. This data informs the development of injury prevention policy, stimulates research, and provides a touchstone for evaluation of preventative initiatives (3). One of the central datasets that contributes to the VISU is the Victorian Emergency Minimum Dataset (VEMD). Hospital admissions data were extracted from the

Victorian Admitted Episodes Dataset (VAED) and ED presentations data from the Victorian Emergency Minimum Dataset (VEMD). The VEMD aggregates emergency presentation data from 38 public hospitals across Victoria that have a 24-hour Emergency Department (ED) service (5). The VAED records all hospital admissions in public and private hospitals in the state of Victoria and the VEMD records all presentations to Victorian public hospitals with a 24-hour ED (3).

Unlike larger hospitals with an ED, Urgent Care Centres (UCCs) are a key entry point to medical facilities that service smaller rural and remote districts, many of which are located in Victorian agricultural communities. They have the capacity to perform first-line emergency care: treat injuries, set fractures, and stabilise patients for transfer (6). There are around 40 UCCs in Victoria (for example: Camperdown, Benalla, Mansfield, and Portland) that currently do not routinely report emergency presentation data to the VEMD central database, and therefore this data does not appear in the VISU data (7). A study of five small rural emergency UCCs reported that they received almost all categories of emergency presentation, saw almost all diagnostic categories, treated critically ill and injured patients, and performed most procedures (8). Due to the presentations of farm injuries to these centres it is imperative to have access to this currently silent data on injured members of the farming community (farmers, children, visitors) attending UCCs. This is a necessity if we are to genuinely understand injuries on farm, the contributing safety climate, and measure farm safety culture. However, farm injuries and fatalities are very much lag indicators of what happens (or doesn't). Why it happens, and to whom it happens also provides important insights into farm safety culture.

BACKGROUND TO THE METHODOLOGY

Designing a methodology to measure farm safety culture requires in-depth understanding of the vernacular, critical thinking and a range of tools and appropriate data. Whilst this report focuses on a methodology for *Measuring a culture of safety on farms*, it also acknowledges the work that has previously been undertaken in the *Influencing Farm Safety Culture* project; both critical elements of research undertaken for Agriculture Victoria.

What ensued from this cognisant process was a triangulated approach to measuring farm safety culture. Figure 1 illustrates this approach. To explain, three fundamental elements were relied upon to guide the priority of projects to measure farm safety culture. The literature review (Element 1) and the SEM framework (Element 2) highlighted the levels where key indicators of safety are measured. The literature review informed the question: "a challenge of measuring farm safety culture is..." for the Expert Reference Group (Element 3). This group of experts then suggested, sorted, and ranked responses that led to statistically mapping the background evidence for which methods are used to measure safety culture. As an outcome, the cluster map (Figure 3) was generated which largely reinforced the findings from the

literature review. This completed a holistic, triangulated approach. The SEM framework continues to build the story of where safety is measured, and the methods deployed, which the NCFH considers are required.

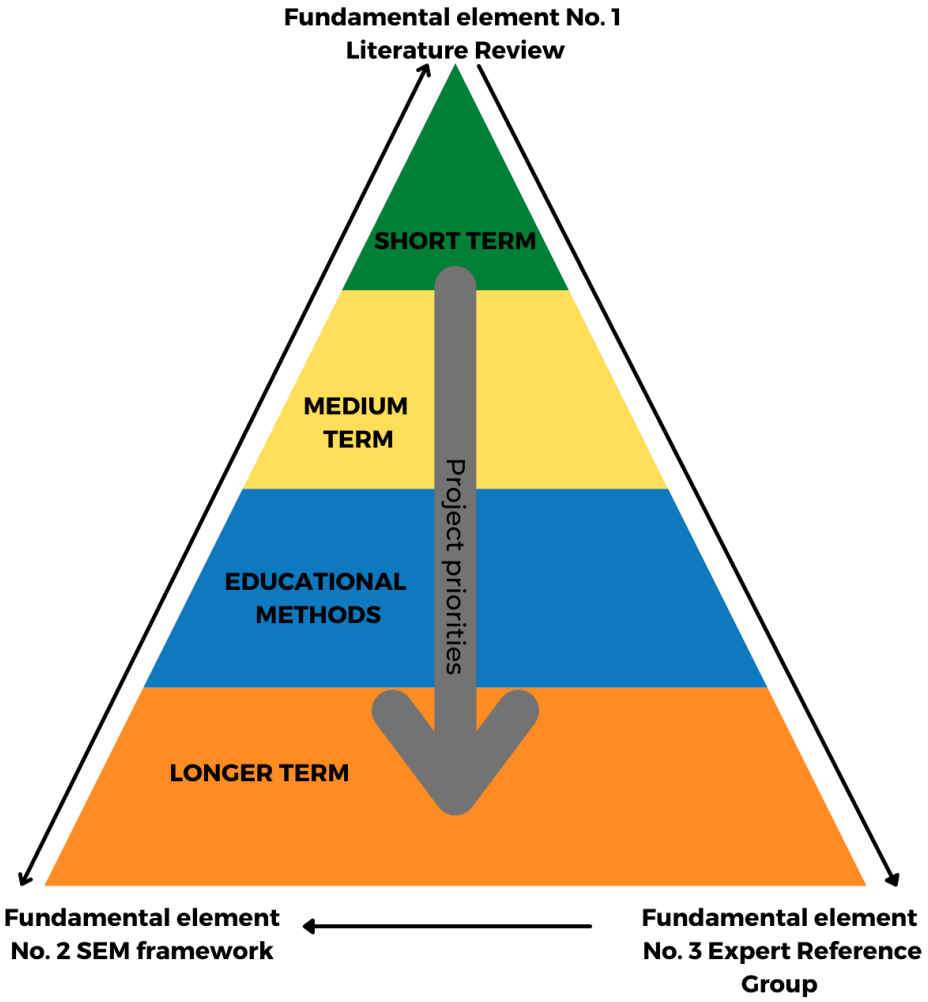

Figure 1: Triangulation process of the literature review, SEM framework and the Expert Reference Group to develop the recommendations to measure farm safety culture.

Short, medium and long term priorities, as well as important links with education, health and industry, are presented as methods to measure farm safety culture on an ongoing basis.

SUMMARY OF THE FUNDAMENTAL ELEMENTS

Each element contributes as an interdependent component in the project. Combining these elements using a triangulated approach strengthens the results as they become robust and validated. This bespoke approach supports our current understanding of how to measure farm safety culture. This validation is

necessary given that much of the literature concerning measuring farm safety culture, or even measuring safety culture in general, often remains theoretical or under-validated. This chapter provides a brief summary of the preceding literature review (1), an outline of the SEM framework, and provides the results from the Expert Reference Group input to endorse the recommendations.

Fundamental element No. 1 The literature review

Starting with over 8000 documents, the literature review process (see Appendix 1) outlines the research method of search, retrieval and refinement that resulted in the final dataset of 328 articles of interest that were used to shape the final eight recommendations for this final report. Using the SEM framework (described in Element 2), the literature reveals why repeated safety interventions at a farm-level are failing to change the continual high rate of farm accidents and fatalities.

The literature review starkly illustrated the demarcation between grey and peer reviewed literature based on the realisation that they are for two very different types of audience. Grey literature is accessible and mostly presented as trying to engage with its readers (farmers and agricultural workers). It was predominately sourced using Google and is readily available for the industry. Conversely, the peer reviewed literature is less accessible and more readily available only to researchers. Indeed, it is written for an academic audience. As a result, the literature review conclusions were structured to reflect these significantly different audiences as found in the literature, and to highlight the divergent approach to farm safety. Whilst the literature demonstrated a wide range of stakeholders in farm safety, through research, industry and resource creation for farmers, a significant disconnect between delivery and outcomes was noted.

The prominence of farm safety self-assessment checklists and safety guides for farmers, presented as documents or in digital formats, showed the interface between industry and government's efforts in farm safety and the farmer. These farm-level resources highlight the intention of industry to 'help farmers' reduce their risks and hazards on their properties. However, these completed farm safety checklists are not collected or collated by those who create or disseminate them. Subsequently, these self-assessment checklists cannot be used as a leading indicator for measuring farm safety culture because they are not measured, consistent or benchmarked in their current on-farm form. In other words, they fit the category of a tick and flick type form—possibly used widely, but difficult to quantify.

In contrast to the grey literature, the peer reviewed literature highlighted a broad range of indicators and measures, databases, statistical methods and questionnaires—demonstrating the range of constructs used to conduct safety culture measurement. Indicators are the knowable elements that relate to illness and injury, and they generate much of the peer reviewed research. Some examples of these indicators are exposure to pesticides, roll over protection devices, use of PPE, training undertaken, language barriers of

farm workers, musculoskeletal discomfort, working while injured, farm safety awareness and health and safety leadership. The variation in safety culture measurement methodology currently implies both experimentation and subject infancy.

A list of these indicators and measures was created by extrapolating the variables found within the titles and abstracts of the peer reviewed literature dataset and the grey literature (where applicable). The number of indicators and measures were then overlayed on the levels of the SEM. This exercise was useful in understanding the differences where safety culture measurement takes place, by showing us that the majority of indicators, or measures, of farm safety culture are positioned at an individual level (the farmer) or community level (agriculture or multi-sectoral level). Additionally, it was noted that responsibility for safety culture was very farm-focussed with little or nil contribution of what safety culture encompasses within the broader agricultural/ agribusiness, community, education sectors including—somewhat surprisingly—health.

Globally, it is not a coincidence that research and safety interventions target individual farmers. Culturally, farming accidents are 'blamed' on individuals rather than the equipment or the environmental, structural and legal context, in which they work. This helps to explain why over half of the grey literature is written for a farming audience and why the majority of research focusses on indicators of individuals' knowledge, behaviour and attitudes. These findings suggest that it is well overdue to shift the focus from the farmer--looking further down the supply chain, or further up the SEM levels—to make other groups and agencies also accountable for farm safety. The farm services sector, including regulators, banking and insurance, together with all levels of government are also accountable for farm safety.

In short, the purpose of the eight recommendations made in the literature review were to show how farm safety culture is measured, theoretically and practically, and the applicability to Victorian farming. The literature review concludes that farm safety culture measurement must be grounded in a supportive industry and with multi-sectoral collaboration.

Fundamental element No. 2 The socio-ecological model

Best practice in the design of public health prevention and control initiatives use a contextual model for interpretation. The socio-ecological model (SEM), first introduced in the early 1970's through the work of Urie Bronfenbrenner on human development, endeavours to explain the interplay between the individual, personal relationships, organisations, regulations and other environment factors that have influence (9). Commonly used in public health, and utilised by Deakin University, it is a theory-based framework which supports understanding of how personal and external factors interact and influence individual behaviour and health (10). Refer to Figure 2 for the SEM model as a diagram.

Figure 2: The socio-ecological model (SEM) adapted from Bronfenbrenner (1979) to demonstrate the interplay between individuals, their interpersonal relationships, workplaces, community and public policy including law.

The SEM model has been used to frame agricultural safety and health in the USA (11), organise the influences of farmer behaviour in Australia (12), and shift the central focus from the farmer and farm worker to study other factors influencing the under-reporting of illness and injury (13). The SEM model improves our understanding of the influencing factors at each level to achieve and measure behaviour change within organisations and communities. The SEM model was used to review literature to identify the distribution of research from individual, interpersonal, organisational, community and public policy levels. This framework is a fundamental element that strengthens the outcomes and safeguarded tangibility for the Victorian agricultural sector via the literature review, the Expert Reference Group consultation, and the recommendations for this final report.

Fundamental element No.3 Expert Reference Group

The third independent element of this methodology is the use of the Expert Reference Group, the engagement of which further strengthens and validates the recommendations. This group included 19 people overall (Table 1), with representatives from Farm Safety organisations, the Country Women's Association, Industry Research Groups (e.g. Dairy Australia), cropping organisations, livestock producers, cropping and mixed farming enterprises, agribusiness, academia, WorkSafe Victoria, Agriculture Victoria

and NCFH. A full list of these members is listed in Appendix 2. These experts in safety and agriculture were invited to undertake a concept mapping process, known as a Delphi process, to assist in building consensus with the outcomes then visualised as a concept map.

Table 1: Expert Reference Group Wisdom activities undertaken during the stakeholder consultation phase

Activity	**Comment**	**Date completed**	**No. of participants**
1. Pre Reading			
2. Meeting 1	Introduction to the project	15/07/2021	18 and 1 observer
3. Expert Activity 2: Brainstorming on Group Wisdom software	83 statements provided	25/07/2021	15* brainstorming
4. Reviewing of statements by Project team	20 duplicate statements removed leaving 63 for ranking		Project Management Team and A/Prof Wong Shee
5. Expert Activity 3: Sorting and rating of statements on farm safety culture	Participants rank and sort on Group Wisdom software.	05/08/2021	14* sorting 13* rating
6. Analysis and Cluster by A/Prof Anna Wong Shee and Dr Alex Donaldson			
7. Expert Meeting 2: Reporting back and discussion	Reporting back findings	12 /08/2021	15 attendees

*****NB where there were multiple members representing the same organisation, not all members participated in the process. One invitee was recorded as an apology at both meetings, but still participated in elements of the process.

This process of concept mapping is a structured method designed to organise and represent ideas from the group—in this instance the Expert Reference Group. It is a participatory, mixed-methods approach that integrates qualitative individual and group processes with multivariate statistical analyses to assist the participants describe ideas on the challenges of measuring farm safety culture, and represent these ideas visually through a series of related two-dimensional maps, called cluster maps. Concept mapping is used frequently in evaluation as a cost-effective and practical method to facilitate stakeholder participation in ways that enhance the relevance, ownership, and use of evaluation data. The online platform that

facilitated the data collection and analysis process is created by Group Wisdom. This software was developed by Concept Systems as a commercial by-product from research and programming by William Trochim (14), an assistant professor in the Department of Human Service Studies in the College of Human Ecology at Cornell University.

The multi-phase process required the Expert Reference Group to:

- Brainstorm a large set of statements relevant to "*the challenges when measuring safety culture on farms...*"
- Sort these statements into 'piles' based on perceived similarity of meaning, and
- Rate each statement on one or more scales (e.g. importance and feasibility) using a Likert (15) scale of 1-5:
    - 1 = not at all important
    - 2 = a little bit important
    - 3 = important
    - 4 = very important
    - 5 = critical

Multivariate analyses, including two-dimensional multidimensional scaling and hierarchical cluster analysis, and computation of average ratings for each statement and cluster of statements, was performed. This analysis produced a map that shows the individual statements in two-dimensional (x, y) space. Statements that are more similar are located nearer to each other within clusters, with the relationship between clusters shown in Figure 3. This quantitative map displays how the Expert Reference Group discerned the interrelationships between and among items, and assigned values to ideas and concepts, providing a basis for further discussion, interpretation, and action.

The bridging values are a measure of whether a statement was generally sorted with nearby statements (values close to 0) or with items located in other areas of the concept map (values closer to 1). Individual statements with lower bridging values can be thought of as 'anchors' for that section of the cluster map because they closely reflect the conceptual content in that area of the map. Statements with higher bridging values can be thought of as 'bridges' that link different parts of the map together. Clusters with lower bridging values indicate more stable, and narrowly focused thematic content while those with higher bridging values are conceptually broader. In our project, this is reflected in the conceptual cluster map (Figure 3) and the respective spatial areas that each of the issues covers (e.g., narrowly focussed issues such as 'Siloed farm safety assessments' with a lower average bridging value of 0.35 compared to 'Fear of bureaucracy' with a higher average bridging value of 0.68). The 'points', which represent a statement, when close to each other show that the issues are similar. The points highlighted as red were the most

highly ranked statement by the Expert Reference Group on the Likert scale of importance in that cluster. When the clusters are bigger and cover more area, it suggests we need to appreciate that there are different aspects of that concept when checking against the statements, and the subsequent ranking.

The role of the Expert Reference Group has clearly highlighted the importance of particular issues, as they ranked the statements regarding farm safety culture, with the lower scores indicating issues of less importance. Additionally, we can see that the statement around lack of understanding of the benefits of farm safety culture are not well defined and that this was both highly rated as an issue, and also an area for prioritisation.

This method of distilling and understanding the input from the Expert Reference Group is complemented by the literature review of both peer-reviewed and grey literature, and the application of the socio-ecological model (SEM). By bringing these three pieces of information together, we are able to make recommendations on the feasibility of using different existing datasets and methods to measure farm safety culture in the future.

At the time of this process the NCFH team were aware of some of the sensitivity surrounding this process due to the uncertainty of the question being asked, and particularly the feeling of situational repetition (eg. we have done this before) and revisitation of how to address farm safety. The NCFH team acknowledged these sentiments and explained how the Delphi process is used to get to the crux of the hardest issues that industry faces in measuring safety culture, rather than how to change farmers' behaviour. A total of 15 of the 19 stakeholders responded. It needs to be noted that not all members from the same participating organisations participated in the process. The intent was to reduce the potential of collecting similar thoughts which may be influenced by organisational culture and/or shared-office bias.

At the conclusion of the first stage, a total of 83 statements were recorded, allowing the NCFH team to remove duplicates, which resulted in 68 unique and independent statements. The platform showed that 82% of participants (n=14) sorted the data, and 76% of participants (n=13) rated the statements. Even though the process was not completed by everyone, this provided more than adequate data to generate the cluster map (see Figure 3). The engagement and subsequent response to this process was considered very high.

A complete list of the statements and values are provided in Appendix 3.

Cluster map

Figure 3: Cluster map created from the Expert Reference Group identifying the challenges of measuring farm safety culture.

The cluster map reflects the findings of the literature review. Consequently, it suggests there is a lack of understanding about the benefits of safety, the definition of safety culture, and of the value of measuring safety culture (refer to Table 2). It is important from this perspective that the rhetoric, or vernacular/terminology, of farm safety culture is actively adopted by the industry through shared outcomes and communication. Specifically, '*farm safety culture*' needs to be a term discussed from policy level to the farm kitchen table level.

The nine clusters were named to reflect each grouped theme, as shown and colour-coded in Table 2.

Table 2: Cluster themes (colour-coded to the concept map) and the average importance rating out of five from the Expert Reference Group (n=17).

	Cluster themes (groups, colour coded reference)	No. of statements	Average importance rating	Average bridging values
1	Lack of understanding of the benefits	4	Avg 3.62 (Range 3.31 – 4.0)	Avg 0.66
2	Missing health, wellbeing and safety data	4	Avg 3.54 (Range 3.15 – 3.85)	Avg 0.49
3	Siloed farm safety assessments	4	Avg 3.54 (Range 3.31 – 3.69)	Avg 0.35
4	Power, vulnerability and workplace relations	7	Avg 3.49 (Range 2.92 – 3.92)	Avg 0.38
5	Issues with farm safety measurement tools	16	Avg 3.31 (Range 2.69 – 3.85)	Avg 0.14
6	Fear of safety bureaucracy	9	Avg 3.29 (Range 2.77 – 3.77)	Avg 0.68
7	Industry safety competency and consistency	5	Avg 3.27 (Range 3.08 – 3.54)	Avg 0.80
8	Relevance of reporting measure	7	Avg 3.26 (Range 2.67 – 3.62)	Avg 0.45
9	Farmer perceptions and attitudes	12	Avg 3.05 (Range 2.08 – 3.54)	Avg 0.23

This cluster map shows that the 'Cluster No. 5 Issues with farm safety measurement tools' is a priority challenge by the number of statements, the closeness of the cluster and the low bridging value (0.14). These statements, as a cluster, relate directly to the purpose of this project which is to address how to measure farm safety culture and offer ways to collect data more effectively from farms to coroners' reports. These statements are instrumental in scoping and developing the recommendations in this report.

These clusters highlighted that the current reliance and expectations of farm safety checklists, or relying on individual farmers' behaviour change and actions, is not delivering the desired result. This consultation

and input from the Expert Reference Group was used to scope the recommendations and the method to achieve an effective metric.

THE OPM-MU

The literature review, which is the first element of the *Measuring Safety Culture on Farms* project, and is available as a full report, identified the research undertaken by Monash University in the Leading Indicators of Occupational Health and Safety project which encompassed the OPM-MU tool. This eight question survey measures health and safety culture using a five point scale. The literature review included this questionnaire in the top 20 most influential articles, with a commentary on its applicability to Victorian agriculture.

The OPM-MU measures organisational and workplace safety culture. It has many positive traits that make it a most appropriate questionnaire to embed into any existing delivery method on the basis that it is:

- developed to measure OHS leading indicators that measure the positive steps that organisations take that may prevent an incident from occurring;
- psychometrically sound (i.e., reliability, validity, readability);
- a generic measure that could be administered across industries and job roles; and
- short and practical to use across a variety of settings.

The OPM-MU was adapted and developed by the research team (Helen De Cieri, Tracey Shea, Ross Donohue, Brian Cooper and Cathy Sheehan) from Monash University in partnership with WorkSafe Victoria, the Institute for Safety, Compensation and Recovery Research (ISCRR), the GM Forum, and Safe Work Australia. The authors suggest that the peer reviewed article by Shea *et al* (16) demonstrated that the OPM-MU is an important advancement in the field of the identification and use of leading indicators of OHS performance. Describing the method as a promising new tool with established reliability and validity, Shea *et al* propose that the construct of leading indicators of OHS performance encompasses the following 10 areas:

1. OHS systems (policies, procedures, practices),
2. Management commitment and leadership,
3. OHS training,
4. Interventions, information, tools and resources,
5. Workplace OHS inspections and audits,
6. Consultation and communication about OHS, prioritisation of OHS;
7. OHS empowerment and employee involvement in decision making,

8. OHS accountability,
9. Positive feedback and recognition for OHS, and
10. Risk management.

The OPM-MU has been validated in research conducted with employees and managers in 66 workplaces across six industries (n=3,605) and by members from two unions—the Australian Nursing and Midwifery Federation and the Australian Education Union (n=9,641) (17). The authors have stated that there is substantial social value to be gained from wide-spread uptake of the OPM-MU as a model construct to measure safety, and it is therefore important to supplement the knowledge of, and access to, the OPM-MU (17). The final report for the Leading Indicators of OHS suggests that Monash University would continue to collect and analyse the data for benchmarking purposes and compile a de-identified database that could summarise performance across a range of organisational characteristics and regions, and develop norms for each industry over time (17). This is a very exciting opportunity. To achieve this the OPM-MU as a web-based tool would enable better access.

The OPM-MU is an adapted version of Canada's Institute of Work and Health (IWH-OPM). The OPM-MU and the IWH-OPM are licensed under creative commons enabling the questionnaire to be used for non-commercial purposes, with no changes (see Table 3 below).

Table 3: The Organisational Performance Metric – Monash University metric used to measure safety culture in organisations

Please read each statement carefully and select the number that best shows your views about health and safety at this workplace.

		Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
1.	Formal OHS audits at regular intervals are a normal part of our workplace*	1	2	3	4	5
2.	Everyone at this workplace values ongoing OHS improvement in this workplace	1	2	3	4	5
3.	This workplace considers health and safety at least as important as production and quality in the way work is done	1	2	3	4	5
4.	Workers and supervisors have the information they need to work safely	1	2	3	4	5
5.	Employees are always involved in decisions affecting their health and safety	1	2	3	4	5
6.	Those in charge of OHS have the authority to make the changes they have identified as necessary	1	2	3	4	5
7.	Those who act safely receive positive recognition	1	2	3	4	5
8.	Everyone has the resources and/or equipment they need to complete their work safely	1	2	3	4	5

***For the purpose of this survey an audit means a formal process of evaluating and reporting on how the workplace manages health and safety in accordance with a recognised standard. Regular means that an audit is repeated at regular intervals, for example, once every year.**

From the validated findings, higher scores of the OPM-MU are associated with more positive employee behaviours (17) and culture. The workplaces where the principles of OHS leading indicators were advocated were more likely to have employees who complied with safety rules and participated in safety at a higher level, beyond basic compliance (17). There was also a correlation between employees who rated their workplaces higher in the OPM-MU and the tendency to be involved in fewer unreported incidents and fewer near misses, but not fewer reported OHS incidents (17).

To achieve meaningful data to measure farm safety culture, the OPM-MU requires respondents' pre-questionnaire demographics such as age, gender, farming enterprise, agribusiness sector, and region. As previously discussed in the literature review (1) the Dairy Australia's report *Power of People on Australian*

Dairy Farms (18) demonstrates how industry can measure its labour force and safety culture through a longitudinal study of dairy farms (n=417). This report profiles the farmer who responds to the survey, and continues to capture how their farm recruits, retains, provides professional development, their industry confidence, farm management systems, and farm safety culture. In this report, farm locality is less important than farm structure. The survey focusses on the number of people in each business; the owners, sharefarmers, and paid and unpaid employees. The capability of these people are reported; qualifications, years of experience, length of farm ownership, recruitment and retention times, and participation in ongoing training and engagement in industry events. The survey includes the use of safety plans, Standard Operating Procedures for quads and tractors, induction processes, employment contracts, use of Dairy Australia's Farm Safety Starter Kit, and details around the workplace impacts of injuries and accidents. This survey is an outstanding example of how the dairy industry invests in measuring and understanding their workforce. Conversely, to measure farm safety culture for a greater number of Victorian farms and industries that is, beyond dairy, the literature review suggests that the metric does not require this much data collection from farmers particularly when many farmers are already participating in so many industry surveys.

For the OPM-MU to achieve meaningful data to measure farm safety culture, it first needs to be tested in agriculture. The OPM-MU is designed to provide a big-picture lens of farm safety culture at an industry, state or Australian scale, rather than a specific local farm measurement, which is where big data is needed for this metric. There will be a need for respondents to complete a pre-questionnaire demographic survey, such as age, gender, farming enterprise or agribusiness sector, and as demonstrated by Dairy Australia, farm structure in last 12 months (size, paid and unpaid labour, employees, contractors). We acknowledge that much of this data is already collected through different types of participation (eg. existing surveys, farmer-groups) and a new mechanism in the future (eg. software importing function) will be needed to shift respondents' data with the survey data to enable analysis.

Ethical research principles will also need to be considered. It would be advisable for those facilitating the completion of the survey, such as trusted advisors, trainers, RDC's, Agriculture Victoria, or group coordinators, to understand the ethical procedures in place for the data collection, use and storage, and the broader purpose that measuring farm safety culture has for reducing farming incidents. There clearly also needs to be a feedback mechanism to ensure the data generated from such a tool is utilised, reflected upon, shared, translated and where required, action taken. This is why a specific delegated group to oversee these recommendations, minimum demographics and implementation is required.

Utilising and collaborating with existing data sets such as the Regional Wellbeing Survey or Livestock Monitor should assist with agreement on minimum demographic data. The recent Regional Wellbeing Survey may also inform specific target demographics, with which to measure safety culture. There is also strong interest in the Rural Safety and Health Alliance to work on utilising a common metric.

NCFH's rationale for using the OPM-MU

The NCFH Team are confident that the OPM-MU is the most appropriate survey to measure farm safety culture at this time. This decision is based on their extensive reviewed literature (n=328) analysis seeking methods to measure safety culture. This recommendation follows four of the eight recommendations that were previously presented in the literature review:

- ✓ Build on existing databases and seek linkages
- ✓ Consolidate and integrate a questionnaire fit-for-agriculture
- ✓ Utilise experts and key stakeholders
- ✓ Resourcing provisions for longevity

The rationale for using the OPM-MU is that it builds Victoria's capacity as a state that values workplace health and safety. The literature clearly articulates that building on existing databases, surveys, questionnaires, and industry capacity progresses the safety industry as a whole. There is capacity and capability for NCFH to work with the Monash University experts to broaden the validity of OPM-MU, and refrain from re-invention of safety questionnaires of which there are already numerous.

The OPM-MU is a short, 8 question Likert-scale survey. It has been validated in an Australian setting, and it can be embedded and amalgamated into existing survey data, such as the Regional Wellbeing Survey, Dairy Farm Monitor, Livestock Monitor and VFF's Making Farms Safer questionnaires. Large numbers of survey results can be collected, and utilising the above farmer groups this would enable agricultural data to be accessed easily and quickly. This was demonstrated by Monash University by surveying members of two unions (n=9,641) to collect significantly large data for analysis. It is also possible the groups such as the Rural Safety and Health Alliance would also have an interest in using the OPM-MU.

The OPM-MU is different to the traditional farm safety self-assessment checklist. Over half of the results from the Google Advanced search resulted in a farm-specific risk and hazard identification tool (n=53), so we know that they are abundant and available. The OPM-MU is a high-level analysis. It is an overarching survey for workplace health and safety attitudes, whereas farm safety self-assessment checklists are grounded at farm-level, leading farmers to identify and assess immediate risks and hazards. The OPM-MU identifies culture, and the extent to which farmers consider their farms a workplace. Using a more generic workplace safety culture survey, like the OPM-MU, is a cultural change in itself, allowing for measurement between agricultural industries, within agricultural industries and across sectors.

Farmers are capable of thinking broadly. Given that they are working under the Victorian government's manslaughter laws, there is no reason why farms should be considered different to any other workplace.

The OPM-MU fits Victoria's OHS Act (2004) as it treats farms as any workplace. For this reason, the NCFH identifies that thinking of, and treating farms as workplaces needs to be improved.

There is rationale to measure safety culture of agriculture as a whole, not just on farm. Using the socio-ecological model (SEM) as a framework to analyse the peer and grey literature, much of the research and extension focus has been farm-level with little change to the overall trends in farming fatalities and injuries. As per our previous recommendations in the literature review the OPM-MU aligns with the research findings:

> This shifts the measurement paradigm to consider organisational, managerial, technical and behavioural factors, rather than mechanical failure or human error, as the cause of on farm accidents and fatalities…using the SEM as the conceptual framework, has demonstrated that measuring safety climate is too narrow, specific and limited. The construct of safety climate remains fixated to the farmer as the individual. As an alternative, a measure of farm safety culture re-directs measures to inter-personal, organisational, community and public policy levels and makes connections to farm safety through the interplay of the individual farmer (1).

How to measure farm safety culture is in research infancy, globally. The OPM-MU remains untested in a farming context, however its Australian validation as a workplace culture survey shows that it is fit for purpose for agricultural organisations such as Cargill, Nutrien, Elders and AWI. The OPM-MU is not "farmerised", meaning that it is not tailored specifically for a farming audience. How the survey is accepted by the farming community is yet to be tested. Nonetheless people working in agriculture, such as grain receival sites, livestock exchanges, abattoirs, or agronomy, are all employees with their own organisational safety culture. These respondents, all having important roles in the sector, should not find this survey unusual. The long term challenge will be engaging the broader agricultural industries to participate in the survey for a whole of industry metric. The authors predict that moving to a 'non-farming specific' safety tool to measure industry safety culture equally and equitably, is a change in itself. A generic survey tool should endorse the OHS Act that farms, just like any business, are workplaces front and centre.

Notwithstanding, the NCFH team did facilitate a meeting with Professor Ross Donohue from Monash University to discuss to feasibility of the OPM – MU and possible minor language adjustment for on farm use without affecting its readability, validity and reliability. This will enable (if desired) context to be created so that the user/respondent can reflect appropriately on either their *farm and/or home* as a workplace. This decision should rest with the delegated implementation group.

PROPOSED METHOD TO MEASURE FARM SAFETY CULTURE

Farm safety culture is relational to social elements of people with others, animals, machinery and the landscape, and henceforth challenging to pin point accurately using one or two tools alone. To measure farm safety culture, the knowable tools, accessible databases, and indicators are all needed to construct the metric. Due to the complex nature of achieving this measurement, the proposed methodology is shown in both diagram and table forms to support the reader. Simultaneously, the authors recommend that farm safety culture measurement maturity needs to be factored into the methodology through short, medium and longer term steps and priorities. This systematic approach improves how meaningful the measurement is, over time. In other words, how safety culture will be measured on farms in the short term is predicted to be quite different to how safety culture will be measured in 5-10 years. Figure 4 presents both existing and new methods. The methods were selected based on the feedback from the Expert Reference Group, known indicators of farm safety at the SEM levels, and available data bases.

In order to ensure that farm safety culture is measured across the whole farming sector the methods have been systematically considered by referring to the SEM model as the conceptual framework (as shown in Tables 4, 5 and 6). Rather than creating a new survey, the authors recommend the OPM-MU survey is embedded into existing and new methods to collect data from a cross-section of Victoria's agriculture community (refer to Figure 4). The authors also recommend that a responsible group is delegated to oversee the implementation of the following recommendations. Using this governance approach would improve how we understand farm safety culture, changes over times and identify ways to intervene at various levels.

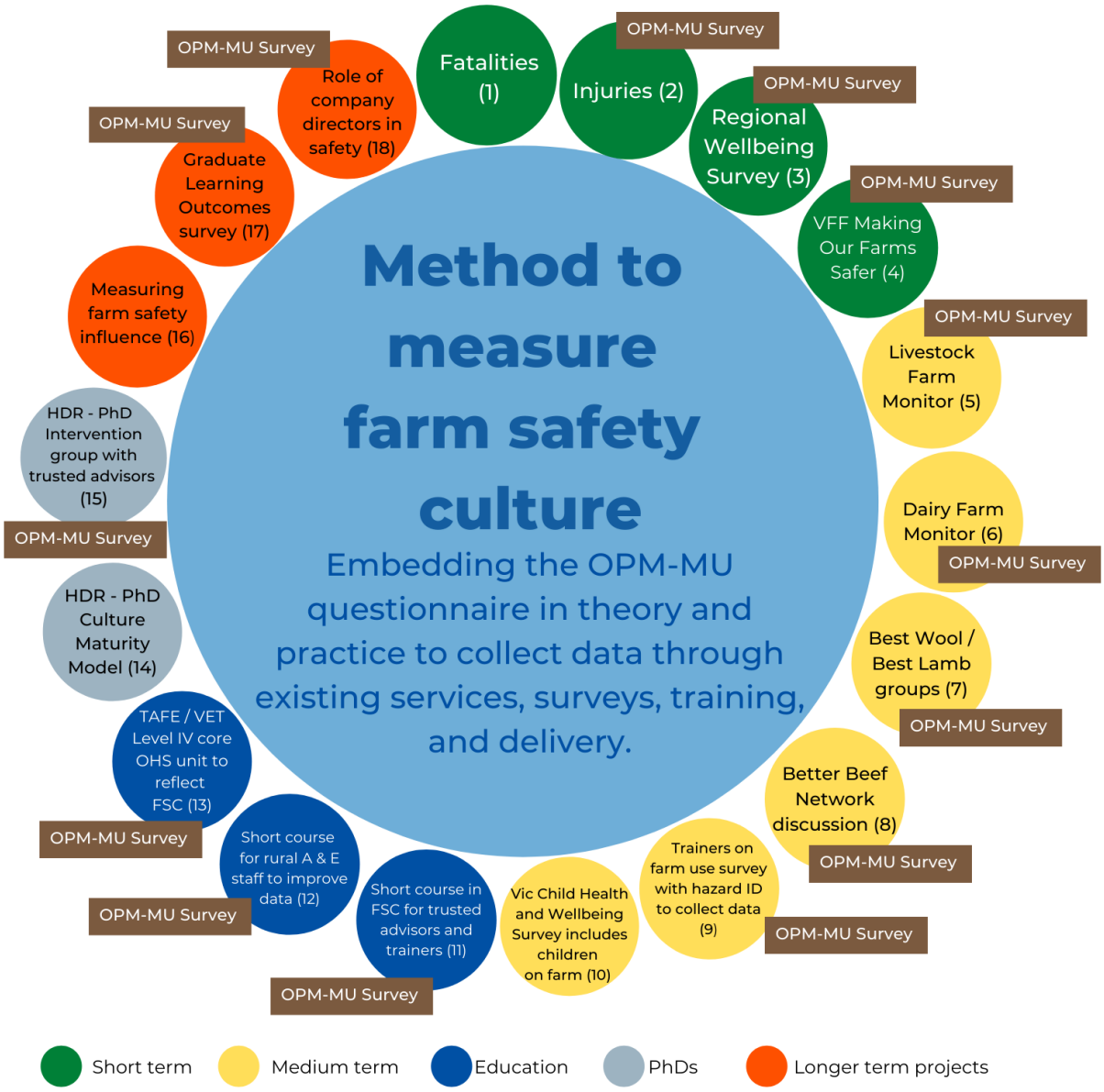

Figure 4: A diagram of the linkages that creates the method to measure farm safety culture and where the OPM-MU survey is undertaken

The authors recommend that the NCFH could work with Monash University in the collection, collation and analysis of the OPM-MU survey data in a partnership arrangement, to be the repository and centre for advice measuring farm safety culture in Victoria.

Short term methods

The short term, or immediate proposal (as shown in green) is to continue to use fatality and injury data. Noting, as previously described, that there are significant gaps in this injury data coming from agricultural

communities from smaller Urgent Care Centres. There should be an effort to collect and interpret this information.

The OPM-MU survey can be used to improve injury data from farmers where they connect with the survey (eg. insurance claims, hospital, AgriSafe clinics). The Regional Wellbeing Survey provides insightful farm safety data and remains a significant method, with the potential for modification to ensure the OPM-MU questions are included. The VFF Making Our Farms Safer should also include the survey for participating farmers. This is an important aspect of the recommendation to help get numbers quickly. Relying on these two latter methods will immediately connect with a statistically meaningful cross-section of the farming community and would be relatively easy to commit to. It is also possible that interest may occur from other areas including outside the state.

Table 4: Short term method to measure farm safety culture

Method Numbers and links	Method of measurement	Type: (Lag, Lead, Ed'n)	Agriculture Victoria's role	Additional comments	Recommendations	SEM Alignment	Expert Ref. Group Alignment (No. linked to cluster)
1, 2	1. Fatalities	Lag	None	Useful, but details of causes are held in different databases (Work Safe, Safe Work Australia, coroner's office)	Continue to use.	Individual (deceased), Interpersonal (family, friends, neighbours), organisational (paramedics, hospital) Community (agriculture), Public policy (cause of death vs regulations)	9. Farmer perceptions and attitudes
1,2	2. Injury	Lag	Endorse collaboration and education to reduce data deficit.	Useful, but current data has significant gaps.	Monash University, Accident Research Centre & VISU use RAHDaR and data from UCC's to capture farm injury data and reduce data deficit. Refer to education recommendation.	Individual (injured), Interpersonal (family taking over work duties), Organisational (paramedics, hospital staff, Workcover)	2. Missing health, wellbeing and safety data 9. Farmer perceptions and attitudes

Method Numbers and links	Method of measurement	Type: (Lag, Lead, Ed'n)	Agriculture Victoria's role	Additional comments	Recommendations	SEM Alignment	Expert Ref. Group Alignment (No. linked to cluster)
3,4,5,6,7, 8, 10	3. Regional Wellbeing Survey	Lead	Continue to fund and incorporate the OPM-MU into the survey.	Useful data and well received within survey community. Longitudinal data.	Include OPM- MU and SACURIMA (Part 4).	Individual, organisational, Influencing policy	3. Siloed farm safety asse'ts 5. Issues with farm safety measurement tools
3, 4	4. VFF Making Our Farms Safer	Lead	Request VFF to use OPM-MU in Making Our Farms Safer program.	Ability to collect survey data quickly through existing safety initiative with capable and trusted advisors.	OPM- MU pre and post as part of evaluation impact. Could also include interview with farmers to capture near-miss stories.	Organisational (VFF and farms), Individual (farmers)	5. Issues with farm safety measurement tools 6. Fear of bureaucracy 7. Industry safety and competence consistency

Medium term methods

The medium term methods combine extension, benchmarking and education tools to measure farm safety culture. Embedding the OPM-MU survey into Livestock Farm Monitor, Dairy Farm Monitor, Best Wool/Best Lamb and Better Beef Networks as existing frameworks is the proposed methodology (as shown in yellow). The authors recommend using these established methods as a minimum to connect with a cross-section of farmers who are already engaged with Agriculture Victoria, reducing the need to re-create farming groups to participate in the OPM-MU. The longitudinal childhood study, the Victorian Child Health and Wellbeing Survey, which is funded by the Department of Education also have scope to count children living on farms. At this stage the authors don't believe that the OPM-MU needs embedding in that survey, but one or two questions about children on farms and respondents' actions to keep children safe would be valuable data. Table 3 summarises these methods and their linkage to SEM levels and the themes from the Expert Reference Group.

Education and cultural competence methods

As described previously in this report and others, education plays an important role in influencing culture, knowledge and behaviour and also in collecting useful data. Education provides an important mechanism in generating cultural competence in farm safety across a variety of industries associated with agricultural production in Victoria. There is opportunity to systematically improve the understanding and definition of safety culture within education content and curriculum across all levels of education (primary through to tertiary and adult vocational education, as shown in blue). It is also needed across sectors—for example, in health.

There are few primary and secondary level education programs in Australia that specifically focus on farm safety. Current programs include the Farm Safety Program delivered in primary schools across south-west Victoria by HESSE Rural Health and the National Centre for Farmer Health's Gear Up for Ag program, delivered to secondary and vocational students across the state. Data obtained through student evaluation of Gear Up for Ag suggests that 76% of students (N=195) start completing tasks/working on farm between the ages of 13-17 years. This trend is supported by students undertaking the program in the United States with 72% of students also stating they were concerned about the health and safety of their family and co-workers in agriculture (19). This USA study was also the first to ask young adults to report 'near misses' whilst operating machinery and vehicles.

In their capacity as trainers and facilitators, trusted advisors, experts and extension officers are often required to complete and administer both location-specific hazard identification forms prior to many on-site farm visits and post-course/workshop evaluation material. Hazard ID forms provide an important insight into the safety measures undertaken by farmers such as gate signage, pedestrian safety, and identification of hazards such as steps and meeting spaces.

Completion of evaluation forms provides an opportunity to incorporate the OPM-MU and to measure farm safety culture of farmers participating in group activities and workshops. However, the competence and confidence with which advisors and facilitators asses the farm site is not known. Trusted advisors interact with farmers and farm workers in a variety of ways and possess varying degrees of experience and expertise (both on- and off-farm)—from career educators to contract/consultant deliverers of training and on-farm advisors (agronomists, veterinarians, agribusiness advisors). There is a need to recognise the variation in age and experience of advisors working on-site with farmers and the role these professionals play in influencing farm safety culture through interpersonal (peer to peer) conversations within the groups' working and learning environments. It is likely that incentives or funding will be required to support trusted experts, as they adapt the workshops to embed safety culture into field-based group learning activities.

Short course for farm advisors

To begin the vernacular of farm safety culture it is imperative that trusted advisors and farming industry leaders are on-board with the signs, meanings, vocabulary, purpose, intention, and the role of the OPM-MU. Conversations are necessary. They are needed to explain and demonstrate the contribution to new knowledge from this project as to why the traditional farm safety self-assessment checklists are not meeting the needs to measure farm safety culture, nor reversing the trend of farm fatalities and injuries. This is where the NCFH proposes to deliver a short course for trusted farm advisors and trainers. This course will introduce the concept that farm safety culture is the industry's responsibility, not just individual farmers. Training sessions provide an opportunity to both introduce and administer the OPM-MU with advisors, encouraging them to also consider their own—sometimes mobile—workplaces.

Short course for accident and emergency department staff

As discussed in the literature review, the Farm Injury Optimal Dataset (20) was designed to collect NSW farm injury data at hospital-level to improve data quality. Unfortunately, this coding practice was not taken up, leaving farm injury data to omit specificities and remain somewhat unreliable. To begin this cultural change on a smaller geographic scale, with the intention to improve the quality farming injury data and reduce the gaps, the NCFH proposes to develop and lead a short course for A&E department staff. This course is intended for staff to learn how to record and collect farm injury data effectively. It would be delivered as a self-taught, online portal, requisite employee course at Western District Health Service, and

the injury data forms for farming would be available in the hospitals admission forms. It could also partner with the Rural Acute Hospital Data Register (RAHDaR) to increase the data uptake in regional south west health services and all UCCs, which are the key entry point to medical facilities that service smaller rural and remote farming districts. This method would work towards capturing more accurate farming accident data. According to Peck et al, by capturing emergency presentations at the lower-resourced UCCs, RAHDaR also captures as much as 35% more data than currently available via the government-reported dataset (21, 22)

Level IV OHS unit at VET/ TAFE

Farm safety culture should be represented in the Level IV OHS unit that is delivered nationally. The current level four unit, which is compulsory, should be superseded (AHCWHS401 Maintain work health and safety processes) by developing and adopting a revised competency under the AHC package such as “Develop and maintain a workplace safety culture.”

Table 5: List of medium term methods and tools including education to measure farm safety culture

Method Numbers and links	Method of measurement	Type: (Lag, Lead, Ed'n)	Agriculture Victoria's role	Additional comments	Recommendations	SEM Alignment	Expert Ref. Group Alignment (No. linked to cluster)
3,4,5,6,7, 8, 10	5. Livestock Farm Monitor	Lead	Include OPM-MU for longitudinal safety culture measurement	Reaches 94 farms across cropping, sheep and beef enterprises		Organisational (farm and finances), community (AgVic, industry)	3 Siloed farm safety assessments 7 Industry safety competence and consistency
3,4,5,6,7, 8, 10	6. Dairy Farm Monitor	Lead	Include OPM-MU for longitudinal safety culture measurement	Reaches 80 Victorian dairy farms		Organisational (farm and finances), community (AgVic, industry)	3 Siloed farm safety assessments 7 Industry safety competency and consistency
3,4,5,6,7, 8, 10	7. Best Wool/ Best Lamb discussion groups	Lead	Add the OPM – MU survey at the beginning and end of year	Advisors need briefing and education (see education recommendation)	Provide support and training for coordinators to incorporate and/or suggest OHS into discussions	Individual, interpersonal (sharing ideas), organisational (AgVic and farm business representation), and community (industry)	3 Siloed farm safety assessments 7 Industry safety competency and consistency

Method Numbers and links	Method of measurement	Type: (Lag, Lead, Ed'n)	Agriculture Victoria's role	Additional comments	Recommendations	SEM Alignment	Expert Ref. Group Alignment (No. linked to cluster)
3,4,5,6,7, 8, 10	8. Better Beef Network discussion	Lead	Add the OPM – MU survey at the beginning and end of year	Advisors need briefing and education (see education recommendation)	Provide support and training for coordinators to incorporate and/or suggest OHS into discussions	Individual, interpersonal (sharing ideas), organisational (AgVic and farm business representation), and community (industry)	3 Siloed farm safety assessments 7 Industry safety competency and consistency
3,4,5,6,7, 8, 10	9. Group coordinator/ Industry Advisors	Lead	None. RTOs only	Hazard Identification form (pre farm visit) are collated and reported on back to advisory boards and committees	Undertake an audit of the use of these forms and consider safety climate/ culture for the farms and safety of students and staff.	Community (higher level advisory and levy expenditure)	3 Siloed farm safety assessments 5 Issues with farm safety measurement tools
12, 14 & 16	10. Vic Child Health and Wellbeing Survey	Lead	Support Department of Education to include 1 or 2 key questions about children on farms	Potential for OPM-MU to be embedded in the long term.	Short term data about children on farms needed. This is a cross-sectoral shift to consider child safety, health and education.	Individual, inter-personal, community and public policy.	1 Lack of understanding of safety benefits 2 Missing health, wellbeing and safety data

Method Numbers and links	Method of measurement	Type: (Lag, Lead, Ed'n)	Agriculture Victoria's role	Additional comments	Recommendations	SEM Alignment	Expert Ref. Group Alignment (No. linked to cluster)
2 & 9	11. Group coordinator/ Trusted advisors	Education	Provision of funds to NCFH or partnership arrangement	Training in safety culture in your agribusiness workplace and how it translates to the farmers you connect with.	NCFH to design a short education course for agribusiness and extension staff in rural and regional farm services.	Community, organisational and interpersonal (medium to farm level for influential/ relationships with farmers)	5 Issues with farm safety measurement tools 7 Industry safety competency and consistency
2	12. Public health and administration to collect data effectively	Education	Provision of funds to NCFH or partnership arrangement	Partner with PHN and Western Alliance's RAHDaR, WDHS, Deakin University	Design and deliver a short education for A & E staff in rural and regional health services.	Community (data sharing) and organisational (data collection) and individual (skills to collect the data)	5 Issues with farm safety measurement tools

Longer term methods

The longitudinal foresight for these methods reflects farm safety culture maturity which accounts for the non-linear cause and effects of safety interventions and their influences. Three methods are proposed as projects to measure farm safety culture (as shown in orange) in a more mature context. From ongoing discussions throughout this project term with Agriculture Victoria, the authors suggest that two higher degree by research (HDR) PhDs be created, one specifically to develop a maturity model (as shown in grey). Table 4 expands on strategic topics for PhDs and links the SEM levels and the themes from the Group Wisdom to the remaining project proposals to measure farm safety culture.

Recommended Higher Degrees by Research

The literature showed minimal evidence of validated and published evidence of how to measure farm safety culture. The NCFH proposes to build on this contribution to new knowledge by delivering two PhDs to continue to research and refine the techniques to effectively measure farm safety culture.

PhD A

Using the OPM-MU, baseline data, and the current industry surveys, this PhD measures farm safety culture and farm safety culture maturity. As demonstrated by the ARPANSA Cultural Maturity Model, safety maturity develops in the spirit of best practice (23). This PhD would use range of data and refer to known influencing factors in time (eg. WorkSafe television and social media campaigns, VFF Making Farm Safer program, facilitators using the OPM-MU with participants in the Dairy Farm Monitor and Farm Monitor) to model predictors for farm safety culture maturity on farms from different farming sectors in Victoria. This PhD would require statistical modelling support to predict farm safety culture maturity.

PhD B

This PhD researches the integration and effectiveness of the OPM-MU used by trusted advisors and facilitators in making farms safer. The project includes a control group (non-OPM-MU advisors) and an intervention group (advisors using the OPM-MU to facilitate farm safety discussions) to identify how farm safety and farm safety culture is discussed, symbolised, imitated and represented within these farmer-advisor inter-relationships. This PhD would use critical ethnography as the research method to better understand the role of trusted advisors and the OPM-MU survey as a measure of farm safety culture.

Graduate Learning Outcomes Survey

Whilst inroads are being made in educating and measuring impact of postgraduate education in Agricultural Health and Medicine, there is little evidence to suggest that farm safety, safety culture and safety communication are currently incorporated in Victoria Bachelor-level Agricultural and Veterinary sciences. These tertiary qualifications are a pathway for many agricultural professionals working as trusted advisors in the areas of agribusiness, agronomy, crop science, animal health and production, research and private consultancy. Addressing the gap in working knowledge and understanding of farm safety culture at a tertiary level will enhance the leadership, skill and confidence with which graduates engage with their clients regarding farm safety. Inclusion of farm safety culture content in existing curriculum would continue to complement—if not enhance—current graduate learning outcomes (GLOs) outlined by institutions. Incorporation of the OPM-MU safety culture question set into graduate outcome surveys would serve as a mechanism for measurement of the extent to which graduates are considering safety culture in their professional roles.

Recent evaluation of post-graduate Agricultural Health and Medicine students from a variety of professional backgrounds highlighted the importance of a collaborative, multi-generational and multidisciplinary approach to improving health, wellbeing and safety. The study reported that the cultural competence of graduates improved as a result of undertaking the post-graduate course, with 73% agreeing that their ability to address the occupational and environmental hazards of agricultural communities in their region has improved (24).

In summary, reversing the trend of farm fatalities, injuries and illness means farm safety culture must be on everyone's agenda —individuals, families, industry, health, general practitioners, agribusiness, policy and government and it must be measured and measured with a common metric. Just as farm safety culture does not occur in vacuum, neither will its improvement.

Table 6: List of longer term methods and tools, including two PhDs, to measure farm safety culture

Method Numbers and links	Method of measurement	Type: (Lag, Lead, Ed'n)	Agriculture Victoria's role	Additional comments	Recommendations	SEM Alignment	Expert Ref. Group Alignment (No. linked to cluster)
1 - 10	14. HDR – PhD A	Lead	Provision of funds and advice in a partnership arrangement with stakeholders	Larger scale survey	Safety culture maturity model	Community, organisational and individual	5 Issues with farm safety measurement tools
1 - 10	15. HDR- PhD B	Lead	Provision of funds and advice in a partnership arrangement with stakeholders	Action research	Control group and intervention group of trusted advisors to determine the effectiveness of the OPM-MU	Community, organisational, individual	5 Issues with farm safety measurement tools

Method Numbers and links	Method of measurement	Type: (Lag, Lead, Ed'n)	Agriculture Victoria's role	Additional comments	Recommendations	SEM Alignment	Expert Ref. Group Alignment (No. linked to cluster)
1-10	16. Safety for advisors	Lead	Provision of funds and advice in a partnership arrangement with stakeholders	Intervention and control groups study of advisors' workplace safety culture	Measuring farm safety culture influence	Interpersonal, individual	7. Delivery of safety advice
1,2	17. Graduate learning outcomes for safety culture in organisations in Australian agriculture.	Lead	None	NCFH with Longerenong College, SW TAFE, RIST (Western Vic perspective) as pilot, then roll out at a university level. Opportunity to use peer research and use the survey to measure safety culture.	Evaluation of the graduate learning outcomes could be undertaken through addition of specific questions to existing survey instrument (e.g., Graduate Outcome Survey)	Organisation, individual (tertiary students), and interpersonal (peers at tertiary level)	5. Issues with farm safety measurement tools 6. Fear of safety bureaucracy 7. Industry safety competence and consistency 8. Relevance of reporting measure
1,2, 3	18. 18. Role of company directors in farm safety project	Lead	None	Cultural shift to acknowledge that safety needs to be owned by the industry, not just the farmer	All peak industries, NFP, RTOs, private agribusiness, RDCs ensure that safety is part of their formal business evaluation.	All levels	7. Industry safety competence and consistency

APPENDICES

Appendix 1. Search methodology for the peer and grey literature review

Peer review literature search method

The peer reviewed literature search follows a rigorous academic process. The search was constructed in MEDLINE Complete (via Ebsco), Embase (via Embase.com), APA PsycINFO (via Ebsco), Global Health (via Ebsco) and SocINDEX (via Ebsco) and Engineering Village. The search incorporated the following concepts:

- Farmer (farm, agriculture, agricultural worker, pastoralist, herder, farm hand, family farm)
- Workplace (injury, accident, safety, hazard identification, incident, occupational hygiene occupational health, safe environment, chemical safe)
- Safety (culture, climate, habit, health behaviour, safe practice, ways of doing, attitude)
- Occupational illness (fatal, death, danger, safe, risk, fatigue, trip, slip, fall, near miss, well-being, emergency department, ambulance, hospitalisation, physical health, tired)
- Culture (safety, safe practice, safe approach, duty of care, safety invest, positive work culture)
- Behavioural change (measurement, influence, barrier, adopt, attitude)

Each concept was searched independently and then combined. All bibliographic database search results and selected grey literature were collated in EndNote X9 citation software. Citations were exported to Covidence for screening workflow, aligned to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines. Two reviewers independently screened studies for inclusion in the dataset based on the title and abstract details. Any discrepancies between the researchers were resolved by a third reviewer who cast the vote to whether the article met the project criteria or not.

Search comprehensiveness and literature sourcing was limited by time constraints, language proficiencies (English) and the nature of review conducted.

Grey literature search method

A simplified version of the MEDLINE Complete search strategy was adapted to source government and other reports, or grey literature. The search was run through Google Advanced search using the terms Assessment or tool or measure | “farm safety” | “safety climate” | agriculture | program “safety| filetype:pdf. A total of 34,000 results were retrieved. The first one hundred websites, contained within the first 9 pages of search results, met the project criteria.

Twelve attempts were made to capture an accurate search, keeping terms simple and ensuring that the search results stayed relatively similar when searches were shifted from the Google interface to the advanced search interface.

The final search terms that were used to capture a broad farm safety focussed literature included: Assessment or tool or measure | “farm safety” | “safety climate” | agriculture | program “safety| filetype:pdf. All of the references included the term “safety climate” with the exact phrase farm safety. Any site with the words assessment, tool or measure were included with the web address limited to .edu, .gov and .org. However, with no time limits set to refine the search further, 34,000 results were retrieved. The first one hundred websites, contained within the first 9 pages of search results, met the project criteria.

Data identification and extraction

The dataset was tabled in discrete forms (grey literature, stakeholder materials and peer reviewed) with identifiers to show where it was sourced. An internal review of stakeholders’ programs of interest contributed to the data. During the summarising process duplications were found; but both were retained and counted once only.

The following headings were used to extract the data:

- Identifier
- Web address or Author and date
- Organisation
- Source type (Government, statutory agency etc.)
- Safety program title
- PDF downloaded (Yes/No) – if yes, saved with identifier at beginning of file name for reference
- Is it relevant? (Yes/No)
- Target audience (population, setting, opportunity)
- Country (or State if Australia)
- Form or literature type
- Measurement tool, indicator or evidence of measuring change in safety
- SEM level
- Outcome
- Recommendations
- Comments/notes

Appendix 2. Participating stakeholders' details for Group Wisdom input

ORGANISATION	NAME
Farm Safe Australia	Stevi Howdle
Country Women's Association (State Pres. Vic)	Marion Dewar
Country Women's Association	Margaret Wood
Dairy Australia	Sally Roberts
Victorian Young Farmers Advisory Council/Grain Grower	Joe Boyle
Victorian Farmers Federation	Martha Eccles
Birchip Cropping Group	Fiona Best
WorkSafe Victoria	Cait Lewis
WorkSafe Victoria	Tarnya Dalla
Livestock Producer	Sally Jarvis
Endowed Chair Rural Safety and Health (Uni Iowa, USA)	Prof. Diane Rohlman
Agribusiness	David Matthews
National Centre for Farmer Health	Prof Susan Brumby
National Centre for Farmer Health	Dr Jacquie Cotton
National Centre for Farmer Health	Dr Amity Latham
Deakin Rural Health	A/Prof Vin Versace
Ballarat Health Services	A/Prof Anna Wong Shee
Agriculture Victoria	Dr Lisa Cowan
Agriculture Victoria	Julie Harman
Agriculture Victoria	Claire Ouna
Honours Safety Student (observing)	Jordan Walker

Appendix 3. Statements under headings with weighting, colour coded for cluster map

	Cluster groups	AVERAGE IMPORTANCE RATING	AVERAGE BRIDGING VALUE
1	**Lack of understanding of the benefits**	**Avg 3.62**	**Avg 0.66**
8	Safety culture is not well defined. Is it having a policy? Providing training? Creating an environment where you are not afraid to speak up if something is unsafe?	4.00	0.68
47	The impact of farm safety training and safety plans on farm safety culture is not evaluated.	3.77	0.71
62	There is no incentive for farmers to provide accurate farm safety data.	3.38	0.71
20	The cost-benefit of complying or not complying with occupational health and safety is not measured.	3.31	0.54
2	**Missing health, wellbeing, and safety data**	**Avg 3.54**	**Avg 0.49**
68	Poor incident reporting culture on farms means accidents and injuries are not a good indicator of farm safety culture.	3.85	0.44
23	Many do not identify a farm injury as a workplace injury.	3.62	0.50
35	Chronic and long term health and injury (pack pain, chemical exposure) are not recorded as work injuries.	3.54	0.52
50	Small injuries are often not considered worthy of reporting.	3.15	0.49
3	**Siloed farm safety assessments**	**Avg 3.54**	**Avg 0.35**
61	Farm safety self-assessment hazards checklists “end” at the farm (i.e. we don’t know if or how the assessments are used to improve farm safety).	3.69	0.28
40	Farm safety is measured using a narrow approach (e.g. hazards or industry-specific way), so there is no ‘whole-farm’ approach to farm safety assessment.	3.62	0.28
53	There is a gap between the developers of safety assessments and farmers who complete them.	3.54	0.49
55	There is no benchmarking of key indicators of positive farm safety culture.	3.31	0.37
4	**Power, vulnerability and workplace relations**	**Avg 3.49**	**Avg 0.38**
24	Young workers may be reluctant to speak up about poor OH&S or risk.	3.92	0.38
25	Farm workers reluctant to speak up because of concern about losing their job.	3.83	0.27

26	Farm worker data is poorly recorded - they often do not make the decisions about safety, unwilling to share due to power issues and other sources of vulnerability (language, visa status).	3.77	0.48
58	Many farmers believe that they provide a safe workplace but it means nothing if their employees do not share that belief.	3.69	0.32
16	Farmers with employees may have a stronger vested interest in farm safety as opposed to those working without employees.	3.23	0.28
15	Unless people are employed on farm outside of family members, the importance of farm safety declines.	3.08	0.56
17	Farm workers think they are safe because the farm owner takes the responsibility for induction, PPE provision, demonstrations and supervision.	2.92	0.38
5	**Issues with farm safety measurement tools**	**Avg 3.31**	**Avg 0.14**
42	Lack of objective measurements and data available to assess changes over time and in response to initiatives, programs etc.	3.85	0.07
52	Communication, a key part of any safety system, is often not measured on farms.	3.69	0.07
64	Deaths and near fatal accidents are lag indicators of the impact of farm safety culture.	3.69	0.00
63	Farmers have no base from which to measure themselves and then remeasure periodically to check for improvement.	3.62	0.17
6	It is hard to engage people to take surveys multiple times to develop and validate measurement tools.	3.46	0.05
10	Measurement tools are too long and take too much time to complete.	3.46	0.02
54	We need to understand more about serious injuries and deaths on farm.	3.46	0.24
39	Existing injury/fatality data sets do not predict specific farm safety culture.	3.46	0.19
37	It is hard to identify the right measures to track indicators when multiple measures are available.	3.46	0.01
65	The production cycle (Plan, Do, Review, Adjust) is commonly used to benchmark farm production, but is not used to improve farm safety.	3.38	0.20
56	Farm safety culture measures are needed to account for differences at the farm level (eg. sector level - dairy, horticulture, livestock).	3.00	0.24
38	Knowing how to blend lag and lead indicators.	3.00	0.08
28	How farm safety campaigns influence farm safety culture is not well measured.	3.00	0.27
36	It is hard to incorporate mental health and wellbeing.	3.00	0.36
34	It is hard to connect new measurement tools to other existing surveys (e.g. Regional Wellbeing Survey).	2.77	0.01

27	Visitor injury data is hard to capture.	2.69	0.26
6	**Fear of safety bureaucracy**	**Avg 3.29**	**Avg 0.68**
2	Farmers don't trust 'outsiders' so this needs to be done by trusted people or organisations.	3.77	0.43
4	Most smaller farms don't document Work Health and Safety - it's 'in their head', so evidence of culture is rare.	3.69	0.62
45	Farmers are wary of recording and reporting safety issues to WorkSafe.	3.69	0.71
19	Implementing new safety procedures/equipment may have a financial cost.	3.38	1.00
44	There is a diverse range of farm types (from sole traders to large corporate farms) that have varying resources to dedicate to safety initiatives.	3.38	0.57
21	Family farms may not have "workplace" safety policies.	3.08	0.47
48	Lack of clarity about how safety rules and regulations apply to visitors on the farm.	2.92	0.75
29	Many businesses are not under Workcover.	2.92	0.83
5	Most family owned/operated farms don't have a Health and Safety representative, so who should measure safety culture.	2.77	0.77
7	**Industry safety competence and consistency**	**Avg 3.27**	**Avg 0.80**
43	Peer-to-peer safety training delivered by agricultural industry groups is inconsistent.	3.54	0.77
51	There is no universal professional safety training for farmers.	3.31	0.83
31	The delivery of OH&S information is impeded by poor relationships between farmers and the safety authority.	3.31	0.71
67	Agricultural extension program funding does not prioritise farm safety culture (and evaluation) as a criteria.	3.08	0.86
30	Safety inspectors are viewed negatively because some employ a high enforcement and publicity role to offset their manpower in rural and remote areas.	3.08	0.81
8	**Relevance of reporting measure**	**Avg 3.26**	**Avg 0.45**
59	The family owned/operated nature of farms could impact the objective assessment of safety culture.	3.62	0.53
7	Knowledge of what 'farm safety' means varies from farm to farm.	3.54	0.44
60	Farm safety culture and safety requirements can differ across seasons (eg. harvest, contractors, seasonal workers) affecting measurement.	3.46	0.46
49	Policies and procedures on owner operator farms may not be the best measure as they may not reflect everyday safety practices.	3.31	0.44

41	Farmer perception of their safety will differ from objective measures.	3.23	0.56
32	Structures that are used the least are overlooked when completing audits or maintenance (example, shearing shed steps can be dangerous - only used a couple of weeks per year).	2.92	0.41
22	Farmers don't do the same thing every day - so may not be familiar with safety features.	2.67	0.35
9	**Farmer perceptions and attitudes**	**Avg 3.05**	**Avg 0.23**
18	Farmers don't think about long-term consequences of immediate OH & S (e.g., hearing loss, respiratory symptoms).	3.54	0.45
14	Farmers may not believe the hazard is dangerous.	3.42	0.16
57	Farmers and non-farmers perceive risks differently.	3.38	0.22
3	Many farmers are “time poor”, so perhaps many are less likely to attend farm safety workshops, or spend time on evaluations if it will take them away from pressing day to day tasks.	3.38	0.32
13	The independent nature of farmers means they may be reluctant to ask for help.	3.38	0.13
1	Many farmers don't see themselves as running a business and somehow feel exempt from rules that apply to all other businesses.	3.31	0.24
11	Farmers don't see value in talking about safety culture.	3.00	0.27
12	Farmers may have a fatalistic approach to injuries - it will be what it is meant to be.	2.92	0.17
66	Family farm occupational safety responsibility often falls to women who are not at the greatest risk.	2.77	0.22
9	It can be hard to approach the owner/operator of the farm.	2.77	0.30
46	Masculine hierarchy is the dominant way that many farms operate.	2.62	0.11
33	Perception that people who use lifting apparatus on units are weak.	2.08	0.17

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