NATIONAL CENTRE FOR FARMER HEALTH

Measuring a Culture of Safety on Farms:

A review of the grey and peer literature

A review of the grey and peer literature for the measuring a culture of safety on farms project from the National Centre for Farmer Health (NCFH), Hamilton 2021.

Measuring a culture of safety on farms project.

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Authors

Professor Susan Brumby, Dr Jacquie Cotton & Dr Amity Latham

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Contact Details
Dr Susan Brumby
National Centre for Farmer Health
Western District Health Service
PO Box 283
HAMILTON VIC 3300
Phone: 03 5551 8533
Fax: 03 5551 8267
Email: susan.brumby@wdhs.net

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Glossary of terms

AMOSCC

AMOSSC is an acronym which 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.

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 operations.

Indicators / measures

Indicators, or measures, are the know-able 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.

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 the signs and signals of farm safety culture.

Safety climate

Farm 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.

1. EXECUTIVE SUMMARY

The Department of Jobs, Precincts and Resources is undertaking a project ***Measuring the Culture of Safety on Farms*** in the pursuit to measure and monitor the current and future safety culture on Victorian farms. To begin the process, this report is part of the project sequence to present a literature review specifically to scope how and where farm safety culture could be measured. This is a key phase in the approach to developing an Agriculture Measure of Safety Culture/Climate (AMOSCC) and recommending the methodology to measure the culture of safety on farms to Agriculture Victoria.

Safety culture could be considered as the social by-product of the organisational "walk and talk" that is created by safety attitudes that follow, evolve, and fasten to the workplace. Measuring safety culture is complex and it requires quality data and consistent processes to achieve a meaningful measure. This literature review demonstrates the current but limited measures in place for farming. It is structured to introduce the reader to the definition of safety culture and safety climate, the methods relating to how safety culture is measured, and then it concludes with recommendations while identifying the gaps that exist that may impede the measurement methodology.

It must be noted that this type of work is in its infancy. Measuring safety culture on farms is considerably complicated as most farm businesses are family owned and they may consist of one owner/operator with unpaid family support. These small organisational sizes means that measuring safety culture is micro-scale with significant risk of skewing the metrics and the usual challenges with farmer-engagement. But at the same time these farm businesses are vital to Victoria, and agricultural accidents and fatalities remain consistently higher than other high-risk industries. Therefore a wide net was cast to specifically collect insights from these high-risk occupations. We found that safety culture is measurable as demonstrated by the forestry, nuclear, construction, aviation, gas and oil industries. The purpose of this review is reveal how develop a methodology that is fit-for-purpose for the uniqueness of farming.

This report highlights that farm safety research (intervention, epidemiology, ethnography) focusses on farmers as individuals, and holds them responsible and accountable for farm safety and farm safety behaviour change. Culturally, farming accidents are 'blamed' on individuals rather than the environment, structural, legal and equipment 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 at individuals' knowledge, behaviour and attitude. Using the socio-ecological model (SEM) to distribute where leading indicators are measured the findings reveal that it is well overdue to shift the focus from the farmer and look further down the supply chain or further up the SEM levels, to make other groups and agencies accountable for farm safety. The farm services sector, including regulators, banking and

insurance, together with all levels of government as well as health, need to become part of the system that holds the industry as a whole accountable for farm safety.

Given the immaturity of this work, it is recommended that Agriculture Victoria's next iteration of *Measuring Safety Culture on Farms* project accounts for and maintains collaboration with a global network and seeks to retain collaborations with others doing this work both internationally, nationally and industry wide. The work of the European Agency for Safety and Health at Work, which has dedicated $5M over five years to look at agricultural occupational safety and health, must be considered moving forward. This specific project has been undertaken with the cooperation of safety and agricultural experts across the EU and includes some international observers and participants. Whilst the project has been hampered by COVID-19, which has restricted meetings and also reduced engagement, it is projected to conclude in 2022. Due to the currency of this work there is very limited published peer-reviewed literature though it has appeared in this literature review through the grey literature search. Further discussion and connection with SARCURIMA (Safety Culture and Risk Management in Agriculture) should continue including the consideration of utilisation of their farm survey with adaptation to Victorian agricultural producers. An adaptation of this survey has already been utilised in Nebraska USA (Risto Rautiainen pers. comm). Utilising aspects of both the Nebraskan USA and Sacurima survey could provide a comparable baseline with some key shared parameters with which to measure farm safety culture at a local and global scale.

Based on this literature review there are numerous recommendations that overlap and duplicate themes, which validates the strength of the findings. Measuring farm safety culture about benchmarking safety performance by farmers, and the agricultural industry as a whole, by measuring multi-level indicators that promote farm production, health, and safety simultaneously. These recommendations are designed to overcome these disconnections through identifying who to work with, where to begin, and what exactly to measure. These recommendations draw upon the unique culture of agriculture in Victoria, to work towards making an important research contribution to reducing the mortality and morbidity occurring in the farming industry.

In summary, the recommendations at this phase of the project are to:

- Build on existing approaches to measure farm safety culture and utilise experts and key stakeholders to build capacity and strengthen networks to overcome any reinvention;
- Seek new linkages between farming databases and health databases in line with Agriculture Victoria's selection of databases, to provide longitudinal baseline information, noting legislation for privacy, plus the statistical capacity to connect multiple sets;

- Consolidate and integrate a questionnaire fit-for-agriculture into existing surveys and distribute it through existing farming groups;
- Create efficiencies by standardising and capturing core safety evaluation measures (farm safety self-assessments) from farm engagement activities by industry groups and safety extension, to contribute to a safety culture dataset, supported by resourcing higher degrees by research students, to accelerate Victoria's progress in this field;
- Ensure any metric or framework implemented must inform, encourage action, be easily obtainable and reportable, be transparent in collection and have strong stakeholder and government support;
- A multi-level approach is followed as a starting point in the infancy of this public policy initiative to measure safety culture on farms. Any methodology needs to develop ways to capture data that includes alternative sources to the expectation on an individual tracking it;
- Measuring farm safety culture is an ongoing process that will require funding to re-measure the influence of interventions at farm-level. A recommendation from this review is to consider whether an organisation (regulatory, cross-sectoral partnership, university) should be the peak body for farm safety research, farm extension, and data management in Victoria to maintain a strong industry presence into the future.

2. INTRODUCTION

Williamson et al (1) enriched the field of safety climate and safety culture research and the theories underpinning the development of benchmarking instruments through measuring perceptions and attitudes about safety climate as an indicator of safety culture. As a result, safety climate was defined as the safety ethic within an organisation or workplace that reflects employees' or workers beliefs about safety and predicts behaviours in the workplace, while safety culture is referred more to the overall organisational and company-level beliefs and attitudes (2). Farm safety climate is what is experienced by individuals and what influences and is influenced by cultures and management and operational systems. Griffin and Neal (3) define safety climate as an organisational factor and as an antecedent of systems safety. Mearns et al (4) defines safety culture as what forms the environment within which individual safety attitudes develop and persist and safety behaviours are promoted.

The heterogeneity among farm businesses and safety climates means there is diversity in safety culture. At any point in time every farming business will have its own safety culture that will measure differently to others. The purpose of measuring farm safety culture is to demonstrate and quantify the investment and impact of safety campaigns, health promotion activities, training programs, and other influential initiatives in farm safety. These influential and intervention-type measures have been captured in a previous report by the National Centre for Farmer Health (NCFH). This literature review, which will inform the consultation and development of the AMOSCC methodology, aligns with the *Influencing Farm Safety Culture* report. These projects and their safety subjects (measuring and influencing) are co-dependent, designed to gyrate and reinvent each other through cyclical measurements to build our longitudinal measurement of safety culture on Victorian farms.

Traditionally measuring workplace safety in the higher risk sectors (oil, gas, mining, and forestry) has been based on workplace fatalities or reported serious injury that occur. In agriculture the challenge with this form of measurement is that farm accidents, injuries and illnesses are often under-reported or unreported due to the family nature of farm businesses. The majority of farms in Australia remain family owned and operated and it is recognised that farmers tend not to report or seek assistance with problems caused by the physical, mental and safety stressors of farming. This results in occupational health and safety issues across the short and long term that remain undetected, undiagnosed, unconnected, and thus unreported. While the Australian Farm Injury Optimal Dataset (5) provides excellent technical guidance to classify acute injury experiences its uptake is currently not sufficient to be used as a measurement of farm safety culture.

This review sought to find gaps that need to be addressed to be able to adequately measure farm safety culture. It is important to draw the distinction between influencing and measuring safety culture. Work conducted to influence safety culture is vast and involves all levels of the socio-ecological model (SEM). Influencing culture refers to the environments, interventions and programs that attempt to shift safety culture both on individual farms and within the broader agricultural industry. The extent to which programs, interventions and community are changing safety culture is not well known. As a result, through national and international literature this review has searched for evidence of safety culture measurement and monitoring. The search method is scoped for agriculture and farming, but other industries are considered when they demonstrate methods to measure culture and show how the evaluation is performed.

This review demarcates the grey and peer reviewed literature based on the realisation that they are for two very different types of audience. The grey literature is accessible and it is mostly presented to be engaging with its readers. It was predominately sourced on the internet using Google and it is available material for farmers and industry. This grey dataset is very different to the peer reviewed dataset, where this literature is exclusive to researchers as it is written for an academic audience. This review is structured to reflect these significant differences in the literature.

The first chapter of this review outlines the search methods for the grey and peer reviewed literature. The second chapter summarises the findings in the grey literature and demonstrates the variety and accessibility of farm safety self-assessment checklists and safety guides for farmers. These documents and digital technologies are mostly provided by the agricultural industry for farmers to reduce the risks and hazards on their properties, but they fail to be collected or collated as data by those who create them, making them difficult to use as an indicator of safety culture or to measure safety culture change over time. The third chapter summarises the peer reviewed literature. The range of indicators and measures, databases, statistical methods and questionnaires are presented to demonstrate the constructs of what safety culture measurement relies upon to present a metric. The fourth chapter is a summary of the most valuable literature for addressing these complexities in measuring farm safety culture. This literature varies in form, including articles, tools, a website and a survey. Commentary is offered to explain its applicability to a Victorian farming setting. The last chapter presents the recommendations from these findings with the purpose of showing how farm safety culture can be measured. It concludes that although much of the measurement is undertaken in an individual context (i.e. on farm by individuals) any farm safety culture measurement must be grounded in a supportive industry and with multi sectoral collaboration.

3. SEARCH METHOD

Summary

The research method follows a rigorous academic process to retrieve peer reviewed journal articles from selected databases and download relevant grey literature using Google Advanced search. An internal review of stakeholders' programs of interest contributed to the data to refine the dataset to articles of most relevance for analysis of farm safety culture measurement.

Background

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 (6). 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 (7). Refer to Figure 1 for the SEM model as a diagram.

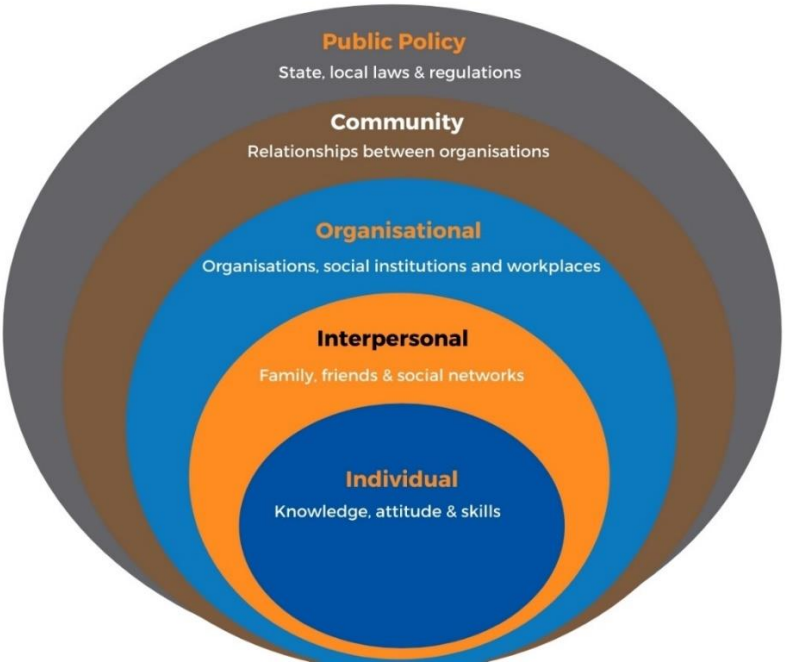

Figure 1: The socio-ecological model (SEM) adapted from Bronfenbrenner (1979) to demonstrate the interplay between individuals, their interpersonal relationships, workplaces, community and public policy including law.

The model has been re-invigorated in farm safety and has been used to frame agricultural safety and health in the USA (8), organise the influences of farmer behaviour in Australia (9), and shift the central figure from the farmer to farm worker to study factors influencing the under-reporting of illness (10). The SEM model improves our understanding of the influencing factors at each level to achieve and measure positive behaviour change within organisations and communities. This framework was followed during the analysis and the development of recommendations for this literature review. The SEM model was used to review literature to identify the distribution of research from individual, interpersonal, organisational, community and public policy levels.

Data retrieval

This literature search followed a rigorous academic process to achieve a reliable dataset to effectively recount and explain what measuring farm safety culture involves. To begin, the literature review employed established and collaborative methods with Deakin expert librarians. The review responded to the aims and objectives outlined by Agriculture Victoria and synthesised and evaluated literature with a focus on identifying the indicators used to measure safety culture. The research team followed an established systematic methodology to identifying both peer review and grey literature. As literature was summarised a snow-balling effect was found as researchers actively sought articles outside the strategic search which contributed to the total database.

During the summarising process duplications were found; but both were retained and counted once only. These duplications and corresponding research identifiers are listed in Appendix 1. The full methodology of how the peer, grey and stakeholder literature dataset was created is listed in Appendix 2.

Figure 2 demonstrates the research review process.

Figure 2: The search method, data management, summarising and synthesis processes undertaken as part of the Measuring Culture of Safety on Farms project.

4. GREY LITERATURE SUMMARY

Summary

Over half of the grey literature is targeted at a farming audience with the majority being farm safety self-assessment tools. Investigating the grey literature that is available to farmers, grounds the research at a farm level to begin to understand the culture of farm safety from the individual or farmer perspective. This chapter demonstrates that safety checklists are found to be the widely promoted "entry level" tool into actively measuring safety climate and change over time. However, a limitation of the check lists is that they are static— meaning that they have no connection or feedback mechanism for measurement. Additional ideas offered in the grey literature included benchmarking and monitoring to measure safety culture and engagement with programs that influence safety behaviour.

Findings

The grey literature dataset consists of 110 resources and initiatives each undertaken by a wide network of state, national and international agencies that are primarily concerned with farm safety or measuring safety culture. It was created from the Google Advanced search results (n=75) and the stakeholders' knowledge of programs (n=35). It reflects agencies and organisations that support measuring safety. Duplicates or irrelevant sources were removed, including Parliamentary budgets and portfolio estimates, agricultural course handbooks, and USDA Farm Safety Net overlap advice.

The grey literature offers many measures, rather than measurements or measurement methodology. This literature takes the form of on farm checklists, insurance membership, safety guidelines, health and safety plans, extension materials, induction checklists, number of participants, research papers, lesson plans, directories, policy priorities, and performance reports.

A full list of peer, grey and stakeholders materials can be found in Appendix 3.

The origin of the grey literature

The grey literature was sourced from a wide range of organisations demonstrating the diversity of agencies that have an interest in making a positive impact in the farm safety domain. The decline of government-funded farm extension services may also explain why there are numerous agencies offering resources in farm safety to fill this niche. Using information from each organisation's website these sources of literature are grouped based on governance structures and funding.

Figure 3 shows that over 60% of the literature is from four main sources: (i) Australia's Agricultural Research Development Corporations and international statutory agencies that each take responsibility in safety initiatives, (ii) independent research partnership-based agencies, including the National Centre for Farmer Health, the Australian Centre for Agricultural Health and Safety, and Pacific Northwest Extension, and (iii) government departments, and (iv) regulatory agencies.

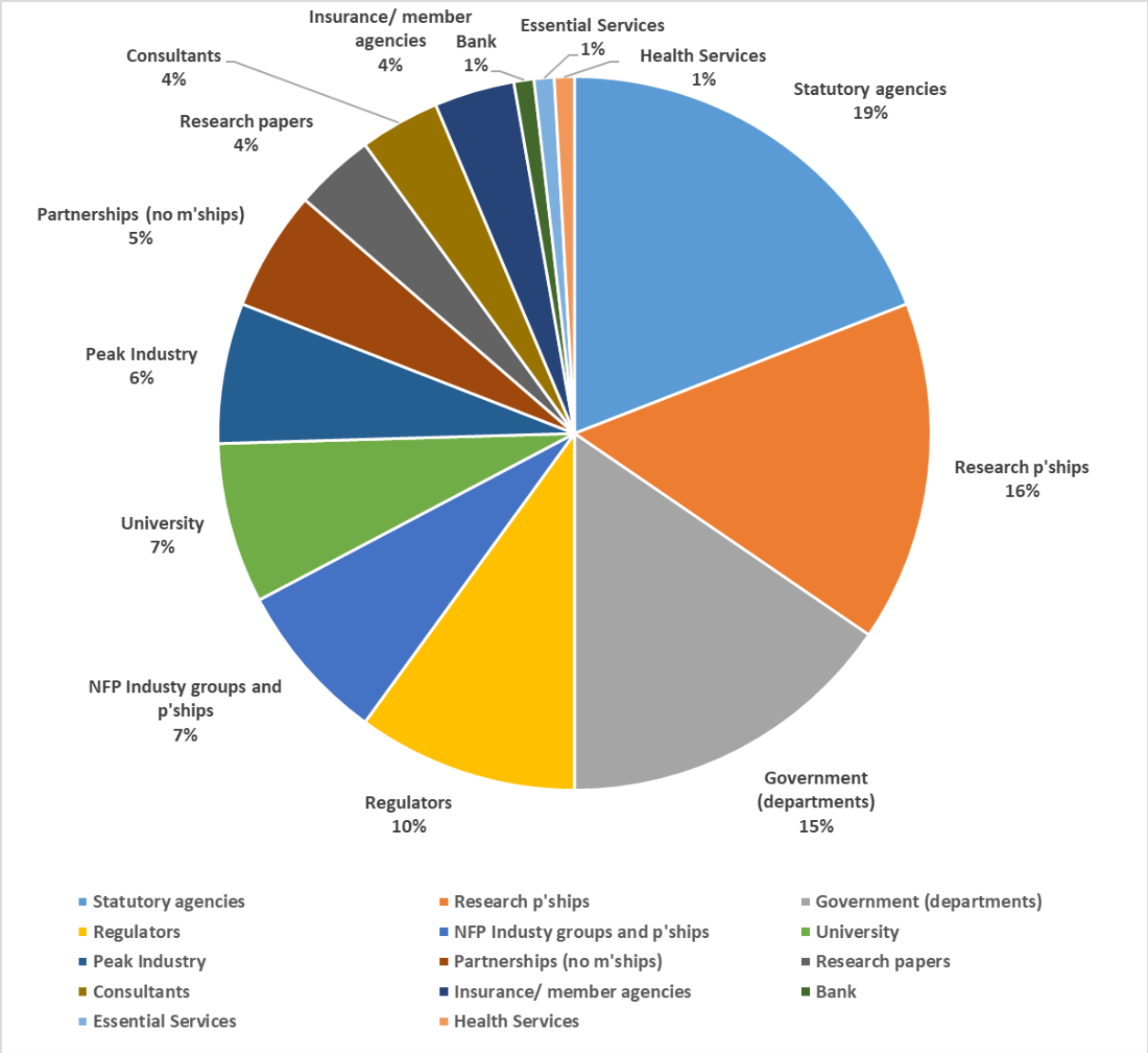

Figure 3: The grey literature downloaded in the search for material relating to farm safety culture is sourced from a range of organisations working in the farm safety domain (n=110).

Literature from universities, Not for Profit (NFP) industry groups, peak industry groups, and agency partnerships make up over 25% of the sources. Seven of the eight universities have available resources in farm safety through their extension services; six are located in the USA and one from Scotland. The Regional Wellbeing Survey from the University of Canberra is included in this group. The NFP industry groups are those that receive funding from multiple sources including memberships. They include organisations such as Farm Safe Australia, Australian Safety and Compensation Council, Farm Safety Nova Scotia and MED Partnerships in Ireland. The peak industry groups are non-statutory and include National Dairy Farm (USA), Canegrowers, Pork SA, the Australian Dairy Council, and the Centre for Construction Work Health and Safety. Partnerships are organisations formed through agreements including People in Ag, Safe Farming Tasmania and the National Rural Network in Ireland.

Four peer reviewed research articles were sourced in the grey literature search, which are not duplicated in the peer-review search. Just over 10% of the farm safety literature was sourced from private consultants, insurance and membership-based organisations, banks, health services and essential services. These less frequent sources continue to demonstrate the broad range of agencies with an interest in farm safety culture.

Where the sources originate supports the understanding of which countries are measuring farm safety and farm safety culture. Figure 4 shows a global spatial representation of farm safety grey literature.

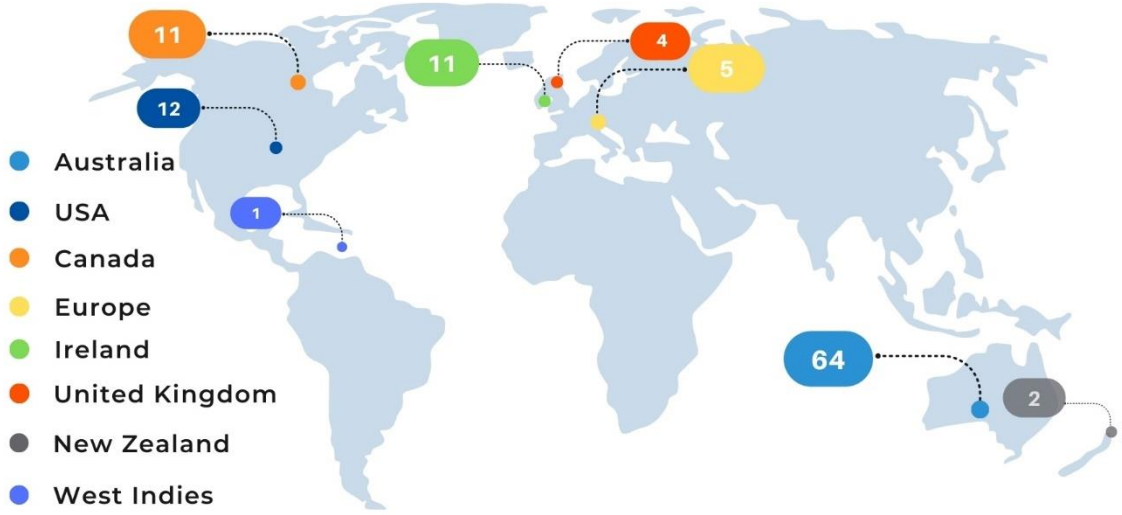

Figure 4: A global perspective of the origin of the grey and stakeholder literature (n=110)

All sources were refined to English, potentially skewing the representation of farm safety initiatives found. Over half of the sources originate in Australia, with Ireland, the USA and Canada collectively representing about 30% of the dataset (refer to Figure 4).

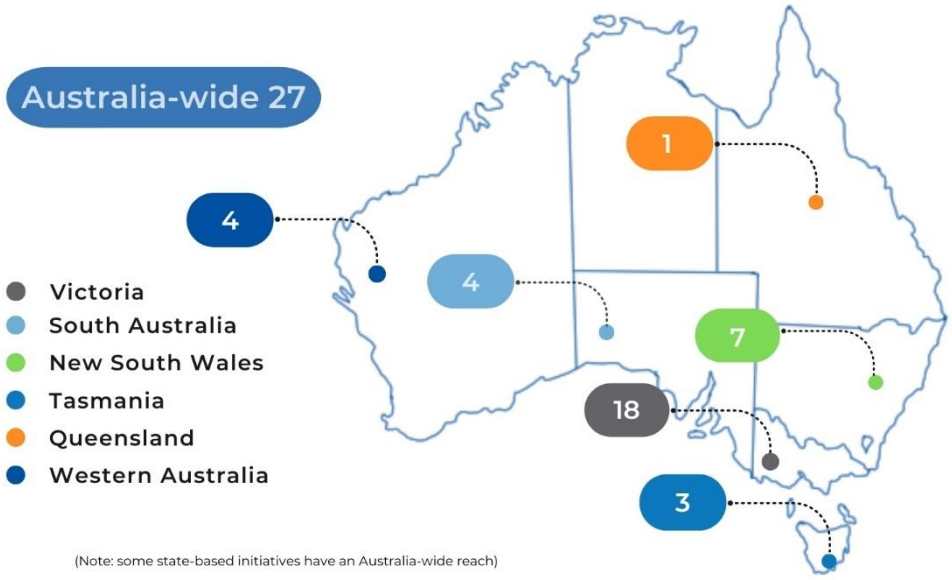

Figure 5: Australian grey literature sources to analyse farm safety culture measurement (n=64).

Over 70% (n = 64) of the national farm safety initiatives are Victorian or Australian-wide in origin (refer to Figure 5). Research organisations and universities in Victoria, such as Monash and Deakin universities, demonstrate capacity in addressing farm safety from a research and evaluation perspective.

Target audiences

The target audience refers to whom the article is intended to be read by. The dataset was classified by considering the purpose of the article, and who is best-fit for applying it in their workplace.

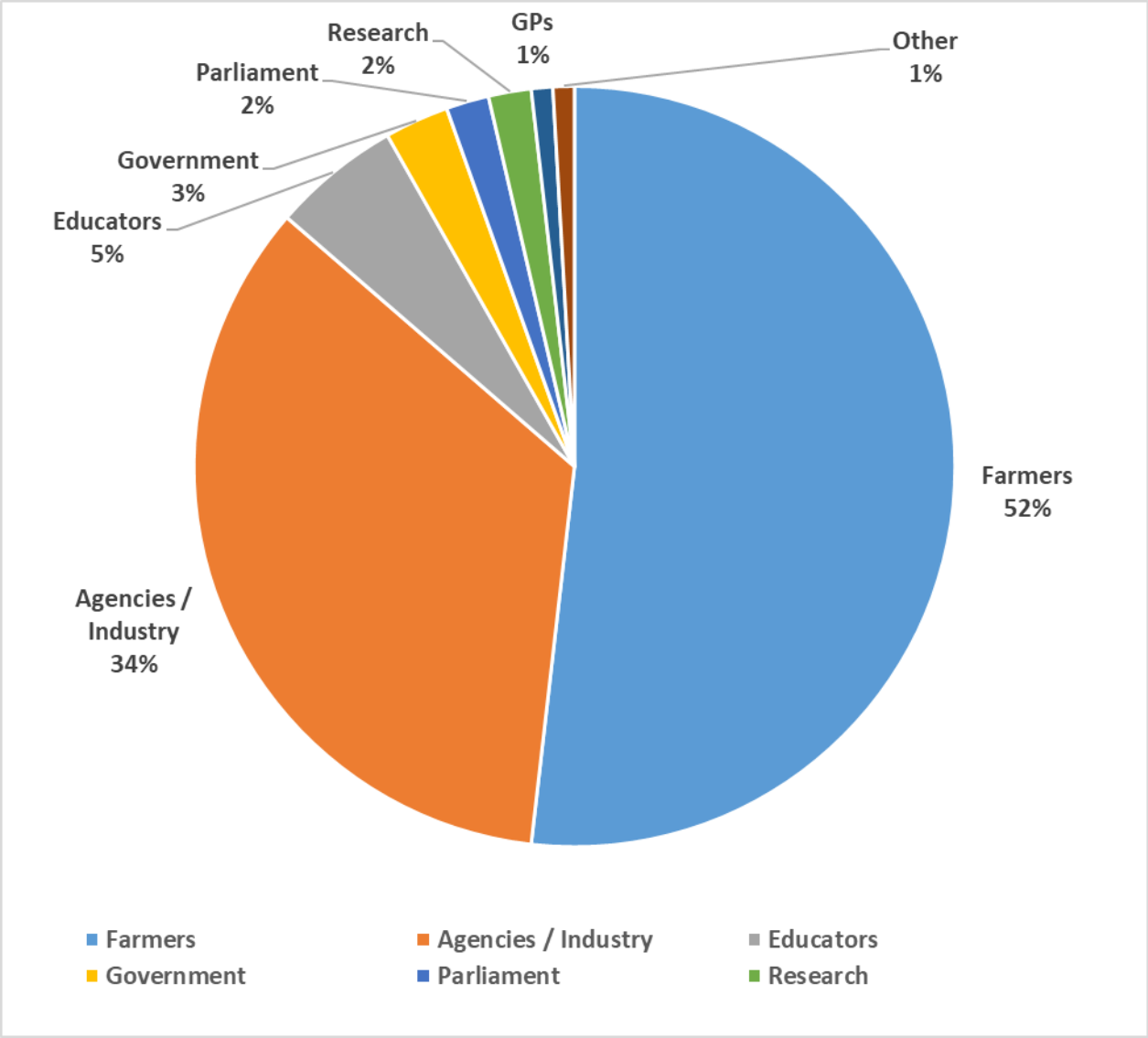

Figure 6: The intended target audiences from the grey literature search (n=110)

Figure 6 confirms that the dataset predominantly targets farmers, which includes all people who live, work and visit farms, as the reading audience. This accounts for just over half of the literature sourced. The second largest target audience for the literature is broadly referred to as agencies. This collective includes the health and safety researchers, policy advisors, investors, and planners, all of whom are involved in agricultural health and safety with a level of decision-making and information sharing. These agencies were grouped because there is consistent overlap in health, safety and policy in this target audience. There are a smaller number of sources of literature targeting those who develop training materials, as well as training materials for educational purposes; these are categorised as education and training (n=6).

These sources may be a lesson plan or they demonstrate how to coordinate a farm safety community event noting that again their intended audience if farmers. The smallest target audiences are government departments, general practitioners, and parliamentarians (n=6).

Document types and purpose

Almost half of the dataset contains self-assessment tools to measure safety (n=53) which is shown in Figure 5. Over one third of dataset contains literature reviews and research papers (n=26) and industry reports (n=12). Public relations documents relate to those which offer services (n=5). The other types of literature include industry strategies (n=3) and directories of services (n=2). Almost 10% of the literature were diverse and could not be grouped. These included rebate information, a grant application, a submission to parliament, a budgetary submission to parliament, a media release, planning resource, survey results, registration for membership, and an agricultural training package (n=9). This broad range of available document types demonstrates the multiplicity of farm safety culture and what it encompasses for stakeholders.

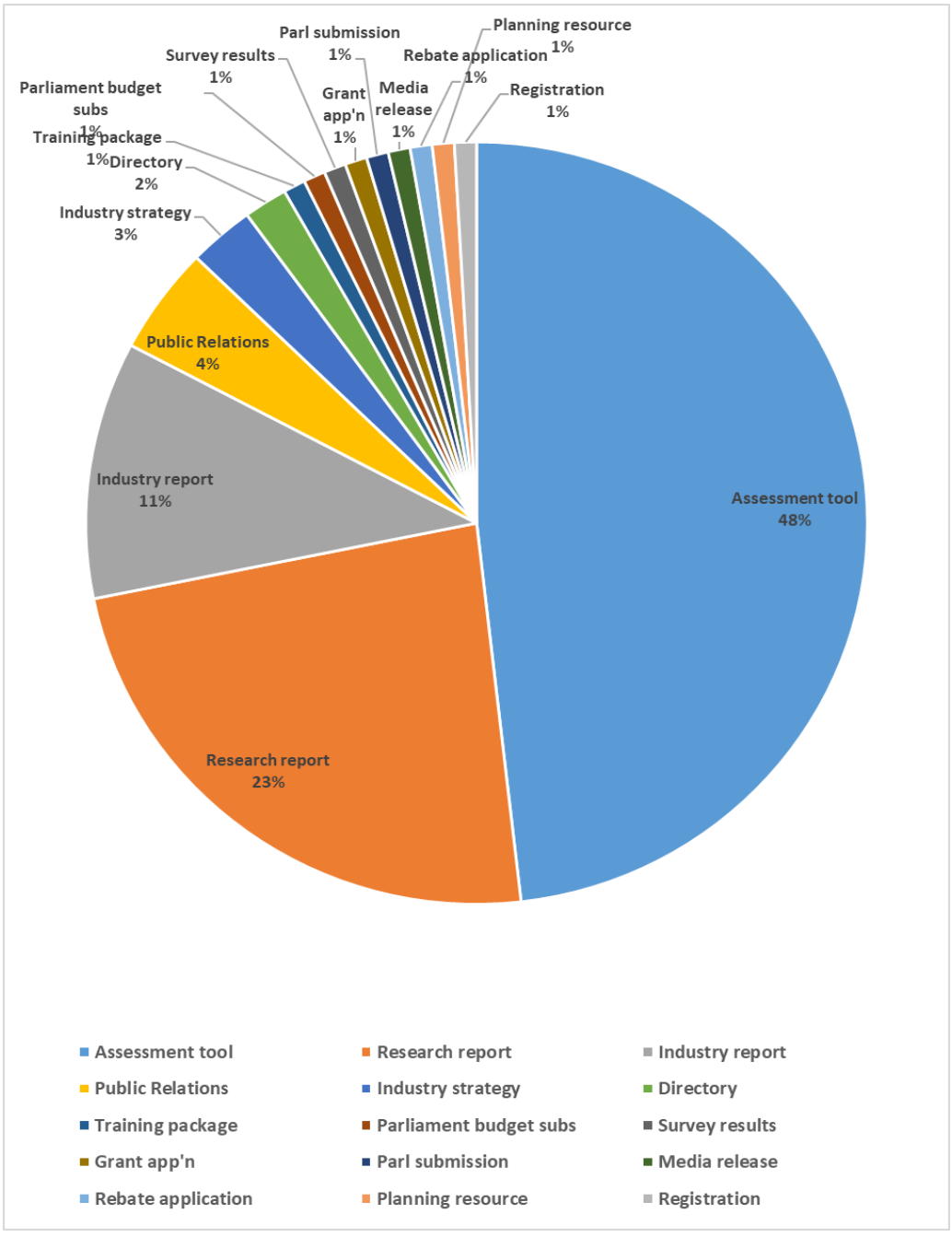

Figure 7: The range of document types found in the grey literature relating to measuring farm safety culture (n=110).

Self-assessment tools to measure safety on farms

In most instances farm safety assessments are designed to be performed as a once-off, individualised activity. This has clear limitations and implications for researchers or agencies seeking to measure and monitor farm safety culture.

The analysis of farm self-assessment safety tools as a farm safety culture measurement moves the analyses of farm safety to farm-level. The dataset shows that farm safety assessment tools are both abundant and inconsistent. These tools take the form of health and safety plans, checklists, and reference guides on farm hazard and risk management. Farm safety and safety climate assessment tools make up 47% of the grey literature dataset (as shown in Figure 6). Aligning with these findings, 53% of the target audience are farmers, farming families, workers and visitors for farm safety assessment (as shown in Figure 5).

What they share is their intention to bring farming risks to the forefront and make the farmer think about their own farm safety behaviours and structural working environment. It is because of these features that they are referred to as self-assessments. Using the socio-ecological model, these documents or forms target individuals to act to protect themselves, with an overlap in SEM levels to protect their interpersonal relationships for family, workers' and visitors' safety on farm, which demonstrates the interplay between the SEM levels.

However, beyond their abundance and accessibility there is little evidence, globally, of the impact of these tools. This is a significant and obvious void in the literature and from the agricultural industry as a whole in understanding the effects of farm safety self-assessment tools and the role that they play in improving farm safety culture and farm safety climate. Referring to the peer reviewed literature (n=218) to check this observation, findings show that there are only seven articles that mention the checklists.

The studies of self-assessment tools include an in-depth study in Korea to classify and review items from four varied safety systems checklists aimed at proposing directions for improving the health and safety of farmers. In this study the authors (11) conclude that it is important to develop checklist items proposing the supplementation of various safety systems. In a US study, the National Children's Center for Rural and Agricultural Health and Safety published Agritourism Health and Safety Guidelines for Children, with policies, procedures and worksite guidelines, to provide helpful recommendations for protecting children visiting agritourism farms (12). In order to better understand what would be required of a farm wishing to implement these safety recommendations the North Carolina Agromedicine Institute conducted a single-family farm demonstration project. The project was successful as the target farm was in compliance with an average of 86.9% of items by the conclusion of the project. Furthermore the project was influential, as

89% of individuals self-identifying as farmers or farm workers who attended the information sessions indicated their intent to adopt or recommend the policies, procedures and guidelines for their own farms or farms with which they work (12). This contributes to understanding the research benefits of tracing the enactment of a farm safety self-assessment tool.

These assessment tools are readily available online which could imply they are widely used and a well-entrenched part of farm safety culture, but evidence of their usage remains unknown and under-researched. Dairy Australia provide the only example where the source, or organisation, that created the checklist has followed up the awareness of their farm safety tool. The Power of People on Australian Dairy Farms (13) reports on the Dairy Australia Farm Safety Starter Kit (14) among other farm safety indicators. The report shows that 17% of dairy farmers in their survey (n=417) have the kit, but it does not ask whether it is being used.

Upon a closer analysis of the 53 self-assessment tools, 70% are targeted at a generalist farming audience, but there are industry specific tools (cane (15), cotton (16), piggery (17), broadacre (18), and livestock (19)) targeted at particular farming sector audiences (refer to Figure 6). Of most interest to measuring farm safety culture is the dairy sector that provides six different tools with one tool, the Farm Safety Starter Kit (14), where photos over time are sought to note changes in safety.

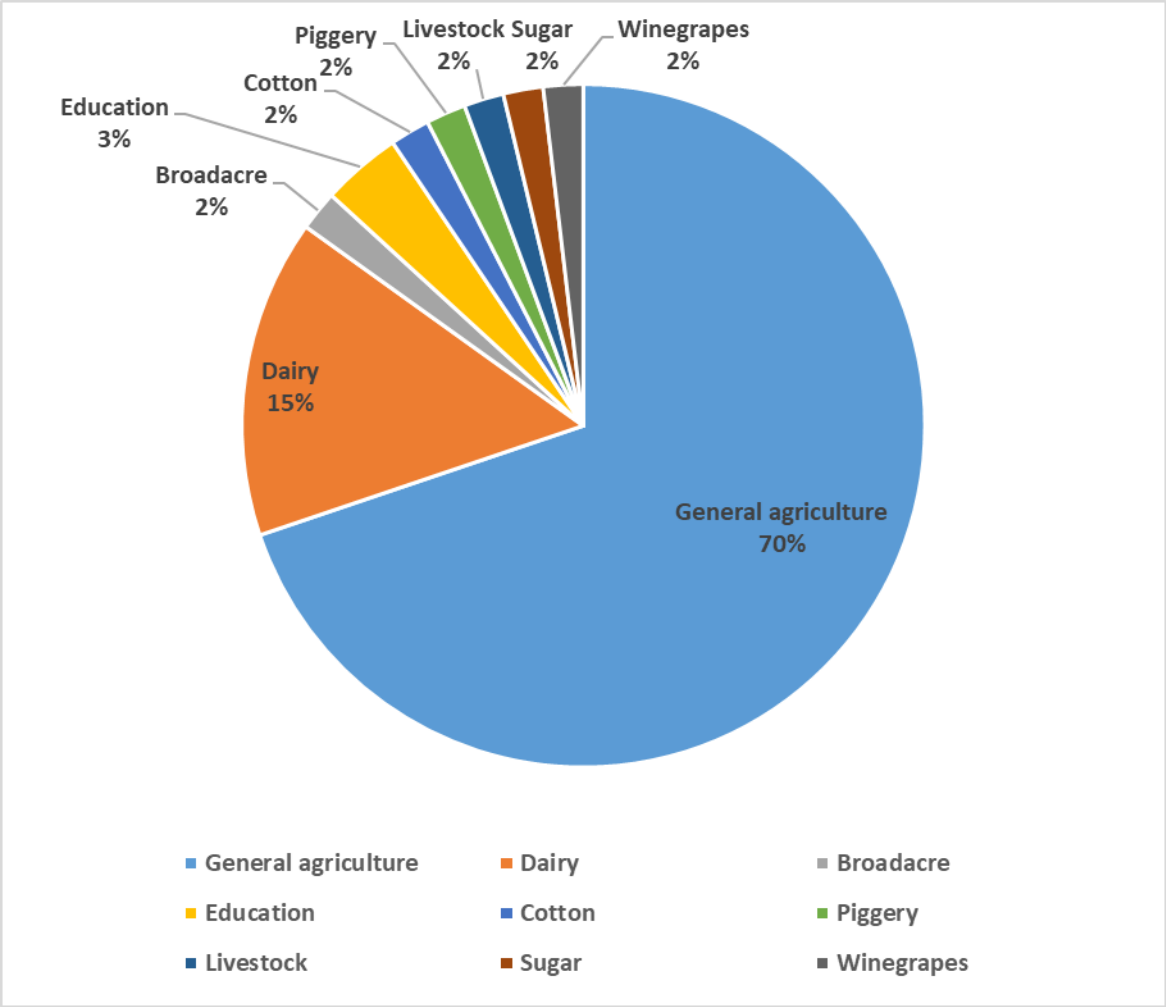

Figure 8: Farm safety self-assessment tools may be industry-specific in focus.

The types of forms that the farm self-assessment checklists, health and safety plans, and guidelines take, illustrates attempts and effort of industry to influence farm safety culture. There is a general pride in the presentation and messaging of safety in these documents. All of the grey literature, except for three hardcopies for the stakeholder materials, are available online. Two self-assessment tools are app-based (Dairy Platform, Farmsafe Induction Tool) and two sites are website information pages (Department of Health Better Health Channel Farm Safety Risks and Hazards and Farm Safety Machinery information sheet). A further analysis of the farm safety checklists and guidelines, such as document forms and lengths are included in Appendix 4.

Whether assessment forms are printable or in mobile-friendly form, they do not effectively facilitate measurement over time. It may be that apps could provide this opportunity in the future.

Digital tools

The grey literature shows that farm safety assessment tools are available through mobile technology. Dairy Australia's shared platform for safety, Dairy Passport[1], is one example where employees and contractors can log in to a registered dairy farm to access maps, safety procedures and messages directly from the farm owner/ manager. It is anticipated that this innovative technology from Dairy Australia has the potential to lead the way to measure farm safety climate and farm safety culture from an industry perspective.

The Farmsafe Induction Tool is an example of mobile technology introducing the farm employee to an example of expected farm safety culture. It is a once-off, 'check the box' for new employees to complete that indicates they agree to abide by a set of safety behaviours and attitudes. If checks are left blank, the farmer is prompted to take action and query the situation with the new employee. When this form is completed, the form is emailed to the farmer for their record keeping. This resource has been created to support farmers' with health and safety compliance but it is not designed to measure farm safety culture.

Similarly, desktop applications to annotate PDF files are changing the traditional paper-based form of farm safety assessments. These electronic checklists bring with them an underlying assumption that the farmer has the software to populate the forms instead of printing selected pages of the manual. There is also a reliance on the farmer to save and electronically file the document for future review. However, during this process of marking-up the forms and filing, there remains no mechanism to prompt this re-measurement and no centralised data collection point outside of the farm.

Ireland's Health and Safety Authority and FBD Insurance have developed an online farm risk assessment tool[2] which allows the farmer to populate their machinery and infrastructure to tailor the assessment for their needs and have a sense of ownership for farm safety. The tool combines safety advice, the code of practice, agreement to accountability as per Ireland's legislative requirements to farm, statistics on injuries and fatalities and photographs to support safety theory and practice (20). If the tool had the ability to generate automatic emails to prompt and measure action, it would be an innovative step towards measuring safety culture.

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[1] https://www.dairypassport.com.au/

[2] https://www.farmsafely.com.

Active and passive ways of measuring

Considering the role of checklists and their accessibility, the data highlighted the two distinct types of tools used by industry to create a farm safety assessment tool for farmers.

i) Active tools where farmers are required ‘to do’ something (farm walk, checklist, actively inspect, date action plans, create a risk register etc.), and

ii) Passive tools where farmers are expected to read the material, reflect on the new knowledge and hopefully follow through.

The active tools found in the grey literature analysis are explained as an infographic in Figure 9, and the passive tools are explained in Figure 10.

Figure 9: Active tools for farm safety assessment featured in the grey literature dataset.

Checklists are the entry level into measuring farm safety. These are strengthened when they are coupled with action lists and risk ratings to highlight the order of priority to reduce risks. Checklists are strengthened further through naming the accountable person and setting dates for completion and review.

The seven active assessments (shown in Figure 9) are approaches that imply the farmer, or employee, is expected to act or do something to measure safety.

Figure 10: Passive, or informative only, farm assessment tools featured in the grey literature dataset.

Seven passive approaches to farm safety are identified (see Figure 10). Creators of the tools predict or intend their farming audience to read the material to increase knowledge and influence safety culture. Measures could be reviewing their practices and making modifications to existing equipment to fulfil the expectations outlined in the literature. However, there is no assessment or action to record this measurement per se.

A total of 252 methods were found in the 53 self-assessment tools demonstrating that most tools have multiple elements that influence farm safety culture (refer to Figure 11). In most cases the tools comprise a variety of assessment methods, for example safety theory coupled with a checklist. Less than 10% (n=5) of the self-assessment tools feature only one type of assessment method. Safety theory (n=43), statements of legal obligations (n=31) and checklists (n=30) are the three most common tools provided to farmers to measure safety.

Figure 11: Passive (green bars) and active (blue bars) assessment methods embedded in the self-assessment tools to measure farm safety found in the grey literature dataset (n=53).

A relationship exists between farm safety self-assessment tools and measuring farm safety climate but there is no published or grey literature available that connects these two ideas. The data that is collected when using these forms is a snapshot of farm safety climate at a point in time; they also remain in isolation with the farmer and/or the responsible person who has undertaken the safety assessment. This demonstrates that this current form of measuring and monitoring farm safety has no obvious feedback mechanism to the source of origin of the document. These sources were shown in Figure 3 and the

assessment forms for industries were presented in Figure 8. The organisations that are disseminating farm safety self-assessment tools that have the capacity to collect farmers' measurements of safety climate, is something to consider when going forward to measure farm safety culture as an agricultural industry.

Other themes from the grey literature

Not all of the grey literature dataset contains farm safety self-assessment related literature but the remaining literature lacks a pattern or a trend. Three themes from the grey literature are presented to demonstrate the limited findings about measuring safety culture found in the grey literature.

Benchmarking and monitoring

Published in 2008 the National Farm Injury Data Report (21) recognises that there is no single dataset that provides a suitable base for monitoring injury and traumatic deaths occurring on farms across Australia and that this is a major challenge of measuring and monitoring farm safety. The National Farm Injury Data Report identified the need for "accurate and timely data relating to farm, injury and illness" to provide industry and injury practitioners with information to prevent injuries (p.iii). The recognition of this need for safety benchmarking systems in the context of farm business management set in place systems designed to contribute to that endeavour. The National Farm Injury Data Report (10) suggests the development of a benchmarking framework for farm safety performance in Australia. Fragar and Pollock, as the authors of this Rural Industries Research Development Council (RIRDC) report and the benchmarking framework, state that "a number of industries and farm business management groups have recognised the need for benchmarks… that will set industry standards that are achievable, and that can signal to individual businesses and to industry groups how well they are performing in comparison with each other and to the industry as a whole" (p.26). This framework is presented in Appendix 5. The specific aims of this partnership between the RIRDC, other partners in the Joint Research Venture in Farm Health and Safety, and the Australian Centre for Agricultural Health and Safety, were to maintain and enhance the National Farm Injury Data Collection, develop and trial benchmarks for OHS performance, and provide support to Farmsafe Australia strategies. Further research by Pollock, Fragar and Griffiths (2016) has been included as key literature in this report.

Participation as a measurable indicator

Despite farm safety initiatives and extension programs being considered as influencers of farm safety culture, (rather than measure), these initiatives still have measurable indicators such as participation rates, number of downloads, website hits, mailbox drops, subscriptions, memberships, and print runs. Whilst a

primitive measure there is data to measure farm safety culture hidden behind these sources. If these forms of extension were evaluated effectively at an agricultural organisational level, they would contribute to a meaningful dataset to support the measurement of farm safety culture and provide some measures over time.

Some examples of farm health and safety programs that were found in the grey literature and measure participation and returning participation longitudinally include the Certified Farm Safe program in the USA (22, 23), the Sustainable Farm Families™ (Brumby, Wilder and Martin 2008) and the Sustainable Dairy Farm Families™ (Brumby, Wilder and Martin 2013). The National Farm Injury Data Report (10) considers the number and nature of those downloading information from the Farmsafe Australia website as an indicator that the information is being used by a range of other individuals and organisations. Table 1 indicates the profile of those who are registered users of resources downloaded from the Farmsafe Australia website. Fragar and Pollock conclude that the number of users who are utilising the material for education and training and for consultancy is indicative that the resources are being used quite widely.

Table 1: Use of downloaded resources by registered users of Farmsafe Australia web resources (sourced from The National Farm Injury Data Project 2008)

Planned Use of Material	Persons registered	Total of downloads	Ave. No. of Downloads / Person
To use on your farm	161	2434	15.1
Promotion and extension	28	404	14.4
Policy development	25	511	20.4
Other, please specify	10	131	13.1
Education and training	157	2163	13.8
Consultancy	21	459	21.9
Assignment	18	320	17.8
Total	**420**	**6422**	**15.3**

Additionally the NCFH has health, wellbeing and safety facts sheets which have grown in numbers since being launched in 2010, with now over 95 topics. A recent website count has shown that in the last 12

months these factsheets have been accessed 41,719 times[3]. The most commonly viewed are those about scabies, parsnip rash, scabby mouth in humans (Orf virus), farmer fitness and tractor safety. Interestingly, in the lifetime of the fact sheets over 101,000 views of pages about scabies, diet and nutrition (farmers' lunchboxes), crush injuries, scabby mouth in humans, and needlestick injuries are the most common. Whilst the number of views are a crude measure these views show the diverse range of interest in farmer health and safety and this is a measure of what information people are seeking.

The NCFH currently offers two short occupational surveys that measure farmers' behaviours, lifestyle, and attitudes towards farm safety. The Health and Lifestyle Assessments (HLAs)[4] are face to face consultations offered to farmers at field days and industry conferences; and the recently launched Farmer HAT[5] is an anonymous, online self-referral and assessment tool to support individuals' self-assessment of their health, wellbeing and safety. Collecting these indicators for a database and a snapshot in time, would contribute not only to measuring farm safety culture but the data could contribute to mental health baseline data for rural health services to support measuring longitudinal change in farmers' health.

Incentivising safety

Irish farmers operate under the Code of Practice for Preventing Injury and Occupational Ill Health in Agriculture. The aim of the Code of Practice is to improve the level of safety and health among all people engaged in the agriculture sector by providing practical guidance with respect to the observance of the Safety, Health and Welfare at Work Act 2005 (24). Ireland's FDB and AVIVA insurance companies offer discounted premiums based on the safety assessment checklist completed and signed by the farmer to abide by the Code of Practice. In the USA, the Certified Farm Safe (CFS) program also provided insurance incentives to its farming participants who met the farm safety targets (22). The feedback from the CFS program suggested that it could be improved by increasing incentives to participate such as further reduced insurance premiums. Similarly but offering a wider range of incentives, the Michigan Farm Bureau (MFB) is a parent organisation that oversees many agricultural companies to ensure that Michigan farmers are supported to produce food. A resource of how to host a farm safety field day was captured in the grey literature search (25). The MFB is multi-purpose, offering members insurance, health and safety resources, agricultural education, legal advice and political action. Members of MFB benefit from

[3] 20210910_ Health and Safety Factsheet Analytics NCFH

[4] https://farmerhealth.org.au/community-support-programs

[5] https://farmerhealth.org.au/farmerhat

discounts on machinery from participating manufacturers and suppliers, and farm and medical insurance premium discounts.

The farm safety infrastructure and equipment rebate scheme led by Agriculture Victoria and administrated by Rural Finance in 2020 and subsequently extended into 2021, aimed to influence farmer behaviour and incentivise farm safety improvements (26) . The strong uptake that is quantifiable through the numbers of subscriptions, with the investment matched by the farmers is a measure of safety culture for both the government side and the farm side. Farmers demonstrated a willingness to improve their farm safety. The success of this scheme hinged on incentivising farm safety change. If the scheme had unlimited funds it would have measured real demand. As the scheme funds were quickly exhausted, its uptake only measures the first part of the adoption/demand curve.

5. PEER REVIEWED LITERATURE SUMMARY

Summary

This chapter summarises the findings from Australian and global research that gathers as a collective of findings to compare and provide an understanding of what can facilitate the measurement of farm safety culture. This chapter supports the findings in the grey literature agreeing that farm safety is measured as leading indicators of workplace and occupational health and safety which is entirely the responsibility of farmers, as individuals and business owners. Tragically, the ongoing trend of farm accidents and fatalities continues despite the interventions that target individual behaviour change. These findings suggest that shifting the focus from the farmer, and looking further down the supply chain or further up the SEM levels, to make other groups and agencies accountable for farm safety may change the industry's safety culture in its entirety. The farm services sector, including regulators, rural and regional health, banking and insurance, together with all levels of government should become part of the farm safety culture measurement.

Findings

The peer reviewed literature dataset encompasses 218 articles, 6 of which are duplicates found in the grey literature through Google Advanced search (refer to Appendix 1). This dataset is a rich compilation of research that demonstrates the diversity in farm safety research. It varies from the grey literature in that this is high-level material which is only accessible through journal membership, but at the same time the research is predominantly farmer and farm focussed. Yet this peer review literature is not written for farmers or farm workers. This chapter reviews literature that is written about farmers, and it contributes to knowledge about safety for researchers in the farm safety field. This chapter captures a range of safety culture measurement tools, how they are formed, where they are applied, and what the results mean in practice and theory which are specific to both agriculture, and other industries.

Indicators and measures aligned with the SEM

Indicators, or measures, are the know-able elements that are relatable to illness and injury, and they are what generates much of the peer reviewed research. Some examples of these indicators are exposure to pesticides, roll over protection devices, use of PPE, training, language barriers of farm workers, musculoskeletal discomfort, working while injured, farm safety awareness, health and safety leadership, and so forth. A list was created by extrapolating the indicators and measures found within the titles and abstracts of the peer reviewed literature dataset and the grey literature where it was applicable (refer to

Appendix 6 for the full list). The number of indicators and measures were overlayed on the levels of the socio-ecological model. This exercise was to help us to understand where safety culture measurement takes place and to highlight that the majority of indicators, or measures, of farm safety culture are positioned at an individual level (the farmer) or at a community level (agriculture or multi-sectoral level).

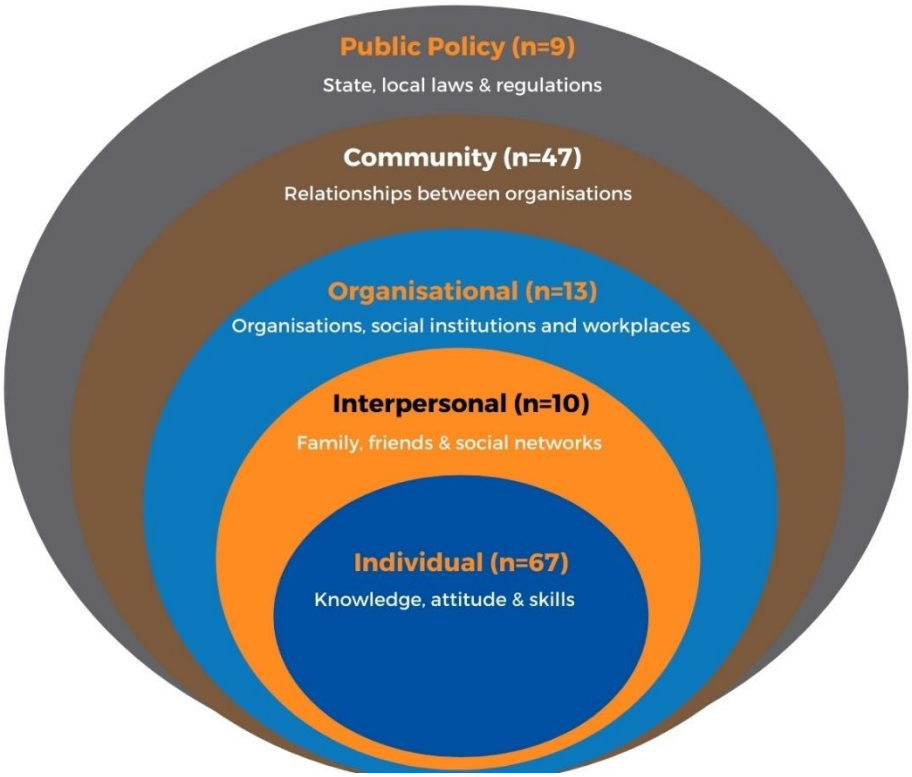


Figure 12: The indicators for measuring farm safety culture at the different SEM levels according to the titles and abstracts in the peer literature (n=218) have been applied to the SEM model to understand the distribution where measurement takes place.

As shown in Figure 12 the schematic representation of indicators at SEM levels endorses the findings from the grey literature that farmers are the key target audience for farm safety, but at the same time measuring farm safety culture does not help farmers. Unlike roll over protection devices, PPE, signs and protective guards where the hierarchy of control is beneficial to farmers, the activity of measuring farm safety culture is for the community or public policy SEM level. This demarcates how influencing farm safety is about farmers' behaviour when measuring farm safety is about indicators.

Research and safety initiatives mainly focus on individual behaviour change, rather than a public policy, inter-personal relationships or at an organisational level. Globally, it is not a co-incidence that research and safety interventions target individual farmers. Culturally, farming accidents are 'blamed' on individuals

rather than the environment, structural, legal and equipment 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 at individuals' knowledge, behaviour and attitude. These findings suggest that it is well overdue to shift the focus from the farmer, and look further down the supply chain or further up the SEM levels, to make other groups and agencies accountable for farm safety. The farm services sector, including regulators, banking and insurance, together with all levels of government as well as health, need to become part of the system that holds the industry as a whole accountable for farm safety.

At this point the notion of farmers as organisations is also relevant in this discussion because a significant number of indicators and measures were also found at this SEM level. The SEM defines the extent or reach of measurement but this is challenging when two levels are inter-related. Every farmer is an individual and measurable by age, gender, educational level, farming experience in years, safety behaviours, appetite for risk, and so forth. However, some farmers are also sole trading organisations. They fit both the individual level and the organisational level in the SEM model. As individuals they have legal responsibilities and accountability to others' safety, but simultaneously they are still human with behaviours, attitudes and beliefs. The way in which farm safety culture is measured is unique and it brings with it complex imbroglios of these single person-structured organisations. According to the Australian Small Business and Family Enterprise Ombudsman 62.8% of Australian businesses are sole traders with no employees (27). The family farming small business model, with one or few employees is the predominant business structure. Methodologies to measure farm safety culture needs to reflect this conundrum.

Creating new metrics through surveys, databases, and statistics

The literature shows that existing baseline datasets can be adapted using statistical methods to strengthen other measurements, gathered through questionnaires or surveys. These datasets can be generic to workplaces, employees, or farm production, but they are used in a statistical way to add value to new findings. Some of the datasets found in the literature have included organisational audits, cross sectional surveys, nationally stratified random samples, regional demographics, socio-economic data, accident data, longitudinal studies with selected participants, National work health leading indicator survey, national household survey, HILDA survey, distribution of crops and growers, occupational diseases, media databases, National Coronial Information System, injury claim rates and compensation for disability days, National Farm Survey, Farm Accountancy Data Network, USDA National Agricultural Statistical Service, General Health Questionnaire and the Big Five Personality Inventory.

Surveys, in the form of postal, telephone interviews and online, are well represented as methods to collect data. Sample sizes vary from less than 10 to many. United States researchers reached 4000 young

people in Ohio schools who were operating farm machinery (28). Similarly, over 14,000 respondents participated in an epidemiology survey of occupational injuries in Germany (29). There are many examples of where surveys are used to follow-up with individuals and peer groups who have participated in safety initiatives. The Iowa Farm and Rural Life Poll in 2017 is a good example of a state-wide survey which is used for multiple purposes but is specific for farmers and agriculture (30).

McNamara et al (31) recently identified farmer workplace injury risk factors in Ireland though a supplementary farm operator workplace survey undertaken in association with the Irish National Farm Survey (NFS) which reports to the European Commission Farm Accountancy Data Network (FADN). Data from this supplementary survey were analysed together with farm and socio-economic data routinely collected by NFS to identify risk factors for occurrence of farm operator workplace injuries. The risk factors for farm operator workplace injury were significantly higher when both the farm operator and spouse engaged in off farm employment (31). More broadly the study data indicates that occurrence of farm operator workplace injury (FOWI) is most closely associated with variables for above median farm size, farm output, and labor input, classification as “full time”, and with below median farm investment. Under investment was found as a risk factor that may lead to inadequate farm infrastructure and machinery and equipment, which in turn could lead to both higher workload and injury risk (31). Also, as FOWI were self-reported, a positive bias in injury reporting may have occurred due to enhanced knowledge of agricultural OSH issues. The rationale for this study is farm workplace injury information allows identification of risk factors, which is central to the development of prevention strategies.

Statistical modelling is often performed and the social science statistics package (SPSS) is a common program used to analyse and measure outcomes. Due to most questionnaires relying on Likert-scales statistical methods are necessary to weight data and take into account a range of influencing variables. Many of the studies that use a combination of existing databases and new survey data use formulae such as Cronbach’s alpha, Six Sigma, Synthetic Index, Pearson’s correlation, structural equation modelling, or multivariate logistical regression.

Confounding variables

Confounding variables are important considerations when measuring farm safety culture. In the literature these variables include sex, gender, age, job position, working experience, farming enterprises, farm size, locality, job training, the number of employees, ethnicity, education level, and health-related factors. Confounding variables are very important as they form part of the factor analysis and weighting for statistical modelling for establishing and measuring the important factors that determine farm safety culture.

A superior Australian example of how to measure safety climate, safety management systems and control of major safety hazards on farms was undertaken by the Australian Centre for Agricultural Health and Safety (2). In this study the researchers established a longitudinal study of 335 NSW farm enterprises to derive data on farm health and safety management and how it relates to farmer perceptions. The specific objective was to develop scores for measures of Safety Climate, Safety Management Systems and Control of Major Hazards, and to try to explain the determinants of those scores. They used triangulation with the comparable scores to prioritise safety interventions. The research also referred to total factor productivity (TFP) as a database to overlay the scores against productivity in each sector to look for trends of lost productivity from farm related accidents. The use of weighting and influencing variables brings statistical rigor to the results showing interactions between age, enterprise and attitudes. The confounding variables show respondents aged 55 years and over scored significantly higher (n.b. a higher score is associated with an individual's positive perception of the safety consciousness of their farm business) when not involved in grain production. For non-grain enterprises, respondents aged 55 years and over scored significantly higher than those under 55. Respondents not involved in either cattle or sheep scored significantly higher, while the lowest mean from this interaction came from enterprises running sheep, not cattle.

Development of questionnaires and measuring tools

Evidence shows that the development of a questionnaire to measure safety is well-planned and targeted at individuals' sense of self, sense of others, and sense for the safety culture of the organisation. The measures sought in these questionnaires focus on indicators such as personal risk perception, attitude, knowledge, conformity, adoption, and behaviours as well as perceptions about the organisation. Questionnaires reflect selected leading indicators of occupational health and safety together with behaviour and attitude. The data is collected, transposing the concept of the farm safety self-assessment tool into a survey to measure farmers' responses to situations.

Research in the development of questionnaires shows that usually a multi-step process is undertaken which includes reviewing the literature, workshopping processes with experts and target audiences, and developing framework to select and modify questions for a specific contextual application. There is a general academic movement to adapt an existing validated questionnaire rather than re-invent new material. The best examples of these questionnaires are the OPM-MU, WEST-AG model, NOSACQ-50 and the Work Crew Performance Model for Kentucky cattle handlers. These examples all are described in detail in Appendix 8.

Leading indicators

Leading indicators of occupational health and safety are defined as measures of positive steps that organisations take that may prevent an OHS incident from occurring (32). A leading indicator is any measurable or observable variable of interest that predicts a change or movement in a trend, or a phenomenon before it occurs. In relation to farming accidents leading indicators are very broad and include multitudes of factors or variables which are somehow associated with farming fatalities, injury and illness. Leading indicators are the signs and signals of farm safety culture.

To understand the factors that make up leading indicators in agricultural safety a rapid analysis was performed to cross reference the leading indicators with the SEM levels. Eight peer reviewed articles: Chapman, Schuler (33), Isaacs, Powers (34), Irwin and Poots (35), Geng, Field (36), Fargnoli and Lombardi (37),Terjék (38), Pollock, Fragar (2) and Leppälä, Kolstrup (39) were combed for leading indicators for farm safety. These findings are shown in Figure 13 and listed in full in Appendix 7 with references to their source.

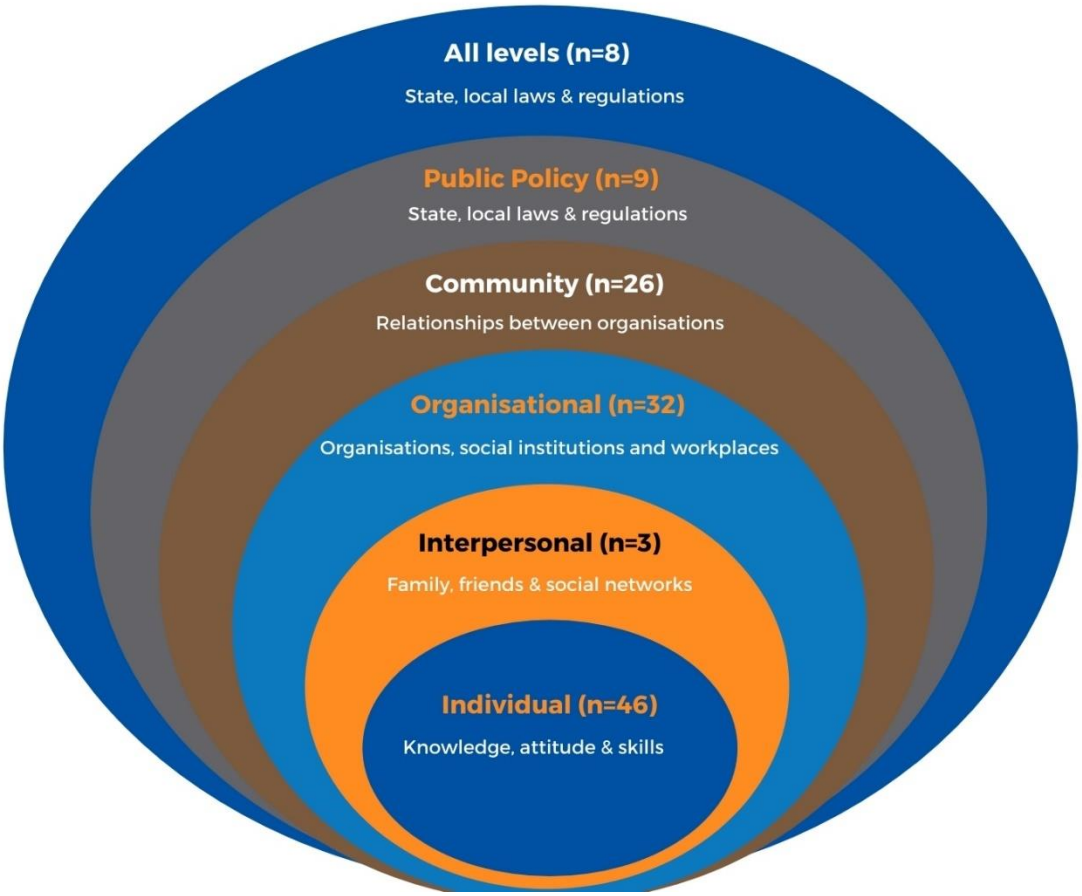


Figure 13: Distribution of leading agricultural indicators mentioned in the key peer literature (n=8)

The purpose of this exercise was to observe the levels at which leading indicators are measured and to consider target audiences for a farm safety methodology suitable for Victoria. This analysis also provides a comparison of the distribution of measures that were previously captured in Figure 12 when casting over the entire dataset of literature (n=218). Figure 13 (n=8) focusses on the distribution of leading indicators; it is more evenly spread between individual, community and organisational levels with significant gaps of leading indicators remaining at the interpersonal and public policy levels. There is currently a lack of research at the interpersonal SEM level to understand the influence of peers, the role of informal farming networks, farming neighbours, and social media networks.

Interplay exists between the SEM levels and there is space for interpretations, or a different lens, as to which level each leading indicator should be placed. Another level was added to Figure 13, 'All levels' (n=8), to demonstrate where leading indicators may be the responsibility, or targeted, for measuring safety culture. The themes of indicators found at this level included electrical safety, cultural differences and norms, benchmarking, and sourcing solutions to implement safety improvements.

Public Policy level: The leading indicators at the public policy level relate to regulations, public consensus, standards, industry reputation, food safety standards, and quality assurance programs. These are relatively obvious to identify and the international research at this level is most insightful. For example, the regulatory differences that protect Swedish farmers is significantly different to the regulations that protect Indianan farmers when they handle pasture-fed cattle (36). For Australian farmers to sell grain to Europe the EUREGAP® is a compliance agreement outlining the farm businesses' procedure for risk assessment, employee training, hazards warning, emergency plans and product handling (2). The use of quality systems as a measure of culture is feasible.

Community level: The community level of the SEM relates to the agricultural industry and the multi-sectoral relations that create a farm safety network. The themes of these leading indicators at this level require expertise, and are somewhat extension-based or leaning towards leadership in farm safety culture measurement. The extension-related leading indicators of safety include checklists, tools, assessments, screening, initiatives, training, and the provision of knowledge. From a research perspective the literature at this SEM level can reflect the use of material found in the grey literature. Expertise-based leading indicators include technical solutions, ergonomic tools, practical solutions and guidance. There are also procedural or structural roles at this level, found through the indicators of reviews and examination of organisational reports, documents and records, benchmarking, safety scores and measure organisational conditions. This SEM level is perceived to be very influential in farm safety culture and leading indicators validate that the community has a large role to play.

Organisational level: In the circumstances where farmers are sole traders and work in isolation the leading indicators for measuring farm safety culture at the organisational level could also be placed for measuring at the individual level. Financial issues are leading indicators as this may cause working longer hours causing fatigue, and also prevents investment in safety equipment (40). In a comparative study of small herds on pastures in Sweden and Indiana leading indicators include direct exposure to unrestrained cattle, potential for needlestick injury, and affordability of safer technologies (36). Other themes found at this level are more business safety focussed. Training workers in safe habits and coaching for the job/ equipment/conditions, practical training intervention, identified conflicting knowledge about procedures, and communication are inter-personal leading indicators but at the same time they are relational to organisational farm safety culture. The theme of management systems as a leading indicator is evident with risk management, best management practices, safety practices, adherence to planned sets of procedures, guidelines for human resource development, incorporation of checklists, and the ability to benchmark and compare performance all signal towards a safer working environment. There are also practical workplace health and safety indicators such as provision of PPE, identification or adequate or inadequate handling facilities, working conditions, job strain, duration of time spent next to cattle, aging or obsolete and rarely used machinery, and extensive pesticide storage and use. The preparedness for unplanned events such as fire safety and rescue skills are also lead indicators. Finally, a conceptual leading indicator where risks are associated with machinery purpose as they found correlations between tractors and equipment used sporadically in the yard, as opposed to field work, in combination with the financial stress of the farmer leads to increase risk of accidents (2).

Individual level: The lead indicators at an individual level for measuring farm safety culture are mostly predictable in that they are human-centred. The measurable leading indicator themes of knowledge, training, skills, and experience are related, but harder to measure are the leading indicators of behaviour, judgement, justification, desire, perception, awareness, motivation, fatalism and optimism. There are more tangible measurements for individuals such as number of manual handling tasks, use of PPE, health behaviours, alignment of behaviour with compliance, and environmental exposure to UV and airborne particles. Lastly, the use of resources is an important individual SEM level leading indicator as it relates to the other SEM levels, these include the use of extension safety and health programs and the use of recommendations from these courses (33).

6. A DISCOURSE ON THE FORMULATION AND MEASUREMENT IN FARM SAFETY CULTURE

Summary

In this chapter the authors draw on the findings from the grey and peer literature dataset and their collective knowledge of the industry to highlight the important elements from most influential literature to scope the recommendations in this review. This chapter is a discourse with the intention to highlight the gaps in the literature and to demonstrate how databases and questionnaires are used in other industries to measure safety culture.

This chapter is the final section before the recommendations. The authors have cautiously selected twenty leading articles and methodologies to achieve a shared understanding of the practice and the theory of measuring. This collection has been brought together from the dataset of 318 grey and peer reviewed literature sources. Each selected article adds value to understanding the complexities and conundrums of applying a metric to a culture. These hand-picked items are summarised and presented in table form in Appendix 8 with a commentary on their applicability to Victorian farming. They not only show the breadth of research, but it demonstrates the deep analysis and considerations that underpin the recommendations.

The theories of workplace safety culture by Griffin and Neal (3), Lay, Saunders (41), Shea, De Cieri (42), and Butterworth, Leach (43) are foundational for this project. These are the reference points to begin to understand occupational safety as a measurement because they have scoped peer literature in-depth to identify the key indicators that measure safety culture. For agriculture, the work by Dairy Australia (13), Whitman and Gabe (44) and Sacurima COST (45), as grey literature sources add immense value to the practicality to our understanding of measuring farm safety culture.

Appendix 8 presents the dimensions and statements in the questionnaires by Butterworth (43), Chapman (33), Fargnoli and Lombardi (37), Geng (36), Griffin and Neal (3), Grimbuhler and Viel (46), Irwin and Poots (40), Isaacs et al (34), Safe Work Manitoba (47), the Regional Wellbeing Survey, Leppälä et al (39) and Sacurima (45). The dimensions and statements vary, but at the same time they are comparable. One dimension may be too limited because the questionnaires tend to be grouped into themes to capture the dynamics of human, workplace and industry cultures. The surveys/ questionnaires from the grey literature (Regional Wellbeing, Safe Work Manitoba) are simpler than those in the peer literature.

The best example of a questionnaire which then led to a checklist with longevity is by Isaacs et al (34). Originally the Work Crew Performance Model (WCPM) was used in mining, but it was adapted for farming

when farmers could recognise a sequence of repeated actions, known as critical action factors (CAFs), when handling cattle. What is most noteworthy from this article is that the checklist is now an integral part of the Kentucky Master Cattleman Program, sponsored by the University of Kentucky, the Kentucky Beef Network, and the Kentucky Agricultural Development Board. There was industry and farmers' ownership in this safety project. Currently the program consists of farmer-orientated workshops that use the questionnaire to prompt CAFs, and it is anticipated that famers will incorporate this checklist into their own farm. Informal feedback has been positive but again and like many tools formal evaluation has not been undertaken (10).

Using a different approach and significantly changing safety culture is the Certified Logging Professionals in Maine, USA (48). This organisation is an outstanding example of effective industry safety change that was driven not through fear and regulation, but by a ground-up movement by loggers. Its goal was very clear; to reduce accidents and injuries for loggers and their families, and their logging communities.

Their membership-driven culture-change is a simple strategy where the impact has been measured over time. In a very short time, the lagging indicators of logging workplace deaths and accidents have decreased dramatically because they have ownership of their membership, certification, and their training. Measurement is linked to lagging indicators of deaths, injuries, and near misses, plus leading indicators as membership, education through workshop participation and certification, behaviour, code of ethics and pride. Each certified logger is listed on the official CLP website to attract new business, which incentivises their participation and strengthens their peer relationships. This is an influencing factor, but it is an effective way to link lag indicators to membership. There is much to be learned from this simple example of industry resilience.

Existing data is readily available and it can be controlled and manoeuvred through statistical programming to achieve meaningful indicators. It is a proven and effective overlay that can be applied to surveys and questionnaires, to extrapolate measurements for a broad level understanding of safety culture. This was shown in Griffin and Neal (3) when measuring employee perceptions of safety-related factors in the work environment and using archival records of quality assurance audits from organisations to populate the questionnaire. Yet measuring farm safety culture is generally stronger in theory than practice. It needs to be noted that few safety culture researchers have achieved the final metric. The literature highlights the lack of longitudinal knowledge to confirm if measuring farm safety culture actually makes a difference to the safety of people's lives.

Gaining reliable and up-to-date information on both the level and nature of farm workplace injury is necessary to allow occupational safety and health (OSH) policymakers, practitioners, and farming

organisations to develop effective preventative programs (31). In 1989 the enactment of Ireland's Safety Health and Welfare at Work (SHWW) legislation brought in the agriculture sector under this legislation for the first time. A statutory advisory committee to the Health Safety Authority recognised the strategic need for gaining non-fatal farm workplace injury data and recommended that a national survey be conducted as a practical and feasible method of collecting farm workplace injury data. A supplementary, or add-on, farm operator (FO) workplace injury survey was undertaken in association with the Irish National Farm Survey (NFS), which is responsible for provision of Irish farm-level data to the European Commission (EC) Farm Accountancy Data Network (FADN) (31). Data from this add-on survey were analysed in association with farm and socio-economic data routinely collected by NFS as a component of the FADN. The combined data-set was analysed using both descriptive and inferential statistical techniques including multivariate logistic regression to identify risk factors for occurrence of farm operator workplace injuries (31). Work by this group was consulted in the development of a new set of farm safety behaviour and culture questions included in the 2020 Regional Wellbeing survey, and has been designed to capture farm safety indicators and influencing variables. This survey and the data collected longitudinally creates the first step towards a metric of farm safety culture. This review recommends that the recent addition of farm safety culture and health and wellbeing continue and be adjusted following initial analysis and evaluation.

The notion, and hence the process, of farm safety culture measurement is in its infancy to farmers. At this stage there is no collective action from farming groups, health services, specific farming districts or sectors to begin to quantify farm safety. The metric will not become a 'sector standard' unless significant engagement is undertaken to introduce the concept of farm safety culture. At the same time, farmers who would be most ready to engage with this methodology are also most likely to be implementing safety management systems, hence skewing the potential results. Future measuring farm safety culture for Victorian farmers needs to be 'owned' and understood by those working closely with farmers. Traditionally the State departments of agriculture were responsible for supporting farmers to be safe in their workplace through farm extension programs. The grey literature clearly demonstrates a wide range of organisations who are resourcing safety as good will and as a by-product of their usual service delivery. Dairy Australia is an exception to this observation. This organisation is demonstrating an outstanding job of making resource available to dairy farmers and integrating safety culture among the different SEM levels of dairy the dairy sector, including processing. The NCFH team suggest that long-standing and embedded food safety standards for milk production may influence farm safety culture of Dairy Australia and the dairy sector as a whole.

Safety is not driven by benefits to health, rather safety is driven by fear. The literature highlights that farm safety lies with individual farmers which is endorsed at a policy level with regulations and laws, including Victoria's new workplace manslaughter laws. Due to the absence of on-farm support from industry to help

farmers carry out non-litigious reviews of their workplaces, the ongoing trend of farming accidents remains a policy problem. It is ill advised to continue to rely on farmers to change their behaviour, such as an avoidance of employing staff, and to rely on their sense of fear of penalties/jail to change the trend of lagging indicators.

7. RECOMMENDATIONS

Summary

There is great potential and industry capacity to work collaboratively during this phase of determining how best to measure farm safety culture in Victoria. This chapter concludes the report by offering eight recommendations based on the grey and peer reviewed literature dataset which specifically focused on how to measure farm safety culture. In summary the recommendations in this report are to:

- **Build on existing approaches to measure farm safety culture (databases and linkages between databases, process of utilising experts, adapting a questionnaire) to overcome any reinvention;**
- **Seek to retain collaborations with others doing this work (both internationally, nationally and industry specific);**
- **Create efficiencies by standardising core safety evaluation measures (from farm engagement activities by farming groups and safety extension) - to contribute to a safety culture dataset - supported by resourcing higher degrees by research students, to accelerate Victoria's progress in this field.**
- **Ensure any metric or framework implemented must inform, encourage action, be easily obtainable and reportable, be transparent in collection and have strong stakeholder and government support.**

The following recommendations have been developed for Agriculture Victoria by reviewing the grey and peer reviewed literature to specifically seek structural and procedural advice on how to best measure farm safety culture. There is overlap between some of these concepts, therefore recommendations that link ideas have been signposted to reduce the duplication of these insights.

Safety climate has been researched for many years and there have been various attempts to develop methods which can measure this concept (1). However, for Agriculture Victoria and industry organisations there remains disconnection between the data collected and those farming, to effectively measure and respond to farmers' safety needs. Measuring farm safety culture relies on more than understanding the behaviour of individuals. It is about the consideration of indicators at multiple levels that relate to farm production, health and safety simultaneously. These recommendations are designed to overcome these disconnections through identifying who to work with, where to begin, and what exactly to measure.

Most significantly in this process is the identification of leading indicators of occupational health and safety. These can be defined as measures of positive steps that organisations take that may prevent an OHS incident from occurring (32). This shifts the measurement paradigm to consider organisational, managerial, technical and behavioural factors, rather than mechanical failure or human error, as the cause of accidents and fatalities. This literature, together with 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.

The 8 recommendations as to how best to measure farm safety culture are:

1. Build on existing databases and seek linkages

As demonstrated by Butterworth (43) databases have the potential to be the denominator in the metric to measure farm safety culture, however there is no fit-for-purpose database. In the next stage of the project we will be providing a method for Agriculture Victoria's to consider their role through range of databases and select those that can be easily accessible in the short, medium and longer terms. It may be that a 10 year plan would assist in considering how to measure farm safety culture and or safety climate over time. This is linked to Recommendation 5 (Embed evaluation framework for existing farm programs for access to data) offering potential for a new farm safety specific database for the future.

Databases are powerful in that they overcome the persistent surveying of individuals to capture a meaningful sample. Farmers are often inundated with surveys therefore using existing databases not only collects more information but it reduces survey fatigue and resourcing. There is significant data from many sectors that is already available, noting legislation for privacy, plus the statistical capacity to connect multiple sets.

Databases have limitations and benefits that must be well-considered. Funding sources, ethics, and privacy are important factors, and particularly the expectations of people who provide their personal information and are later followed up. The protection of personal information is critical, and that consent is obtained for the sharing of that information. At this early point in measuring safety culture, much can be learned from other sectors as to how to link databases and build efficiencies to reduce costs. A recommendation is to seek new linkages between farming databases and health databases in line with Agriculture Victoria's selection of databases, to provide longitudinal baseline information.

The data that is available, and possibly relevant for Victoria, is listed in Table 2.

Table 2: Possible datasets for consideration for measuring farm safety culture

Dataset and URL	**Reach**	**Benefits**	**Limitations of this data**
ABARES Ag Labour Data	Australia and Victoria	Free and available. The data describes the use of labour on farms and the profile of farm workers. These have been collected through surveys of broadacre, dairy, vegetable, fruit, grape and nut farms. https://www.agriculture.gov.au/abares/research-topics/labour	Requires statistical modelling. Locations are challenging to refine below state level.
ABARES Agricultural workforce: Stocktake	Australia	Free and available; Identifies sources of publicly available agricultural labour data in Australia and current information gaps. A dashboard presents the main sources of Australian agricultural labour data that are currently available, and provides information about the quality of each data source and its usefulness to policy makers and industry. Uses a traffic light system. https://www.agriculture.gov.au/abares/research-topics/labour/labour-data	Requires further statistical modelling. Locations are challenging to refine. Intervals of measurements are unknown.
AgHealth Farm Deaths and Injuries Snapshot	Australia	Compilation of statistics based on media and coroners reports. https://aghealth.sydney.edu.au/wp-content/uploads/2019/09/Farm-Related-Injuries-Jun-Report-2019.pdf	Fatality counts come from *National Farm Injury Coronial Database* (NFICD). data inputs from the *National Coronial Information System* (NCIS), Safe Work Australia's *Traumatic Injuries Fatalities* database and media monitors
State Coronial data	Victoria	Traditional lagging indicator used to underpin safety research for all occupational health and illness research. Core data	Unable to follow up with questions with the deceased. Ethical issues following up questions with deceased next of kin.

		https://www.coronerscourt.vic.gov.au/forms-resources/request-coronial-data	May lack detail of actual cause.
Data about the agriculture sector	Various statistics including number of farms, farmers, farm workers, women and young farmers.	Can be requested from Agriculture Victoria https://agriculture.vic.gov.au/about/agriculture-in-victoria/victorias-agriculture-and-food-industries	Some data is public other is not Analysis is not public.
Rural Acute Hospital Data Register (RAHDaR) database	Rural and regional hospitals in South West Victoria (n=9 health services)	Complete register of data that captures emergency presentations in SW Vic. Includes injury cause, injury location which allows "farm" as a category of location. It is possible to review accidents and injuries in line with the ICD-10 codes (International Classification of Diseases) and also major diagnostic blocks. Excellent place to start with a region already doing this work.	Further education to educate ED staff to collect better data. It does not record occupation.
Regional Wellbeing Survey	Victoria/ National and can divide by industry or region	Ongoing survey that can be tracked through time. Able to access data and analyse in different ways in partnership with University of Canberra. Reliable funding source for ongoing surveying. https://www.regionalwellbeing.org.au/	Farm safety may not be in standard questions and requires active effort to include/fund questions and analysis. The population of survey respondents also limits this dataset. Numbers are small but could be increased.
Victorian Injury Surveillance Unit (VISU)	Victoria and regions	The Victorian Injury Surveillance Unit (VISU) analyses, interprets and disseminates data on injury deaths, hospital admissions and emergency department presentations in the state of Victoria. Freely available, data collected as routine	Limits on hospitals that collect? Further education to educate ED staff to collect better data re agriculture/farming.

		https://www.monash.edu/muarc/research/research-areas/home-and-community/visu	
WorkSafe Victoria - Workplace fatalities	Victoria	Workplace accident specific data https://www.worksafe.vic.gov.au/resources/workplace-fatalities	
WorkCover injury data	Victoria	Spreadsheet contains standardised claims reported to WorkSafe for financial years 2009/10 to 2018/19. Breakdowns are provided by industry, occupation, age and gender, nature of injury, mechanism of injury, bodily location of injury, agency of injury and injury year. https://www.worksafe.vic.gov.au/resources/claims-statistical-report-financial-year	Compensation-based data that only reports compensatable injury on farms; so does not capture injuries where claims were not made, and where claims were made but the time lost to injury was less than 7 days.
Victorian Child Health and Wellbeing Survey	Victoria	Ongoing funding through the Department of Education and Training. Potential for framework with child farm safety. Fourth iteration just completed for tracking changes. https://www.education.vic.gov.au/about/research/Pages/newdatahealth.aspx	Survey does not ask about farming. Survey is not related to postcode with risk differentiation. Children's age is limited.

Peak industry organisations that register farmers as members as per their commodity group are potential sources for data. Horticulture, viticulture, forestry, poultry, and fisheries, among others, are omitted at this stage due to timelines in preparing this review.

Table 3 lists the more obvious potential sources for database linkage of Victorian farmers.

Table 3: Potential sources for datasets to link indicators and questionnaire results.

Dataset and URL	**Reach**	**Benefits**	**Limitations of this data**
National Growers Registration National Grower Register Austraila (ngr.com.au)	Australia	Registers every grain grower that delivers grain to receiving centres for all grain commodities. Updated annually through End Point Royalties and levy payments.	Excludes growers that only retain seed and either sell grain privately or feed grain to livestock – with livestock farmers most likely to be at highest risk for farming accidents.
NLIS | Australia's system for identification and traceability of livestock	Australia	Registers every livestock owner that sells or buy stock. Many collaborating industry partners.	Livestock farmers only. Excludes hobby farmers with small self-replacing herds (do not buy or sell sock).
Power of People on Australian Dairy Farms The People in Dairy |	Australia	Highly engaged in dairy farm safety. Longitudinal survey of approximately 400 dairy farmers.	Dairy-farming specific.
VFF membership	Victoria	Known distribution of farm safety information. Connection to two farm safety field staff for advice.	Privacy of membership agreement. Limited to members only, not all farmers in Victoria.
National Centre for Farmer Health	Australia	Longitudinal data on website hits, users and pages downloads of fact sheets and utilisation of the FarmerHAT health and lifestyle tool.	Crude tool but maybe useful to highlight trends and areas of interest. Limitations in funding and ongoing support to collect these analytics.

2. Consolidate and integrate a questionnaire fit-for-agriculture

Databases have the potential to be the denominator in the metric to measure farm safety culture but at this stage there is no fit-for-purpose database. The NCFH team recommend that a questionnaire, fit for all SEM levels in the agricultural industry (eg. farms, chemical resellers, stockyard manufacturers, rural banking etc), is paired with existing surveys to strengthen data.

Databases are important and we acknowledge that persisting with the same individuals provides meaningful data over time. In order to reduce survey fatigue we believe that embedding questionnaires (modified or taken in full by another author) into existing farming groups for completion on an ongoing basis will achieve a measurement and as change in measurement for comparison.

The literature has demonstrated that questionnaires are significant elements for measuring workplace safety culture. The literature provided examples of questionnaires and questions, designed differently for employees in office environments, building sites with sub-contractors, nuclear energy plant teams, managers, and employees. Examples of these questionnaires are presented in Appendix 8. The review recommends the adoption, and perhaps adaption, of a well-designed questionnaire to build on existing approaches to measuring safety culture. However, the literature review did not retrieve sufficient evidence to support the reliability and validity of all questionnaires that were found. What has been concluded though is that validated and reliable questionnaires reduce the need for re-invention. Linking with Recommendation 3 - Utilise experts, stakeholders and peak industry, experts and stakeholders may be used for critical problem solving and providing different perspectives. They also play a part in the broader validation process to increase the likelihood of the questionnaire's success. This was most evident by Fargnoli and Lombardi (13) using NOSACQ-50 for farmers in Central Italy.

This recommendation is to deliver a questionnaire, embedded into existing surveys or consultation process, to measure safety culture of farms, with the characteristics and wording to measure farm safety culture for individuals and differing workplaces, at multi-SEM levels and across geographic locations. This has been demonstrated in NSW (2) and offers scope for Victoria, however due to a lack of resourcing this project ceased (pers. comms. Kerri- Lynn Peachey 06/09/2021).

The NCFH team are aware of the significant resourcing and engagement that would be required to transform existing farm safety self-assessment tools into a form that can capture safety culture data. This is Recommendation 4 – Farm safety self-assessment tools measure safety culture for industry, but it is outside the expectations for Agriculture Victoria.

3. Utilise experts and key stakeholders

Measuring farm safety culture over time is still in its infancy worldwide, which means that the next iteration of this project needs to allow for research in the wider-global context to support and share learnings from this process, as discussed in detail Recommendation 8 (Seek and retain internationally and interstate farm safety collaborations). The literature supports the participation of experts to strengthen the end product using consultation activities such as roundtable processes, adaptations of safety culture questionnaires, models, frameworks, safety maps, web tools, and alike. This review recommends that to trial the proof of concept for the AMOSCC methodology, Agriculture Victoria needs to work with experts and key stakeholders at all stages and to sample farmers from existing groups (eg. grower groups, peak industry members) or at key agricultural regions (eg. survey farmers attending Sheepvention in Hamilton) to facilitate this process.

The literature presented numerous examples of stakeholder engagement. In South Korea a study was undertaken to understand the causes of tractor based accidents (49). The researchers undertook an innovative approach using a Delphi process with 27 experts in agricultural machinery to analyse tractor-related farm accident causes, and consequences, to inform interventions. Similarly, the US National Institute for Occupational Safety and Health was called on for their expertise in the re-development of an original survey by Wisconsin extension agents for dairy farmers (33). An expert workshop for horse stable safety assisted in the design of an industry-specific web tool (39). The experts included horse farm managers, farm safety, security and risk management experts from Sweden and Finland. Each of these examples show that it is relevant to draw on a cross section of experts that includes farmers to academics to discuss the issues of measuring farm safety culture and to highlight areas of importance of measuring indicators from different perspectives.

4. Farm safety self-assessment tools measure safety culture for industry

There are two anomalies to the current function of farm safety self-assessment tools – knowing if tools are used, and knowing if they change safety culture. This recommendation, likely to be outside the scope of Agriculture Victoria, is to promote Australia's next generation of farm safety self- assessment tools that captures this knowledge to bring it up to an industry-level dataset.

This recommendation differs from Recommendation 2 – Consolidate and integrate a questionnaire fit-for-agriculture, by acknowledging the role of farm safety self-assessment tools and recommending that they continue to be used by farmers. The grey literature has highlighted the significant role of industry, particularly the dairy and cotton sectors, in creating safety tools for farmers to utilise. However, these tools lack a feedback mechanism beyond the farm to measure hazard reduction and whether the tool changed

farm safety culture. Whilst industry has been producing and promoting these resources there is little evidence of these organisations effectively reviewing the outcome of their safety messaging, ways to collect farmers' data, and sharing this data to support industry safety knowledge as a whole. The literature suggests that farm safety culture brings with it elements of personal privacy where resources are designed as isolated, self-paced activities, rather than participatory group-based learning outcomes. It is reasonable to suggest that the nature of these self-assessment tools do not need to change, rather the nature in how data is captured is required to measure and collect data on farm safety culture/climate. This add-on will require resourcing, which is linked to Recommendation 7 - Resourcing provisions for longevity.

5. Embed evaluation framework for existing farm programs for access to data

Measuring farm safety culture lies with the collective indicators not an individual. Industry data may be available but difficult to access. For example engagement activities such as workshops and field days, farm safety visits, safety consultants and regulators' presentations to industry groups, and farming groups' membership and mentoring are all indicators of participation and 'walking the talk' by showing commitment to improve farm safety. This type of information may be collected by private consulting services that do on -farm training, WHS audits and other activities. Other indicators, such as number of downloads, website hits, social media metrics, mailbox drops, subscriptions, memberships, and print runs, all show a level of participation. If these forms of participation were to be evaluated effectively at an agricultural organisational level to measure engagement, they could contribute to a meaningful dataset of farm safety culture. These indicators could be incorporated into a benchmarking framework, similar to that by Fragar and Pollock (2008) (21), to link off-farm industry participation with occupational health and wellbeing indicators. To achieve this, evaluation frameworks need to be mandated for farming groups upon funding allocations to ensure that data is collected and returned to one research repository for measuring farm safety culture. This recommendation is linked to Recommendation 7 (Resourcing provisions for longevity).

6. Multi-level approach to measuring farm safety culture

This review recommends a shift to measuring at an organisational or industry level through an adapted questionnaire to understand how they perceive farm safety and the safety management systems they undertake to keep farmers safe. Questionnaires should be cross-sectoral and target agribusiness, health sector, education and training, growers groups, regulatory authorities, and government policy to measure the indicators that relate to farm health and safety. This could also build efficiencies to reduce costs (e.g. interim minimal tracking between larger data gathering).

The personal communications with Work Safe Manitoba and Andrew Whitman at Vital Capital Index, from Maine, USA, have both shown that individual farmers are exceptionally challenging to engage in the

concepts of benchmarking and measuring farm safety culture. As a result, this review recommends that a community level approach is used as a starting point in the infancy of this public policy initiative to measure safety culture on farms. Any methodology needs to develop ways to capture data that includes alternative sources to the expectation on an individual tracking it, because this will only capture data from the highly engaged unless it is compulsory or incentivised.

7. Resourcing provisions for longevity

Measuring farm safety culture is an ongoing process that will require funding to re-measure the influence of interventions at farm-level. For the Fragar and Pollock's (2008) safety benchmarking tool (see Appendix 5) to be successful it would have required ongoing commitment to resourcing staff and development. The literature also demonstrates that there is a gap in understanding how questionnaires and their resulting metrics are used in a wider context. Measuring safety culture is academic, and thus the trend in the literature is to publish the process of developing questionnaires and using datasets to create measuring framework, which is repeatable. But at the same time there is much less evidence of the results, and even fewer evaluations. This is an obvious gap, in this infancy phase of measuring farm safety culture.

A recommendation from this review is to consider whether an organisation (regulatory, cross-sectoral partnership, university) should be the peak body for farm safety research, farm extension, and data management in Victoria to maintain a strong industry presence into the future. Additionally, exploring how to specifically resource and support dedicated PhD and other higher degree by research students as a learning incubator, could be worthwhile to enable research progress and develop a new industry culture in farm safety across sectors.

8. Seek and retain international and interstate farm safety collaborations

Given the infancy of this type of work, this review recommends that Agriculture Victoria's next iteration of *Measuring Safety Culture on Farms* project accounts for and maintains collaboration with this global network and seek to retain collaborations with others doing this work both internationally, nationally and industry wide. In particular the work of the European Agency for Safety and Health at Work which has dedicated $5M over five years to look at agricultural occupational safety and health. This specific project has been undertaken with the cooperation of safety and agricultural experts across the EU and includes some international observers and participants. Whilst the project has been hampered by COVID-19, which has restricted meetings and also reduced engagement, it is projected to conclude in 2022. Due to the currency of this work there is very limited published peer-reviewed literature and it has appeared in this literature review through the grey literature search. Further discussion and connection with SARCURIMA (Safety Culture and Risk Management in Agriculture) should continue including the consideration of

utilisation of their farm survey with adaptation to Victorian agricultural producers. An adaptation of this survey has already been utilised in Nebraska USA (Risto Rautiainen pers. comm). Utilising aspects of both the Nebraskan USA and Sacurima survey could provide a comparable baseline with some key shared parameters with which to measure farm safety culture at a local and global scale.

8. APPENDICES

Appendix 1. Duplicate references found across the peer and grey literature datasets

Author or title	Peer literature research identifier	Grey literature research identifier
Pollock, Fragar and Griffith (2016)	3233	16G
Grimbuhler and Viel (2019)	2331	53G
Morgaine, Langley, McGee and Gray (2014)	4021	31G
Brumby, Willder and Martin (2009)	2483	26G
Kline, Leedom-Larson, Donham, Rautiainen and Schneiders (2007)	1323	42G
Jaspersen, List, Howard, Morgan, von Essen (1999)	6834	62G

Appendix 2. Search methodologies for peer and grey literature

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). 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 3. Grey literature referred to for the Measuring the safety culture on farms project

Research Identifier	Source	URL	Organisation and/or authors	Program name
1	Statutory	http://www.safework.nsw.gov.au/__data/assets/pdf_file/0007/55852/Farm-safety-self-assessment-8765.pdf	SafeWork NSW	Farm safety self-assessment
2	Research org	https://aghealth.sydney.edu.au/wp-content/uploads/2019/05/farm_safety_induction_framework.pdf	AgHealth Australia (Uni of Sydney and Aust Centre for Ag Helath and Safety)	Farm Worker Safety Induction Manual 1: Framework and Program Principles
3	Gov	https://pubsaskdev.blob.core.windows.net/pubsask-prod/108865/Farm%252BSafety%252BProgram.pdf	Saskatchewan (Canada)	Farm Safety Program
4	Statutory	https://www.worksafe.qld.gov.au/__data/assets/pdf_file/0019/20197/5564-serious-about-farm-safety.pdf	WorkSafe Qld	Serious about farm safety: a guide to developing a health and safety management system for small to medium sized ag businesses
5	Research org	https://www.sacurima.eu/wp-content/uploads/sites/46/2020/11/Hurdal-2018-WG-2-presentation.pdf	Sacurima COST (Europe)	Innovative approaches to managing safety culture in agriculture

6	Statutory	https://nationaldairyfarm.com/wp-content/uploads/2020/02/FARM-Safety-Self-Assessment.pdf	National Dairy Farm (Farms Assuring Responsible Management)	FARM Safety Self-Assessment (FARM workforce development - Safety reference manual 2019)
7	Statutory	https://www.peopleinag.com.au/media/24923/a_quick_reference_guide_for_broadacre_agriculture.pdf	RIRDC	OH&S A quick reference guide for broadacre agriculture
8	Statutory	https://www.safework.sa.gov.au/__data/assets/pdf_file/0005/136355/Farmers-guidebook.pdf	SafeWork SA	Farmers' Guidebook to work health and safety
9	Research org	https://academic.oup.com/occmed/article-pdf/49/4/231/4193029/49-4-231.pdf	A. Hope, C. Kelleher, L. Holmes and T. Hennessy Department of Health Promotion, Clinical Science Institute, National University of Ireland, Galway, Republic of Ireland	Health and safety practices among farmers and other workers: a needs assessment
10	Statutory	https://worksafe.tas.gov.au/__data/assets/pdf_file/0007/569338/COVID-Safe-Workplace-Guidelines-Agriculture.pdf	Worksafe TAS	COVID Safe workplace guidelines for the Agriculture Industry
12	Research org	https://www.sacurima.eu/wp-content/uploads/sites/46/2020/11/VdBroucke	EU COST Action on Safety Culture and Risk	Evaluation of safety culture in agriculture written by Stephan Van den Broucke

		-SAYKAD-Meetingt-Farm-Safety-Behaviour.pdf	Management in Agiculture (Sacurima)	
13	Essential service	https://www.esbnetworks.ie/docs/default-source/publications/esb-networks-national-safety-challenge---agriculture---lesson-plan-(farm-safety).pdf?sfvrsn=1e8404f0_0	ESB Networks - energy distribution (Ireland)	Staying Safe on the Farm
14	Statutory	https://www.worksafe.govt.nz/assets/dmsassets/1/1637WKS-16-agriculture-farm-health-and-safety-management-self-assessment-table.pdf	Work Safe New Zealand	Farm Health and Safety Management Self-Assessment Table
15	Research	https://www.monash.edu/__data/assets/pdf_file/0009/217755/rirdc54.pdf	Dr Jenny Sherrard and Dr Lesley Day, Monash University Accident Research Centre, Victoria, Australia.	Guidelines for evaluation of safety programs for the agricultural industry: A report for the Rural Industries Research and Development Corporation
16	Research	http://www.agrifood.info/AFBM/2015/Pollock_et_al.pdf	AFBM Journal Vol 13 2016 Kirrily S. Pollock1 , Lyn. J. Fragar2 and Garry R. Griffith.	Occupational Health and Safety on Australian Farms: 3. Safety Climate, Safety Management Systems and the Control of Major Safety Hazards
17	Statutory	https://www.hsa.ie/eng/Publications_and_Forms/Publications/Agriculture_and_Forestry/Code_of_Practice_-_Risk_Assessments.pdf	Health and Safety Authority (Ireland) (www.hsa.ie)	Farm Safety Code of Practice RISK ASSESSMENT DOCUMENT

18	Statutory	http://myosh.com/wp-content/uploads/2017/11/Code_of_Practice_Agri_.pdf	Health and Safety Authority (Ireland) (www.hsa.ie)	CODE OF PRACTICE FOR PREVENTING INJURY AND OCCUPATIONAL ILL HEALTH IN AGRICULTURE
19	Research org	https://cchsa-ccssma.usask.ca/aghealth/documents/resources-by-theme/The%20Farm%20Safety%20Audit%20-%20Fillable.pdf	Canadian Centre for Health and Safety in Agriculture	The Farm Safety Audit A MANAGEMENT TOOL FOR FARMERS Reduce the risk of accidental loss in your farm operation by applying these simple management practices.
21	Research org	https://osha.europa.eu/en/tools-and-publications/publications/protecting-health-and-safety-workers-agriculture-livestock	European Agency for Safety and Health at Work (EU OSHA)	Protecting health and safety of workers in agriculture, livestock farming, horticulture and forestry. A non–binding guide to best practice with a view to improving the application of related directives on protecting health and safety of workers in agriculture, livestock farming, horticulture and forestry
22	Research org	https://osha.europa.eu/en/publications/reports/maintenance-in-agriculture-a-safety-and-health-guide	European Agency for Safety and Health at Work (EU OSHA)	Maintenance in Agriculture - A Safety and Health Guide
23	Research org	http://www.ruralhealth.org.au/14nrhc/sites/default/files/esatchel/NCFFH%20Book%20FINAL%20COPY.pdf	National Centre for Farmer Health	Guide to services
24	Research org	https://www.mdpi.com/1660-4601/17/3/1114/pdf	Madalina Adina Coman 1,* , Andreea Marcu 1 , Razvan Mircea Chereches 1 , Jarkko	Educational Interventions to Improve Safety and Health Literacy Among Agricultural Workers: A Systematic Review

			Leppälä 2 and Stephan Van Den Broucke 3	
25	Gov	http://www.parliament.vic.gov.au/archive/rrc/inquiries/farminjuries/submissions/RRSDC-Sub-56_FarmInjuries_HesseRuralHealthService.pdf	Hesse Rural Health Services, Leigh Community Health Centre	Childless Tractors - farm safety in schools
26	Research org	https://www.farmerhealth.org.au/sites/default/files/2009_SFF_project_-_Changing_Attitudes_to_Health_202kb.pdf	SA Brumby, SJ Willder, J Martin	The Sustainable Farm Families Project: changing attitudes to health
27	Research org	https://ag-safety.extension.org/wp-content/uploads/2019/05/AGRS-123-Revised-Title.pdf	Penn State Extension (USA)	Safety and Health Management Planning for General Farm and Ranch Operations
28	Incorporation	https://open.alberta.ca/dataset/cbea5bb2-7891-49c3-9524-0baed186f797/resource/70caea36-0b79-42bc-8a1b-74a3cfce0f7f/download/af-planning-farm-safety-initiative.pdf	Alberta Farm Safety Program	Planning a Farm Safety Initiative
29	Statutory	https://beeflambnz.com/knowledge-hub/PDF/farm-safety-management-system.pdf	Beef and Lamb NZ	Farm Safety Management Plan 2018

30	Statutory	https://www.ruralfinance.com.au/uploads//grant_files/farm-safety-rebate-guidelines.pdf	Rural Finance website link to Ag Victoria	Farm Safety Rebate Scheme Guidelines
31	Research org	https://www.jstor.org/stable/43188065	Kate C Morgaine, John D Langley, Rob O McGee and Andrew R Gray	Impact evaluation of a farm-safety awareness workshop in New Zealand
32	Statutory	https://www.commerce.wa.gov.au/sites/default/files/atoms/files/agricultural_workboo.pdf	Work Safe WA	Agricultural Workbook
33	Research org	https://journals.sagepub.com/doi/pdf/10.1177/216507990104900707	Ann Marie Lundvall, and Debra K. Olson, (USA)	Agricultural Health Nurses JOB ANALYSIS OF FUNCTIONS AND COMPETENCIES
35	Statutory	https://www.agrifutures.com.au/wp-content/uploads/publications/08-045.pdf	RIRDC	The National Farm Injury Data Project The engine room for Farmsafe Australia farm safety programs
36	Statutory	https://www.frdc.com.au/Archived-Reports/FRDC%20Projects/2012-409%20Adoption%20of%20Health%20and%20Safety%20Change%20on%20Australian%20Farming%20and%20Fishing%20Enterprises.PDF	RIRDC: Collaborative Partnership for FARMING AND FISHING HEALTH AND SAFETY	Adoption of Health and Safety Change on Australian Farming and Fishing Enterprises
37	Research org	https://www.farmerhealth.org.au/wp-content/uploads/2018/10/1.-PHILLIPS-T_AgriSafe.pdf	NCFH	AgriSafe Australia™- addressing health and safety in farm men, women and agricultural workers

39	Research org	https://ses.library.usyd.edu.au/bitstream/handle/2123/6405/Entry%20Level%20Farm%20Safety%20Induction%20Program%20-%20Final%20Report%20100624.pdf?sequence=1&isAllowed=y	Australian Centre for Agricultural Health and Safety	Final Report Pre-start Farm Safety Induction Program for Entry Level Workers
40	Statutory	https://www.teagasc.ie/media/website/publications/2020/Farm-Safety---Getting-farm-safety-culture-right.pdf	Dr John McNamara, Teagasc Health and Safety Specialist.	Getting farm safety culture right
42	Research org	https://www.tandfonline.com/doi/pdf/10.1080/10599240801887827	Aaron Kline BA, Kerry Leedom-Larson DVM MPH, Kelley J. Donham MS DVM, Risto Rautiainen PhD & Sara Schneiders MS (2008) Farmer Assessment of the Certified Safe Farm Program, Journal of Agromedicine, 12:3, 33-43, DOI: 10.1080/10599240801887827	Farmer Assessment of the Certified Safe Farm Program

43	Gov	https://training.gov.au/TrainingComponentFiles/NTIS/RUA98_2.pdf	Agricultural training package RUA98	NATIONAL COMPETENCY STANDARDS ASSESSMENT GUIDELINES QUALIFICATIONS
44	Statutory	https://www.safeworkaustralia.gov.au/system/files/documents/1702/national-agriculture-activity-plan.pdf	Safe Work Australia	NATIONAL AGRICULTURE ACTIVITY PLAN 2014-2019
45	Statutory	https://www.wgcsa.com.au/uploads/5/9/7/5/59756067/farm-safety-checklist.pdf	As extracted from Rural Safety Handbook of SafeWork SA	FARM SAFETY CHECKLIST (As extracted from Rural Safety handbook of SafeWork SA)
46	Research org	https://extension.umaine.edu/publications/wp-content/uploads/sites/52/2020/02/2329_updated2020new.pdf	The University of Maine, Cooperative Extension	Maine farm safety program - Power Tool Safety
47	Research org	https://www.pubs.ext.vt.edu/content/dam/pubs_ext_vt_edu/AEE/AEE-151/AEE-151-PDF.pdf	Virginia State University - Virginia Tech, Virginia Cooperative Extension	The Basics of On-Farm Safety: An Introductory Guide by the AgrAbility Virginia Program
48	Statutory	https://sugarresearch.com.au/sra-information/publications/smartcane-principles-of-farm-business-management/	Canegrowers, Qld Govt and BSES,	SmartCane Principles of Farm Business Management

50	Insurance	https://www.agriaware.ie/uploads/1/1/5/2/115230745/fbd-farm-safety-brochure.pdf	FBD Insurance is regulated by the Central Bank of Ireland	Farm Safety Advice (always think safety first: our policy is you)
53	Research org	https://www.sciencedirect.com/science/article/am/pii/S0013935119301355	Sonia Grimbuhlera, Jean-François Vielb, (France)	Development and psychometric evaluation of a safety climate scale for vineyards
54	Regulatory	https://icash.public-health.uiowa.edu/wp-content/uploads/2018/01/farm_safety_starter_guide_1349-Australia.pdf	NSW Gov't, Work Cover NSW	FARM SAFETY STARTER GUIDE
56	Statutory	https://www.porksa.com.au/wp-content/uploads/2018/05/Pork-SA-Piggery-WHS-Guide-Final-2-4-14.pdf	Pork SA (collaborative effort)	PORK SA GUIDEBOOK – WORKPLACE HEALTH and SAFETY
57	Statutory	https://www.mla.com.au/contentassets/3d97cda19e2d44cd99dbd2a06c0bb057/jvfhs.001_final_report.pdf	Meat and Livestock Australia, RIRDC	Farm Health and Safety
58	Gov	https://novascotia.ca/thinkfarm/documents/fsheets/12-farm-safety.pdf	Government of Nova Scotia (Canada)	Farm Safety Resource Kit for Nova Scotia Farmers
60	Research org	https://www.extension.uidaho.edu/publishing/pdf/PNW/PNW0512-E.pdf	A Pacific Northwest Extension Publication	Farm Safety Series

			Idaho • Oregon • Washington	
62	Research org	https://core.ac.uk/download/pdf/17217036.pdf	The University of Nebraska - Lincoln	The Certified Safe Farm Project in Nebraska: The First Year
63	Statutory	http://hac.ie/wp-content/uploads/2014/07/Case-Study-Farm-Safety-final.pdf	National Rural Network (Health and Safety Authority are referred; Ireland)	NRN Case study: Addressing Health and Safety on the Farm
64	Research org	https://www.uaex.edu/publications/pdf/FSA-1079.pdf	University of Arkansas Systems, Division of Agriculture research and extension	Safe Operation of On-Farm Augers
65	Gov	https://agriculture.vic.gov.au/__data/assets/pdf_file/0010/579979/Final-BB-GpP-27July2020-converted.pdf	AgVictoria	BetterBeef – Risk management for health and safety
67	industry org	https://www.farmsafetyns.ca/wp-content/uploads/2018/08/guide-to-farm-safety-plan.pdf	Farm Safety Nova Scotia	A Guide to Your Farm Safety Plan A Manual by Farm Safety Nova Scotia
68	Research org	https://cdn.csu.edu.au/__data/assets/pdf_file/0003/109632/EFS_Journal_v06_n01_01_Brumby_et_al.pdf	Susan Brumby, Stuart Willder and John Martin	Milking their health for all its worth? Improving the health of farming families through facilitated learning
69	Gov	https://www.hsdl.org/?view&did=10063	Congressional Research Service	Food Safety on the Farm

70	Statutory	https://www.agsafeab.ca/Media/agsafe-ab-hazard-management-on-the-farm-gfii-v17-180206-lise.pdf	AgSafe Alberta	Hazard management on the farm - Quick start guide
71	Research org	http://cesonoma.ucanr.edu/files/141058.pdf	Adapted from Oregon Department of Agriculture 2008	Good Agricultural Practices (GAPs) Manual
72	NFP	https://safefarms.net.au/sites/safefarmswa.com.au/files/docs/Appendix%20B%20-%2030%20Minute%20Safe%20Farms%20Safety%20Checklist.pdf	Safe Farms WA	30 minute farm safety check
73	NFP	https://saiplatform.org/uploads/Library/Manomet%20Final%20Draft.pdf	Natural Capital Initiative at Manomet, Manomet Centre for Conservation Sciences	VITAL CAPITAL INDEX AND TOOL KIT FOR DAIRY AGRICULTURE
74	Gov	http://www.health.vic.gov.au/travelfellowships/downloads/s_brumby_final_report.pdf	Department of Health - Travel Fellowship Report	Susan Brumby 2005-06 Victorian Travelling Fellowship Title: Sustainable Farm Families – the human resource in the triple bottom line. Understanding the triggers and opportunities for improving farming family health in Victoria. Study Area: Quality improvement and patient safety 19 May-29 June 2006
75	Cooperative	https://www.michfb.com/MI/uploadedFiles/Documents/Ag_Ed_and_Leadership/Farm%20Saftey%20Program%20Guide_web.pdf	Michigan Farm Bureau	The How-to Guide for Hosting Farm Safety Education Events
76	Insurance	https://www.bbg.ie/farm-safety-guide/	AVIVA (Ireland)	Farm safety guide Protecting you and yours

77	Gov	https://www.osha.gov/sites/default/files/2018-12/fy11_sh-22318-11_Mod_3_ParticipantManual.pdf	Centre for Dairy Safety - University of Wisconsin	Module 3 Hazard identification and risk assessment
78	Statutory	https://docs.employment.gov.au/sites/default/files/submissions/45281/australian_dairy_farmers_-_r_sjj7lvaufuwkpud_-_attachment_4.pdf	Dairy Australia	The Power of People on Australian Dairy Farms Oct 2017
80	Gov	https://www.hse.gov.uk/foi/internalops/og/og-00115.pdf	UK government	Agriculture Sector Work Plan 2019-20: Inspection of farms with beef and dairy cattle, Inspection in conjunction with Agriculture Compliance Events. Follow-up evaluation inspection of 2018/2018 ACE premises
81	Gov	https://researchlibrary.agric.wa.gov.au/cgi/viewcontent.cgi?article=1073&context=bulletins	WA Department of Primary Industries and Regional Development	Farming for the future self-assessment tool (SAT)
82	NFP	https://content17.green17creative.com/media/99/files/Farm_safety_action_plan.pdf	Northern Ireland	Farm safety action plan
84	Industry org	https://australiandairyfarmers.com.au/wp-content/uploads/2020/05/ADIC-submission-to-the-2014-Federal-Budget.pdf	Australian Dairy Industry Council Inc	Federal budget 2014 Policy Priorities
85	Industry org	https://cottonaustralia.com.au/assets/general/myBMP/myBMP-Brochure.pdf	(myBMP) Best Management Practices for Australian Cotton growers	ONLINE SELF-ASSESSMENT MECHANISMS, PRACTICAL TOOLS AND AUDITING PROCESSES TO ENSURE THAT AUSTRALIAN COTTON IS PRODUCED ACCORDING TO BEST PRACTICE

86	Research org	https://apo.org.au/sites/default/files/resource-files/2007-03/apo-nid151031.pdf	NRHC 9 Conference	Early intervention in farming family health: making informed life choices for sustainable family farming
88	Insurance	https://www.fbd.ie/media/FBD/pdf/FBD-Farm-Safety-Brochure.pdf	FBD Insurance is regulated by the Central Bank of Ireland	Farm Safety Advice. Always think safety first
89	NFP	http://www.medpartnership.com/wp-content/uploads/2013/07/HSA-Farm-Safety-Action-Plan-2013-2015.pdf	Health and Safety Authority Farm Safety Partnership	HAS Farm safety action plan 2013-15
90	Gov	http://www.distance.vic.edu.au/wp-content/uploads/2015/09/SAFETY.pdf	Vic Dep't of Education and Training	Student safety guidelines - technology
91	Gov	https://www.cdc.gov/niosh/agforfish/pdf/2016-2021-Ag-Centers-Projects-and-Contact-Information.pdf	US Agricultural Safety and Health Centers	2016-2021 Projects and Contact Information
93	Research org	https://academicjournals.org/article/article1437737209_Baksh%20et%20al.%20(PDF).pdf	Kurina Baksh, Wayne Ganpat, and Lendel Narine, Tobago	Farmers' knowledge, attitudes and perceptions of occupational health and safety hazards in Trinidad, West Indies and implications for the Agriculture sector
94	Research org	http://www.tars.unsw.edu.au/research/Current/Quad-Bike_Safety/24ESV-000144.pdf	Transport And Road Safety (TARS) Research, University of New South Wales, Sydney, Australia	THE AUSTRALIAN TERRAIN VEHICLE ASSESSMENT PROGRAM (ATVAP)
97	Statutory	https://content-prod.dairyaustralia.com.au/-/media/project/murraydairy/national-home/resources/2020/07/09/dairy-australia-	Dairy Australia	Performance Report 2018-19

		performance-report-201819/dairy-australia-performance-report-201819.pdf		
98	Gov	https://www.gov.mb.ca/agriculture/farm-management/business-management/pubs/gg-agri-business-assessment-workbook.pdf	Canada, Manitoba	Gaining Ground Agribusiness Assessment
99	Gov	http://www.niassembly.gov.uk/globalassets/documents/raise/publications/2013/agric_rural_dev/14513.pdf	Northern Ireland Assembly	Research and Infomration Service Briefing Paper: Overview of approaches to farm safety – Northern Ireland, Great Britain and Republic of Ireland

Stakeholder materials referred to for the Measuring the safety culture on farms project

Research Identifier	Source	URL or access	Organisation and/or author	Program name
1S	Private	#PlantASeedForSafety | Celebrating rural women and amplifying the improvement of work health and safety in rural industries.	Alex Thomas	Plant a seed for safety
2S	Research org and health amalgamation	https://www.farmerhealth.org.au/wp-content/uploads/2018/10/1.-PHILLIPS-T_AgriSafe.pdf	National Centre for Farmer Health	AgriSafe Clinics
3S	Research org and health amalgamation	https://www.farmerhealth.org.au/wp-content/uploads/2018/10/1.-PHILLIPS-T_AgriSafe.pdf	National Centre for Farmer Health	Health and Lifestyle Assessments
5S	Research org and health amalgamation	https://www.farmerhealth.org.au/wp-content/uploads/2020/10/2020-Gear-Up-Program-Flyer-2.pdf	National Centre for Farmer Health	Gear Up for Ag Health and Safety

7S	Statutory	Booklet	RIRDC	Living Longer on the Land Sustainable Farm Families in Broadcare Agriculture
9S	NFP	Farmsafe Induction Tool	Farmsafe Australia	Farmsafe Induction Tool
10S	Gov Dept	https://www.betterhealth.vic.gov.au/health/HealthyLiving/farm-safety-risks-and-hazards	Victorian Government	Better Health Channel
11S	Gov Dept	https://www.betterhealth.vic.gov.au/health/HealthyLiving/farm-safety-machinery	Victorian Government	Better Health Channel
12S	Statutory	https://www.peopleinag.com.au/livestock/employers/rights-and-responsibilities-as-an-employer/providing-a-safe-workplace/	People in Ag	Downloaded pages: Employee induction, contractor safety checklist, safety assessment, health and safety overview sheets
13S	Statutory	https://www.agrifutures.com.au/product/achieving-safety-change-on-australian-farms-using-new-and-established-pathways-to-improve-adoption/	AgriFutures	Achieving Safety Change on Australian Farms – using new and established pathways to improve adoption
14S	Statutory	https://worksafe.tas.gov.au/__data/assets/pdf_file/0010/543079/Safe-Farming-Induction-Handbook-2019.pdf	Safe Farming Tasmania Program	Safe Farming Induction Handbook
15S	Statutory	https://www.dairyaustralia.com.au/people-skills-and-capability/farm-safety-and-wellbeing#.YKseyKgzbcs	Dairy Australia	Dairy Passport
16S	Statutory	FOR526/03/03.05 (worksafe.vic.gov.au)	Worksafe Victoria	15 minute farm safety check

17S	Statutory and joint venture	farm_injury_optimal_data_set_version_1_2.pdf (sydney.edu.au)	Rural Industries Research and Development Corporation and Australian Centre for Agricultural Health and Safety	The Farm Injury Optimal Dataset
18S	Gov	https://agriculture.vic.gov.au/__data/assets/pdf_file/0004/538168/DEDJTR-AG-Vic-Smarter-Safer-Farms-Final-2018-Web.pdf	Ag Victoria	Smarter Safer Farms
19S	Gov	https://broadacrefarmsafety.com.au/wp-content/uploads/2018/03/Beyond-Commonsense-Barriers-to-Adoption-Aust-Comp-Council.pdf	Australian safety and compensation council	Beyond Common Sense
20S	Gov	https://www.arpansa.gov.au/sites/default/files/safety-culture-assesment-report2019.pdf	Australian Radiation Protection and Nuclear Safety Agency (Aust Gov), ARPANSA and Safety Works	Safety Culture Assessment Report of the ARPANSA Regulatory Services Branch
21S	Statutory	https://thepeopleindairy.org.au/wp-content/uploads/2019/03/FSSK_V3.pdf	Dairy Australia	Farm Safety Starter Kit
22S	Peak industry	https://www.rmit.edu.au/content/dam/rmit/documents/research/centres/cwhsr/publications/health-safety-culture.pdf	Centre for Construction Work Helath and Safety	Health and Safety Culture
23S	Statutory	https://www.safemanitoba.com/safetyculture/Documents/Safety%20Culture%20Assessment%20FAQs.pdf	Safe Work Manitoba	Safety Culture Assessment

24S	Gov	https://www.hse.gov.uk/humanfactors/topics/common4.pdf	Health and Safety Executive	Human Factors in Organisational Cultures
25S	NFP	https://keo-cms.appspot.com.storage.googleapis.com/sites/farmsafe/assets/3bf3fa65-6a2a-4acd-9699-65b36998c7f2/Farmsafe_SafeFarms_2020_Report_A4_8Panel_FA_lr.pdf	Farm Safe Australia	Safer Farms 2020 Agricultural Injury and Fatalities Trend Report
26S	Research	https://research.abdn.ac.uk/wp-content/uploads/sites/8/2019/08/Final-Booklet-A6.pdf (original download url not found)	Non Technical Skills in Agriculture (The University of Aberdeen)	SPEAKING UP ABOUT SAFETY When silence is not an option
27S	Part'ship	Hardcopy	Rural Safety and Health Alliance	RSHA03 Identifying and prioritising WHS overlaps across the Agriculture and Fisheries Sectors Final Report September
28S	Part'ship	Hardcopy	Rural safety and health alliance	Identifying and prioritising work health & safety overlaps across the agriculture and fisheries sectors Rural Safety & Health Alliance Report Summary - October 2020
29S	Statutory	Hardcopy	RIRDC	Achieving Safety Change on Australian Farms — Using new and established pathways to improve adoption

30S	NFP (FarmSafe) but Gov checklist	Agricultural safety and health checklist (safefarms.net.au)	Safe Farms	Agricultural safety and health checklist
32S	NFP	https://farmerhealth.org.au/sites/default/files/2009_SFF_Impact_Evaluation_Report_PDF_934_kb.pdf	Roberts Evaluations prepared for the Victorian Department of Primary Industries	Sustainable Farm Families Impact Evaluation 2007 - 2009
33S	NFP	https://farmerhealth.org.au/wp-content/uploads/2020/08/Evaluation_SFF_RIRDCFutureDirections_RobertsEvaluation2010.pdf	Roberts Evaluations prepared for National Cente for Farmer Health WDHS Dec 2010	Evaluation of Sustainable Farm Families RIRDC Future Directions
34S	NFP	https://www.abfarmsafety.com/wp-content/uploads/2020/11/Safety-Smarts-Full-Report-2016-2017-Evaluation.pdf	Farm Safety Centre	Safety Smarts Program
S35	Research	Hardcopy	Australian Centre for Agricultural Health and Safety	Managing the pressures of farming
36S	Research	Hardcopy	Australian Centre for Agricultural Health and Safety	Farm Health and Safety Toolkit for Rural General Practitioners
37S	Research	Hardcopy	Worksafe Tasmania	Safe Farming Tasmania Program

38S	NFP	https://clploggers.com/	Certified Logging Professionals	CLP was started in the 1990s to help reduce logger injuries and cost of worker's injury insurance in the timber felling industry. It greatly reduced logger injury rates though initially there was considerable resistance. Ultimately it greatly professionalized loggers which drove shifts in attitudes about safety and other aspects of logging.
39S	Research	PowerPoint presentation provided by Ag Victoria	University of Canberra, Health Research Institute	Regional Wellbeing Survey Work Health and Safety – Vic Farmers / Agricultural workers Findings from the 2020 Regional Wellbeing Survey

Peer review literature referred to in the Measuring the culture of safety on farms project

Research Identifier (and date)	Authors (and dates)	Title	Summary
7P	Somik Ghosh, Deborah Young-Corbett, and Christine M. Fiori (2010)	Emergent Themes of Instruments used to Measure Safety Climate in Construction	The commonly used indicators to measure construction safety are reactive, or lagging. On the other hand, predictive indicators such as measures of safety climate reduce the need to wait for incident to occur. Safety climate, referred to as the people's perception of the value of safety in the work environment, has been measured in various industries including construction. This paper has reviewed 15 such surveys to find the emergent themes of the instruments.
#2683 - Arcury 2012	Arcury, T. A.; O'Hara, H.; Grzywacz, J. G.; Isom, S.; Chen, H. Y.; Quandt, S. A.	Work safety climate, musculoskeletal discomfort, working while injured, and depression among migrant farmworkers in North Carolina	Data were from a cross-sectional survey of 300 farmworkers conducted in North Carolina in 2009.
#2550		Special Issue: Socio-ecological approaches for improving agricultural safety and health	The socioecological model and its versatility in understanding what influences decisions by farmers, farm parents, and farm workers regarding safety and health in an agricultural environment.
#4325 - Risch 2014	Risch, C. C.; Boland, M. A.; Crespi, J. M.; Leinweber, M.	Determinants of occupational safety for agribusiness workers	The objective of this research is to gain insight into the relationship between safety culture and safety performance, and to identify the determinants of safety culture in agribusinesses.

#3233 - Pollock 2016	Pollock, K. S.; Fragar, L. J.; Griffith, G. R.	Occupational health and safety on Australian farms: 3. safety climate, safety management systems and the control of major safety hazards	The analysis reported in this paper benchmarked the perceptions of the study informants on the role and importance of health and safety on their farms and reviewed the safety performance of the study enterprises, focusing on management of safety systems and processes and control of major risks and hazards on their farms.
#4704 - Kim 2018	Kim, HyoCher; Räsänen, K.; Chae, HyeSeon; Lee, KyungSuk	Analysis of checklists for agricultural safety management	The aims were to classify and review the items from various checklists using safety systems, such as design, training, etc., ultimately aimed at proposing directions for improving the health and safety of farmers.
#4259 - Bailey 2017	Bailey, J.; Dutton, T.; Payne, K.; Wilson, R.; Brew, B. K.	Farm safety practices and farm size in New South Wales	The objective of this research was to conduct a pilot study to investigate whether small- to medium-area farms implement fewer safety practices than large-area farms.
#3056 - Beseler 2010	Beseler, C. L.; Stallones, L	Safety knowledge, safety behaviours, depression, and injuries in Colorado farm residents	An actor analysis was used to produce a single measure of safety knowledge for logistic regression models to evaluate the relationships between injuries, safety knowledge, and behaviours.
#3234 - Pollock 2014	Pollock, K. S.; Fragar, L. J.; Griffith, G. R.	Occupational health and safety on Australian farms: 2. Improved management and the driving forces for practice change	The most frequently reported changes to health and safety by participating farm enterprises were shearing shed safety improvements, improved chemical safety and handling, purchasing new equipment or upgrading existing equipment, greater provision and access to personal protective equipment and improving safety of stockyards and procedures.
#3158 - Guin 2012	Guin, S. M.; Wheat, J. R.; Allinder, R. S.; Fanucchi, G. J.; Wiggins, O. S.; Johnson, G. J.	Participatory research and service-learning among farmers, health professional students, and experts: an agromedicine approach to farm safety and health	Agricultural extension agents were key to developing the trust relationships among farmers, health professionals, and extension personnel required for these successful agricultural safety and health developments.

#3063 - Kadir 2016	Kadir, Arifin; Roziah, Abudin; Muhamad Rizal, Razman; Zitty Sarah, Ismail; Maisarah, Ahmad	Safety climate assessment on priority, commitment and the efficiency of safety management	This study was carried out to assess the safety climate in Ministry of Agriculture (MOA) based on perceptions in handling safety aspect by the management and workers and contributes knowledge and guidelines to improve safety climate in MOA. The questionnaires and simple analysis were used as a method to achieve the objectives.
#5912 - Mosher 2013	Mosher, G. A.; Keren, N.; Freeman, S. A.; Hurburgh, C. R., Jr.	Measurement of worker perceptions of trust and safety climate in managers and supervisors at commercial grain elevators	In this study, 177 workers at three Midwest grain elevator companies completed online surveys measuring their perceptions of trust and safety at two administrative levels: organisational management and work group supervisors.
#3630 - McDonald 1998	McDonald, M. C.; McDivitt, J. A.; Murphy, D. J.; Aherin, R.; Duncan, J. R.; Field, W. E.; Gunderson, P. D.; Popendorf, W.	Evaluation challenges in agricultural health and safety centers	There is a lack of established markers and measures for health and safety problems.
#7868 - Ramos 2020	Ramos, Athena K.; Girdžiūtė, Laura; Starič, Jože; Rautianinen, Risto H	Identifying "Vulnerable Agricultural Populations" at Risk for Occupational Injuries and Illnesses: A European Perspective	Understand vulnerable ag populations (1) foreign-born farmworkers (including both immigrants and refugees); (2) migrant and seasonal farmworkers; (3) beginning farmers (those with <5 years of experience); (4) farm families (including women, children, and older adults), and (5) farmers and farmworkers who have physical, mental health, or intellectual disabilities.

#3875 - Fragar 2011	Fragar, L.; Temperley, J.	Drivers of adoption of safety innovations on Australian cotton farms	A recently defined model for adoption of farm safety, emphasizing individual behavioural, environmental, community, and governmental factors, was used as the framework for the assessment. This hazard-based examination of changes describes improvements that have positively impacted health and safety
#5172 - Rodriguez 1997	Rodriguez, L. A.; Schwab, C. V.; Peterson, J. W.; Miller, L. J.	Safe farm: the impact of an Iowa Public Information Campaign	The baseline survey showed that farm operators relied heavily on local media for farm safety information, as well as the cooperative extension service. When asked where they obtained safety information, 95% of the respondents said newspapers and magazines, 82% radio, 77% television, 59% relied on publications from ISU Extension, and 33% relied on ISU Extension staff.
#5160 - Terjék 2013	Terjék, L.	Safety culture measurements results in the agricultural sector	The author has created a dimension-model, which organically reflects the relations of safety culture within an organisation, projected mainly on conditions in Hungary. The author used a self-made questionnaire for the interviews. In the questionnaire he used Likert-type scale to measure the qualitative elements of the dimensions.
6P	Reason, James (1998)	Achieving a safe culture : theory and practice	Theoretical (Navy and Chernobyl examples)
#4331 - Pickett 2010	Pickett, W.; Hagel, L. M.; Day, A. G.; Day, L.; Sun, XiaoQun; Brison, R. J.; Marlenga, B. L.; King, M.; Crowe, T.; Pahwa, P.; Koehncke, N.; Dosman, J.	Determinants of agricultural injury: a novel application of population health theory	Apply novel population health theory to the modelling of injury experiences in one particular research context to enhance understanding of the conditions and practices that lead to farm injury.

#3557 - Porceddu 2008	Porceddu, P. R.; Rosati, L.	Integrated approach to the safety of dairies through the use of check lists	With these check lists inspections were made in some dairies of the Umbrian region (Italy). The data gathered was elaborated and displayed by means of radar diagrams. The use of radar diagrams gave an immediate idea about the critical aspects that require urgent intervention so as to facilitate the planning of adequate investments with time.
#2200 - Lee 2010	Lee, Barbara C.; Wolfe, Amy; Meyers, James M.	Agricultural safety training: California style	To date, nearly 550 individuals have secured certificates of completion that reflect at least 15 hours of formal coursework. English- and Spanish-language training is offered in a manner that is responsive to the learning styles of a multicultural workforce.
#8319 - Schwab 2019	Schwab, Charles V.; Arbuckle, J. Gordon; Hanna, H. Mark	Barriers and Motivators for Tractor ROPS Retrofitting in Iowa	A state-wide sample of approximately 2,000 farm operators was surveyed in the 2017 Iowa Farm and Rural Life Poll. A series of questions was asked to evaluate the importance of potential barriers to decisions to not retrofit a tractor and potential motivators that could influence the decision to retrofit or purchase a tractor with ROPS. The survey received a 48% response rate (999 responses).
#6421 - Bendixsen 2017	Bendixsen, C. G.	The entanglements of agrarian ethics with agrarian risks and leveraging them in agricultural health safety	This article assesses health and safety within agrarian ethics
#7958 - Vengrin 2018	Vengrin, Courtney; Westfall-Rudd, Donna; Archibald, Thomas; Rudd, Rick; Singh, Kusum	Factors affecting evaluation culture within a non-formal educational organisation	

#2331 - Grimbuhler 2019 - in grey literature not counted here	Grimbuhler, Sonia; Viel, Jean-François	Development and psychometric evaluation of a safety climate scale for vineyards	This study aimed to develop a questionnaire-based tool measuring the safety climate in vineyards and to assess its psychometric properties.
#2167 - Arcury 2017	Arcury, Thomas	Anthropology in Agricultural Health and Safety Research and Intervention	Commentary: Research that goes beyond technological changes to address safety culture and policy are needed to improve health and safety in agriculture
#684 - Kongsvik 2019	Kongsvik, Trond; Thorvaldsen, Trine; Holmen, Ingunn Marie	Reporting of Hazardous Events in Aquaculture Operations - The Significance of Safety Climate	The study is based on a quantitative questionnaire study involving 428 fish farmers, operational managers, and service vessel employees in the Norwegian aquaculture industry, interviewed by telephone.
#635 - Hanson 2020	Hanson, Erik; Boland, Michael	Safety climate at agricultural cooperatives	Survey-based study.
#379 - Jinnah 2014	Jinnah, Hamida Amirali; Stoneman, Zolinda; Rains, Glen	Involving fathers in teaching youth about farm tractor seatbelt safety—A randomized control study	This study treats farm safety as a family issue and builds on the central role of parents as teachers and role models of farm safety for youth. This research study used a longitudinal, repeated-measures, randomized-control design in which youth 10-19 years of age were randomly assigned to either of two intervention groups (parent-led group and staff-led group) or the control group.
#6095 - Reed 2006	Reed, D. B.; Browning, S. R.; Westneat, S. C.; Kidd, P. S.	Personal protective equipment use and safety behaviors among farm adolescents: gender differences and predictors of work practices	593 adolescent high school students enrolled in agriculture class in Kentucky, Iowa and Mississippi, USA, were surveyed during 1997-2000.

#2760 - Citti 2008	Citti, P.; Delogu, M.; Giorgetti, A.	The use of statistical problem solving methods for risk assessment	The aim of this paper is to show how the use of statistical problem solving method, such as Six Sigma, could be useful to improve safety level in working activities. In particular high level of improvement could be obtained by a more structured collection of injuries data considering not only the injuries frequency rate related to the root causes or risks
#3195 - Carrabba 2008	Carrabba, J. J., Jr.; Scofield, S.; May, J.	On-farm safety program	Over a 2-year period, 124 farms were surveyed and 187 safety training sessions were conducted on a total of 271 New York farms. Follow-up phone surveys were conducted with 97 (78%) of the on-farm survey sites at roughly 6 months. Of the 97 survey farms that completed the telephone survey, 77 (79%) reported having made safety improvements.
#2866 - Tutor-Marcom 2013	Tutor-Marcom, R.; Greer, A.; Clay, M.; Ellis, T.; Thompson, T.; Adam-Samura, E. S.	Qualitative assessment of agritourism safety guidelines: a demonstration project	Worksite Guide were subsequently published in 2009 and provided agritourism farms with checklists to use in reviewing, planning, and implementing their own health and safety practices.
#4740 - Adams 2020	Adams, J.; Cotton, J.; Brumby, S.	Agricultural health and medicine education - engaging rural professionals to make a difference to farmers' lives	Graduates were invited to complete an online survey. Following the survey, graduates participated in a phone interview until saturation was reached. Participants: Forty-one graduates completed the survey (31% response rate), and eleven interviews were conducted.
4267 - McNamara 2019	McNamara, J.; Griffin, P.; Phelan, J.; Field, W. E.; Kinsella, J	Farm health and safety adoption through engineering and behaviour change	The aim of this study is to report findings of a Score Card exercise conducted among Irish farmers (n = 1,151) to reveal knowledge on farmers' conceptualisation of accident causation where farmers ranked in order of importance up to five causes of farm accidents.

#4602 - Kaustell 2011	Kaustell, K. O.; Mattila, T. E. A.; Rautiainen, R. H.	Barriers and enabling factors for safety improvements on farms in Finland	Systematic reviews of agricultural safety and health interventions have shown little evidence of effectiveness. In this study, we used a self-documentation and collaborative interpretation method (cultural probes, n=9) as well as farm interviews (n=11) to identify factors affecting the adoption and implementation of safety information.
#3606 - Legault 2000	Legault, M. L.; Murphy, D. J.	Evaluation of the Agricultural Safety and Health Best Management Practices Manual	The Agricultural Safety and Health Best Management Practices (ASHBMP) Manual was developed as an alternative intervention tool to help identify and correct farm work hazards. A modified pre-test/post-test control group experimental design was used to test the effectiveness of the manual with three intervention groups and a control. Testing consisted of conducting baseline and post-intervention audits on 150 farms in Pennsylvania, USA.
#1476 - Arcury 2020	Arcury, Thomas A.; Quandt, Sara A.; Arnold, Taylor J.; Chen, Haiying; Daniel, Stephanie S.	Occupational Injuries of Latinx Child Farmworkers in North Carolina: Associations With Work Safety Culture	Interviews were conducted in 2017 with 202 Latinx farmworkers aged 10 to 17 years. Results: Occupational injuries were common among the child farmworkers: for example, 66.8% reported any work injury and 45.5% reported heat-related illness.
#2001 - Stoneman 2014	Stoneman, Zolinda; Jinnah, Hamida Amirali; Rains, Glen C.	Changing a dangerous rural cultural tradition: a randomized control study of youth as extra riders on tractors	AgTeen, an in-home, family-based farm safety intervention, in decreasing extra riding on tractors by youth. Having children as extra riders on tractors has deep roots in farm culture, but it can result in serious injury or death.

#4599 - Arcury 2019	Arcury, T. A.; Arnold, T. J.; Mora, D. C.; Sandberg, J. C.; Daniel, S. S.; Wiggins, M. F.; Quandt, S. A.; Markowitz, S.; Ehrlich, R.	"Be careful!" perceptions of work-safety culture among hired latinx child farmworkers in North Carolina	In-depth interviews in North Carolina in 2016 with 30 Latinx child farmworkers, ages 10 to 17. Our analysis used the work-safety culture conceptual framework to delineate their perceptions of the psychological, behavioural, and situational elements of safety culture
#7260 - Shirahige 2018	Shirahige, Y.; Tamura, T.; Matsui, M.; Moriyama, T.	Actual condition and characteristics of farm work safety measures in large farm management entities	To reduce the causes of such accidents, it is essential that preventive measures based on an investigation from the perspectives of machinery, the environment, and human are implemented.
#3597 - Reyes 2016	Reyes, I.; Ellis, T.; Yoder, A.; Keifer, M. C.	An evaluation tool for agricultural health and safety mobile applications	The smart device paired with a well-designed app has potential for improving workplace health and safety in the hands of those who can act upon the information provided.
#7939 - O'Connor 2020	O'Connor, Tracey; Meredith, David; McNamara, John; O'Hora, Denis; Kinsella, Jim	Farmer Discussion Groups Create Space for Peer Learning about Safety and Health	Occupational safety and health (OSH) interventions emphasizing regulation or education have had limited success in reducing agricultural accidents and fatalities. There is a growing interest in sociocultural approaches to OSH promotion amongst farmers, such as peer learning groups (PLGs). The level of OSH engagement within farmer PLGs (e.g. dairy discussion groups (DDGs)) is unknown. This study evaluates Irish DDG engagement with OSH in 2016 to better understand how DDGs contribute to OSH promotion.
#5608 - Abdollahzadeh 2021	Abdollahzadeh, G.; Sharifzadeh, M. S.	Predicting farmers' intention to use PPE for prevent pesticide adverse effects: an examination of the Health Belief Model (HBM)	This study used the Health Belief Model (HBM) as a framework in predicting farmers' intention to use a series of PPE (face mask, goggles, gloves, protective clothing and rubber boots) for prevent pesticide adverse effects.

#6749 - Ayers 1989	Ayers, P. D.	Data gathering techniques to accurately direct a farm safety program	A new approach for obtaining accident information useful for identifying state safety problem areas and implementing an accurately directed safety programme is described. This 2-step process involves reviewing accident information readily available from state sources and then developing a survey to isolate the major safety problem areas.
#7281 - Reber 1983	Reber, Robert A.; Wallin, Jerry A.	Validation of a behavioural measure of occupational safety	Behaviourally specific safety rules were written for 12 departments that comprised 107 employees of a farm machinery manufacturing company. Trained observers collected baseline data concerning the percentage of employees in each department working in complete compliance with the rules.
#4021 - Morgaine 2014 - also in grey lit search so not counted here	Morgaine, K. C.; Langley, J. D.; McGee, R. O.; Gray, A. R.	Impact evaluation of a farm safety awareness workshop in New Zealand	This short communication presents the results of an impact evaluation of the FarmSafe Awareness Workshop (FSAW) in its first two years of operation. Methods: All FSAW participants completed, and received credit for, formal educational assessments. Pass rates were used to assess safety knowledge, and a quasi-experimental design with intervention and comparison groups was applied to assess attitudes, safety behaviours, and environmental determinants of injury.
#3560 - Klembalska 2004	Klembalska, K.; Bręczewski, J.	Instruments of work safety improvements in agriculture	This paper presents the current status and needs of used instruments for the creation of work safety in Polish agriculture.
#6428 - Jones 1998	Jones, M. S.; Luchok, K. J.; McKnight, R. H.; Schuman, S. H.	Empowering farm women to reduce hazards to family health and safety on the farm	12 influential farm women were recruited as the core group of the Kentucky Partnership for Farm Family Health and Safety in February 1993. Together with technical assistance from 2 universities, they built a coalition of local farm families, health professionals, businesses, and volunteer agencies.
#1051 - Kogi 2006	Kogi, K.	Low-cost risk reduction strategy for small workplaces: how can we spread good practices?	A noteworthy progress is the wider application of low-cost improvements to risk reduction particularly in small enterprises and agriculture in both industrially developing and developed countries. This is helped by the readiness of managers and workers to implement these improvements despite many constraints.

#4739 - Lower 2011	Lower, T.; Fragar, L.; Temperley, J.	Agricultural health and safety performance in Australia	This study aimed to determine the proportion of Australian farming enterprises with systems and processes that meet current regulatory and industry standards for health and safety.
#1495 - Murphy 1996	Murphy, D. J.; Kiernan, N. E.; Chapman, L. J.	An occupational health and safety intervention research agenda for production agriculture: does safety education work?	But does participation in farm safety and health educational programs lead to a reduction in risk of injury from farm work? Questions are being raised about the value of farm safety and health educational information, campaigns, programs, and related activities.
#2483 - Brumby 2009 - In the grey literature - not counted	Brumby, S. A.; Willder, S. J.; Martin, J.	The sustainable farm families project: changing attitudes to health	The relationship between occupational health and safety and farm family health has not been fully investigated. The Sustainable Farm Families (SFF) project attempts to make this connection in order to address premature death, morbidity and injury on Australian farms.
#570 - Mazur 2017	Mazur, Joan M.; Westneat, Susan	A socio-cognitive strategy to address farmers' tolerance of high risk work: Disrupting the effects of apprenticeship of observation	Why do generations of farmers tolerate the high-risk work of agricultural work and resist safe farm practices? This study presents an analysis inspired by empirical data from studies conducted from 1993 to 2012 on the differing effects of farm safety interventions between participants who live or work on farms and those who don't, when both were learning to be farm safety advocates.
#2546		Special issue: Workplace health and safety	This journal issue contains 6 articles on workplace health and safety
#3234 - Pollock 2014	Pollock, K. S.; Fragar, L. J.; Griffith, G. R.	Occupational health and safety on Australian farms: 2. Improved management and the driving forces for practice change	longitudinal study of 335 farm enterprises throughout New South Wales, Australia, was examined focusing on the changes farmers were making to farm health and safety and the motivating drivers behind those changes

4P	Griffin, M and Neal, A 2000	Preceptions of Safety at Work: A framework for linking safety and climate to safety performance, knowledge and motivation	The model of antecedents of safety performance, determinants of safety performance and components of safety performance is quite a good visual to understand the relationships of safety climate and performance.
3P	De Ceri, Shea, Cooper, Sheehan & Donohue 2016	A multi-stage validation study to assess an OHS leading indicators tool: Final Report	Leading indicators of OHS can be defined as measures of the positive steps that organisations take that may prevent an OHS incident from occurring. The OHS leading indicators project is a large research project that has been conducted by Monash, Worksafe Vic, Institute of Safety, ISCRR, GM forum and Safe Work Australia.
2P	Collie, Marembo, Massani-Mahmooei, De Ceri, LaMontagne, Smith, Scollay and Thompson 2017	National work health and safety leading indicator survey	
1P	Butterworth, Leach, Strazdins, Olesen, Rodgers and Broom	The psychosocial quality of work determines whether employment has benefits for mental health: results from a longitudinal national household panel survey	The satisfaction of employment is correlated with job quality
#7445 - Wilmsen 2019	Wilmsen, Carl; Castro, A. Butch de; Bush, Diane; Harrington, Marcy J.	System Failure: Work Organisation and Injury Outcomes among Latino Forest Workers	We sought to understand how workplace organisational factors and safety climate affect job-related injuries in this forestry industry.

#4267 - McNamara 2019	McNamara, J.; Griffin, P.; Phelan, J.; Field, W. E.; Kinsella, J.	Farm health and safety adoption through engineering and behaviour change	The Public Health Model (PHM) of accident causation conceptualises an accident as occurring due to multiple interacting physical and human factors while the Social-Ecologic Framework enhances the PHM by defining various levels of the social environment which are influential on persons' OSH actions.
#5338 - Stelmokienė 2018	Stelmokienė, A.; Gustainienė, L.; Kovalčikienė, K.	Psychosocial factors that predict safety climate of organisation in agricultural industry	961 employees from a large Lithuanian company of agricultural industry participated in the survey. The study was conducted using Sexton's Safety Climate Questionnaire and two scales from Copenhagen Psychosocial Questionnaire. The analysis of data via Structural Equation Modelling confirmed the theoretical model of psychosocial safety climate antecedents.
#5187 - Mayer 2010	Mayer, B.; Flocks, J.; Monaghan, P.	The role of employers and supervisors in promoting pesticide safety behavior among Florida farmworkers	Farmworkers' beliefs about chemical exposures and their perception of employer's or supervisor's valuing of safety may limit the practice of workplace hygiene.
#3041 - McCallum 2005	McCallum, D. M.; Conaway, M. B.; Drury, S.; Braune, J.; Reynolds, S. J.	Safety-related knowledge and behavior changes in participants of farm safety day camps	This project assessed changes in safety-related knowledge and behaviours among participants in the Progressive Farmer Farm Safety Day Camp program.
#2645 - Hagevoort 2013	Hagevoort, G. R.; Douphrate, D. I.; Reynolds, S. J.	A review of health and safety leadership and managerial practices on modern dairy farms	Transformational leadership has been associated with improved safety climate and reduced incidence of injury, whereas passive leadership styles have opposite effects. There is a need to develop and evaluate the effectiveness of safety-specific transformational leadership among dairy owners and managers.

#2682 - Kearney 2015	Kearney, G. D.; Rodriguez, G.; Quandt, S. A.; Arcury, J. T.; Arcury, T. A.	Work safety climate, safety behaviors, and occupational injuries of youth farmworkers in North Carolina	The aims of this project were to describe the work safety climate and the association between occupational safety behaviours and injuries among hired youth farmworkers in North Carolina (n=87).
#5603 - Irwin 2018	Irwin, A.; Poots, J	Predictors of attitudes toward non-technical skills in farming	However, there is a lack of research evaluating factors that may contribute to NTS attitudes and behaviours. As a first step to address this literature gap, the current study evaluated a range of individual and environmental factors as potential predictors of attitudes toward NTS in agriculture.
#8374 - McNamara 2017	McNamara, John; Griffin, Patrick; Kinsella, James; Phelan, James	Health and Safety Adoption from Use of a Risk Assessment Document on Irish Farms	This article describes levels of implementation of occupational health and safety (OHS) controls on a sample of Irish farms following completion of a risk assessment document (RAD) made available as part of a statutory code of practice (COP) for the agriculture sector. The article describes the legislation mandating the COP and the operation of a prevention initiative (PI) among key stakeholders to develop and promote farmer use of the COP and RAD.
#5145 - Pontigia 2006	Pontigia, L.; Fiala, M.	Safety: self-assessment of risk	Spreading a culture of safety among workers remains one of the most important issues. The need to find incentives or prevention of and protection from risk led to the development of a database which provides guidelines for operating farm machines safely and coupled with a system for self-assessment of risk in using any type of farm machine.
#4116 - Chattha 2017	Chattha, H. S.; Corscadden, K. W.; Zaman, Q. U.	Hazard identification and risk assessment for improving farm safety on Canadian farms	The purpose of this study was to develop and apply a generic farm safety protocol to hazards that have been identified in previously published literature and demonstrate the potential benefits of such a protocol with a view to raising awareness of farm safety.

#8321 - Low 1996	Low, J. M.; Griffith, G. R.; Alston, C. L.	Australian farm work injuries: incidence, diversity and personal risk factors	Information on farm work-related injuries was sought to assist in the design of effective farm safety prevention programs. A telephone survey was conducted using a stratified random sample of 919 sheep/wool, beef cattle and dryland broadacre cropping farms from three shires in the wheat/sheep belt of New South Wales.
#2708 - Ozegovic 2011	Ozegovic, D.; Voaklander, D. C.	What we are not talking about: an evaluation of prevention messaging in print media reporting on agricultural injuries and fatalities	We conducted a scan of all media reports contained in the Canadian Agricultural Safety Association (CASA) archives for the period January, 2007 to September, 2009, inclusive, for injury and fatality and analysed newspaper articles for prevention messages.
#5669 - Terjék 2009	Terjék, L.	Organisational safety climate measurement at agricultural organisations in Hajdú-Bihar county of Hungary	Eighteen agricultural juristic personality organisations Hajdú-Bihar County, Hungary were studied to assess the occupational safety climate-related perceptions among farm workers (n=230).
#8373 - Hiscock-Corney 1989	Hiscock-Corney, L. S.	Health and safety issues for Victorian farmworkers	This paper reports a study of Victorian agricultural workers' awareness of occupational health and safety (OH&S) services and their perceived need for a locally-based service. An exploratory approach was used to investigate a convenience sample of 25 agricultural workers comprising predominantly self-employed landowners and two employees, one of whom also owned their own property.
#3493 - Arcury 2015	Arcury, T. A.; Summers, P.; Talton, J. W.; Nguyen, H. T.; Chen, H. Y.; Quandt, S. A.	Job characteristics and work safety climate among North Carolina farmworkers with H-2A visas	Migrant farmworkers with H-2A visas are the only agricultural workers with temporary work permits. Little research has directly focused on the job characteristics and work safety of workers with H-2A visas.

#3085 - Cecchini 2015	Cecchini, M.; Monarca, D.; Colantoni, A.; Baciotti, B.; Bedini, L.; Menghini, G.; Porceddu, P. R.; Failla, S.	Safe in the field: a project for training and integration of foreign agricultural workers	One of the aims of the research is to understand the relationship between risk perception among farmers and the main risk factors to which they are exposed. Furthermore to investigate the influence of the training in risk perception in agriculture.
#3137 - Geng 2015	Geng, QiuQing; Field, W. E.; Salomon, E.	Risk assessment of cattle handling on pasture using work environment screening tool	A pilot study was conducted to test the cross-cultural usability of the Working Environment Screening Tool in Agriculture (WEST-AG), a modification of the WEST, developed for Swedish industrial applications, to assess risk factors associated with farmers working with cattle being raised largely on pasture as compared with cattle raised in confined feeding operations. Swedish and English language versions of WEST-AG were developed and pilot-tested on a convenient sample of eight Swedish and eight Indiana farms that raise beef cattle primarily on pasture.
#4736 - Gasperini 2017	Gasperini, F. A.	Agricultural leaders' influence on the safety culture of workers	Large agricultural enterprises that employ larger numbers of non-family workers are more regulated and more highly incentivized by economic, supply chain, and societal factors to implement cultures of safety, and are more readily influenced by agricultural opinion leaders, agribusinesses, farm organisations, and agricultural media. These agricultural influencer institutions must find ways to play more significant roles in changing the culture on operations that use only family labour.

#2754 - Monaghan 2008	Monaghan, P. F.; Bryant, C. A.; Baldwin, J. A.; Zhu, YiLiang; Ibrahimou, B.; Lind, J. D.; Contreras, R. B.; Tovar, A.; Moreno, T.; McDermott, R. J.	Using community-based prevention marketing to improve farm worker safety	Community-based prevention marketing (CBPM) combines a powerful planning framework, social marketing, with community organisation principles to design behaviour change programs. In southwest Florida, a coalition comprised of citrus workers and their employers, health providers, and academic researchers is using CBPM to identify occupational health issues among agricultural labourers, conduct community-based participatory research, and design culturally appropriate interventions.
#4975 - Elahi 2019	Elahi, E.; Weijun, Cui; Zhang, HuiMing; Muhammad, Abid	Use of artificial neural networks to rescue agrochemical-based health hazards: a resource optimisation method for cleaner crop production	The main aim of the study was to estimate the target values of agrochemical use, and its impact on crop productivity, and human health.
#3212 - SaifulAzhar 2015	Saiful Azhar, M. S.	Occupational safety and health in plantation agriculture: the Malaysian perspective	The Malaysian Government through the Department of Occupational Safety and Health (DOSH) under the Ministry of Human Resources is encouraging planters to improve occupational safety and health (OSH) by making mandatory the requirements for safety and health policy and the safety and health committee.
#4361 - Cividino 2018	Cividino, S. R. S.; Pergher, G.; Gubiani, R.; Moreschi, C.; Broi, U. da; Vello, M.; Rinaldi, F.	Definition of a methodology for gradual and sustainable safety improvements on farms and its preliminary applications	A lack of attention to safety and poor risk awareness by operators represents a crucial problem, which results in numerous serious injuries and fatal accidents.

#1498 - Lincoln 2013	Lincoln, Jennifer M.; O'Connor, Mary B.; Retzer, Kyla D.; Hill, Ryan D.; Teske, Theodore D.; Woodward, Chelsea C.; Lucas, Devin L.; Somervell, Philip D.; Burton, Jason T.; Mode, Nicolle A.; Husberg, Brad J.; Conway, George A.	Occupational fatalities in Alaska: two decades of progress, 1990-1999 and 2000-2009	Alaska had the highest work-related fatality rate of any state during 1980-1989. The National Institute for Occupational Safety and Health established the Alaska Field Station (AFS) to address this problem
#1339 - Kinnunen 2009	Kinnunen, Birgitta; Manninen, Pirjo; Taattola, Kirsti	Factors associated with farmers joining occupational health services	The aim of an occupational health service (OHS) is to reduce the risk of work-related diseases, occupational diseases and injuries and to promote workers' health. In Finland, they are part of the public health care system, but for farmers OHS is voluntary. Aims: To explore factors associated with farmers joining farmers' occupational health services (FOHS). This knowledge is important for improving the coverage of FOHS and to motivate farmers to join.
#2883 - Snipes 2015	Snipes, S. A.; Smyth, J. M.; Murphy, D.; Miranda, P. Y.; Ishino, F. A. M.	Provision increases reported PPE use for Mexican immigrant farmworkers: an mHealth pilot study	Personal protective equipment (PPE) reduces pesticide exposures, but many farmworkers complain that it is difficult to obtain. We examined if PPE provision increased usage. We also delivered motivational messaging aimed to promote PPE use.

#3581 - McBain-Rigg 2017	McBain-Rigg, K. E.; Franklin, R. C.; King, J. C.; Lower, T.	Influencing safety in Australian agriculture and Fisheries	With Australian agricultural industries being among the nation's most dangerous workplaces, there is a need for action. While there are currently known solutions, their implementation is limited. Influential agents, i.e., people who can influence others, are important for helping engender action to enact solutions into practice.
#3023 - Ramaswamy 2015	Ramaswamy, S. K.; Mosher, G. A.	Perceptions of agricultural college students on the relationship between quality and safety in agricultural work environments	Little research has studied how young workers perceive the relationship between safety and quality and how these perceptions vary based on demographic characteristics. This study builds on prior research that measured the interactions between employee perceptions of safety and quality in an agricultural work environment.
#2568 - Bendixsen 2017	Bendixsen, C.; Barnes, K.; Kieke, B.; Schenk, D.; Simich, J.; Keifer, M.	Sorting through the spheres of influence: using modified pile sorting to describe who influences dairy farmers' decision-making about safety	Objectives: The primary goal of this study was to describe the mutually perceived influence of bankers and insurers on their agricultural clients' decision-making regarding health and safety
#8317 - VandenBroucke 2011	Van den Broucke, Stephan; Colémont, Ariane	Behavioral and non-behavioral risk factors for occupational injuries and health problems among Belgian farmers	Preventive interventions to reduce occupational injuries and diseases among farmers require an appraisal of the relative importance of the various risk factors. This paper describes the results of a cross-sectional study investigating determinants of occupational health and injuries among 510 Belgian farmers, looking at health-related behaviours (machinery use, animal handling, fall prevention, and pesticide use), as well as non-behavioural risk factors (demographic characteristics, farm characteristics, and participation in safety training).
#3515 - Irwin 2018	Irwin, A.; Poots, J.	Investigation of UK farmer go/no-go decisions in response to tractor-based risk scenarios	Tractors are a source of injury and fatality in agriculture. Despite this farmers continue to engage in risk-taking behaviours, including operating tractors without appropriate equipment. In order to change behaviours and attitudes toward safety, it is important to understand how farmers approach different types of risk relevant to tractor use.

#204 - VanDenBan 1960	Van Den Ban, Anne Willem	Locality Group Differences in the Adoption of New Farm Practices	The study presented in this article tests the hypothesis that the social organisation and culture of locality groups are major factors that are influencing adoption of new farm practices.
#3478 - Zappavigna 2008	Zappavigna, P	Knowledge evaluation test as a tool for the accident prevention in livestock housing	Several investigations on the accident causes in animal housing have revealed that the risk reduction is strongly related not only to the objective conditions of the operational means (buildings, machines and plants) but even more to the subjective modes adopted in using such means by workers.
#5362 - Dioguardi 2010	Dioguardi, L.; Ariano, E.	The project "safety prevention in agriculture": main results of a triennial survey	Prevention system is based on an approach that combines information activities firstly, followed by check-up in the farms. Thus the concept of priorities through the progressive application of the rules is introduced. The rate of accidents was effectively reduced throughout the region. The survey - carried out in the years 2006-2008 on a sample of one thousand farms per year - involved all PSAL (Health and Safety in work premises) of the region.
#5364 - Hagel 2016	Hagel, L.; King, N.; Dosman, J. A.; Lawson, J.; Trask, C.; Pickett, W.	Profiling the safety environment on Saskatchewan farms	Our objectives were four fold: (1) to provide a contemporary update on the prevalence of hazards on farms; (2) to document the safety practices of farm owner-operators; (3) to measure investments in farm safety and (4) to assess their relationship with injury within a current regulatory environment.
#1588 - Scott-Harp 2019	Scott-Harp, DeAnn; Peek-Asa, Corinne; Rohlman, Diane S.; Janssen, Brandi	More than time and money: A mixed-methods study of the barriers to safer cattle handling practices	This project identified the types of equipment commonly used on farms and assessed farmer perceptions of safety and barriers to implementing changes.

#8402 - BinNordin 2001	Bin Nordin, R.; Araki, S.; Sato, H.; Yokoyama, K.; Bin Wan Muda, W. A.; Win Kyi, D.	Gender difference in safe and unsafe practice of pesticide handling in tobacco farmers of Malaysia	To identify gender difference in safe and unsafe practice of pesticide handling in tobacco farmers of Malaysia
#6833 - Schneiders 2001	Schneiders, S.; Donham, K.; Hilsenrath, P.; Roy, N.; Thu, K.	Certified safe farm: using health insurance incentives to promote agricultural safety and health	(1) Are farmers with high cost coverage less likely to seek health care when they have illnesses and injuries than are farmers who have low cost insurance coverage? and (2) Do farmers with off farm employer coverage have lower insurance costs than farmers who have individual coverage? No conclusive evidence supported a relationship between the cost of coverage and the number of health care visits. However, persons with off-farm employer sponsored coverage had significantly lower premiums than those without off-farm coverage.
#2481 - Sorensen 2017	Sorensen, J. A.; Tinc, P. J.; Weil, R.; Droullard, D.	Symbolic interactionism: a framework for understanding risk-taking behaviors in farm communities	This study utilizes data collected over the past decade with a variety of small to midsize farm personnel to explore the meanings that farmers ascribe to risk and safety and how these influence risk and safety behaviours
#6343 - Chumbley 2019	Chumbley, S.; Hainline, M. S.; Wells, T.	Examining university-level agricultural students' safety climate attitudes in the agricultural mechanics laboratory	One of the most important issues an instructor in agricultural education settings faces is safety in the agricultural mechanics laboratory. Identifying and cultivating a culture of safety in students early on is key to reducing injuries and accidents. The purpose of this study was to gauge safety climate attitudes within a university-level agricultural mechanics laboratory.
#4966 - Schenker 2002	Schenker, M. B.; Orenstein, M. R.; Samuels, S. J.	Use of protective equipment among California farmers	We describe California farmers' self-reported exposure to five agricultural hazards and their use of protective equipment. Methods: A telephone survey of 1,947 California farmers recorded information on occupational exposure, health outcomes and use of protective equipment to lessen risk from exposure to dust, sun, noise, pesticides and tractors.

#8284 - Rowley 1990	Rowley, B. D.	A case for social marketing and education for acceptance and implementation of preventive health and occupational safety measure programs for rural communities	The environment in which acceptance and implementation of preventive health and occupational safety occurs is not conducive to the message being heard, nor are people acting upon the message.
#632 - Cecchini 2018	Cecchini, Massimo; Bedini, Roberto; Mosetti, Davide; Marino, Sonia; Stasi, Serenella	Safety Knowledge and Changing Behavior in Agricultural Workers: an Assessment Model Applied in Central Italy	Risk perception plays an important role in preventing every kind of accident and occupational disease. Methods: The aim of this research is to test a new method for understanding the relation between risk perception among farmers and the main risk factors to which they are exposed. A secondary aim is to investigate the influence of training in risk perception in agriculture.
#3781 - Heikkonen 2003	Heikkonen, J.; Louhevaara, V.	Empowerment in farmers' occupational health services	Examining the effects and feasibility of empowered farmers' teams on walk-through surveys of Finnish dairy farms. FOHS personnel of the health centre in three municipalities selected three farmer teams for the intervention group. Each team consisted of three or four couples. The selected comparison group resembled the intervention group. The number of the farms was 31 in the intervention group and 33 in the comparison group. Before and after the intervention each subject responded to questionnaires.
#8167 - Hagel 2013	Hagel, Louise; Pahwa, Punam; Dosman, James A.; Pickett, William	Economic worry and the presence of safety hazards on farms	The effects of these economic conditions on the physical safety of farm work environments remain poorly understood. We studied these possible etiological relationships in a cross-sectional analysis. A baseline survey of 2390 Saskatchewan farm operations was conducted in 2007. A single respondent from each farm provided information about the farm operation, its residents, perceptions of worry surrounding farm economic conditions, and the presence of six types of physical hazards.

#8198 - Moradhaseli 2020	Moradhaseli, Somayeh; Farhadian, Homayoun; Colosio, Claudio; Abbasi, Enayat; Ghofranipour, Fazlollah	Development of Psychometric Properties of Farmers' Occupational Health Behavior Questionnaire for Iranian Farmers	The present work aims to develop psychometric properties of farmers' occupational health behaviour questionnaire for Iranian farmers
#798 - Higgins 2002	Higgins, Doloris N.; Tierney, Jeanette; Hanrahan, Lawrence	Preventing young worker fatalities. The Fatality Assessment and Control Evaluation (FACE) Program	This article describes the Fatality Assessment and Control Evaluation (FACE) program and summarises in-depth data collected on 59 young worker fatalities in 26 states. These investigations were conducted between May 1986 and February 2002. Young workers ranged in age from 9 to 17 years, with a mean age of 15.3 years: 21 were working in the agriculture, forestry, and fishing industry; 12 in construction; 10 in manufacturing; 8 in services; and 8 in the retail industry. The majority worked as laborers.
#1023 - VelaAcosta 2005	Vela Acosta, Martha Soledad; Chapman, Phillip; Bigelow, Philip L.; Kennedy, Catherine; Buchan, Roy M.	Measuring success in a pesticide risk reduction program among migrant farmworkers in Colorado	The High Plains Intermountain Center for Agricultural Health and Safety bilingual pesticide risk reduction program, which complied with the Worker Protection Standard for migrant farmworkers was evaluated.; Methods: A pre-test/post-test comparison of farmworkers (n = 152) assigned to either the experimental or control group was used.

#1319 - Gebrehiwot 2015	Gebrehiwot, Tagel; van der Veen, Anne	Farmers prone to drought risk: why some farmers undertake farm-level risk-reduction measures while others not?	This research investigates farmers' cognitive perceptions of risk and the behavioural intentions to undertake farm-level risk-reduction measures. It has been observed that people who are susceptible to natural hazards often fail to act, or do very little, to protect their assets or lives. To answer the question of why some people show adaptive behaviour while others do not, a socio-psychological model of precautionary adaptation based on protection motivation theory and trans-theoretical stage model has been applied for the first time to areas of drought risk in the developing countries cultural context.
#4718 - Randall 2020	Randall, J. R.; Oliveira, L. P. de; Belton, K.; Voaklander, D.	Agriculture-related injuries: discussion in Canadian media	This study examined news media reporting on farm injuries in Canada for the occurrence of prevention messages and factors related to whether an event was reported in more than one article. Methods: This study used a media database maintained by the Canadian Agricultural Safety Association (CASA), which stores publicly available news media reports of agricultural injuries and fatalities in Canada. Media reports were obtained for the years 2010 through 2017.
#2933 - Rasmussen 2003	Rasmussen, K.; Carstensen, O.; Lauritsen, J. M.; Glasscock, D. J.; Hansen, O. N.; Jensen, U. F.	Prevention of farm injuries in Denmark	This study examined the effects of a 4-year randomized intervention programme that combined a safety audit with safety behaviour training in the prevention of farm injuries.
#385 - Bennett 2003	Bennett, Simon A.; Shaw, Andrew P.	Incidents and accidents on the ramp: Does 'risk communication' provide a solution?	Fifty ramp workers were interviewed at three UK airports. Many admitted to not following procedures. A number of reasons were given - including a perception that workplace rules and procedures failed to take adequate account of the 'lived experience' of ramp-working.

#138	Kidd, Pamela; Reed, Deborah; Weaver, Lori; Westneat, Susan; Rayens, Mary Kay	The transtheoretical model of change in adolescents: Implications for injury prevention	The stages of change consist of pre-contemplation, contemplation, preparation, action, maintenance, and termination. Change is not viewed as an “all or none phenomenon.” Method: Use of the TMC was examined using a quasi-experimental, cross-over design involving high school agriculture students enrolled in 21 schools in Kentucky (n=9), Iowa (n=7), and Mississippi (n=5). A series of physical and narrative simulations (safety training exercises) were developed with a focus on preventing amputation, spinal cord injury, hypersensitivity pneumonitis, and noise-induced hearing loss. Contemplation and action, as part of the TMC, were measured using a 10-item, Likert-type, stages of change (SOC) instrument comprised of two subscales (reliability coefficients were .88 and .81, respectively).
#4258 - Fiske 2013	Fiske, T.; Earle-Richardson, G.	Farm safety research to practice: the long road from the laboratory to the farm	The purpose of this commentary is to discuss the major factors standing in the way of bringing proven agricultural safety innovations into commercial production, and to outline a range of possible solutions to these structural challenges.
#3299 - Janssen 2017	Janssen, B.; Nonnenmann, M. W.	New institutional theory and a culture of safety in agriculture	Health and safety professionals often call for an improved safety culture in agriculture. Such a shift would result in agricultural practices that prioritize safe work habits and see safety as both an effective means to improve production and a goal worth pursuing in its own right.
#3821 - Forst 2004	Forst, L.; Lacey, S.; Chen, H. Y.; Jimenez, R.; Bauer, S.; Skinner, S.; Alvarado, R.; Nickels, L.; Zanoni, J.; Petrea, R.; Conroy, L.	Effectiveness of community health workers for promoting use of safety eyewear by Latino farm workers	In 2001, 786 workers on 34 farms were divided into three intervention blocks: (A) CHWs provided protective eyewear and training to farm workers; (B) CHWs provided eyewear but no training to farm workers; (C) eyewear was distributed to farm workers with no CHW present and no training.

#7160 - Perla 2015	Perla, M. E.; Iman, E.; Campos, L.; Perkins, A.; Liebman, A. K.; Miller, M. E.; Beaudet, N. J.; Karr, C. J.	Agricultural occupational health and safety perspectives among Latino-American youth	Through a university-community partnership, the authors surveyed young primarily acculturated Latino-American farmworkers 14 to 18 years of age regarding their agricultural work experience. Topics included occupational health and safety education, work history, and information sources.
#322 - PalomaresVelosa 2020	Palomares Velosa, Jairo Enrique	Social ecological determinants of occupational zoonotic disease exposure on Colorado dairy farms	People who work or live on a farm, farm visitors, service providers, and veterinarians are the most at risks of zoonotic infections. Dairy cattle operations represent a working environment with a high risk of exposure to zoonotic pathogens. The prevention of zoonotic diseases in animal-human interfaces can be challenging. Due to the complexity of the social ecological system, and it requires comprehensive, integrative, and culturally compelling interventions.
#3605 - Landsittel 2001	Landsittel, D. P.; Murphy, D. J.; Kiernan, N. E.; Hard, D. L.; Kassab, C.	Evaluation of the effectiveness of educational interventions in the Pennsylvania Central Region Farm Safety Pilot Project	This study prospectively evaluates the effectiveness of three specific educational safety interventions in reducing farm hazards. Methods: Farm characteristics and hazard conditions at 216 farms in Pennsylvania, USA were assessed through a questionnaire and objective audit, respectively, at both pre- and post-intervention time points.
#5349 - Heaney 2006	Heaney, C. A.; Wilkins, J. R., III; Dellinger, W.; McGonigle, H.; Elliott, M.; Bean, T. L.; Jepsen, S. D.	Protecting young workers in agriculture: participation in tractor certification training	The major objectives of this study were to (1) provide a rigorous estimate of the number of youth operating tractors in Ohio and (2) assess the extent to which these youth are participating in federally mandated tractor safety training. A self-administered questionnaire was completed by approximately 4,000 students ages 14 or 15 years who were enrolled in a stratified cluster sample of 99 Ohio schools.

#334 - Stave 2008	Stave, Christina; Pousette, Anders; Törner, Marianne	Risk and safety communication in small enterprises--How to support a lasting change towards work safety priority	The aims of the present study were to evaluate long-term effects of the intervention and to assess these results in relation to a randomly selected comparison group. The intervention was based on regular group discussions, focusing on dialogue and reflection in networks for social support.
#4328 - Voaklander 2019	Voaklander, D. C.; Norman, P.; Dosman, J. A.; Day, A.; Brison, R. J.; Koehncke, N.; Pickett, W.; Markowitz, S.; Ehrlich, R.	Determinants of injury among older Saskatchewan farm operators: a prospective cohort study	Often farm owner-operators work beyond what society would expect to be a normal retirement age. Older farmers may be less receptive to behavioural changes designed to improve worksite safety and are at increased risk for experiencing a work-related injury. We had a unique opportunity to evaluate the relative influence of specific occupational conditions and practices reported by older farm operators (age ≥55 years) on the occurrence of injury using a longitudinal approach.
#1438 - Kawakami 2008	Kawakami, Tsuyoshi; Van, Vhu Nhu; Theu, Nguyen Van; Khai, Ton That; Kogi, Kazutaka	Participatory support to farmers in improving safety and health at work: building WIND farmer volunteer networks in Viet Nam	The Ministry of Labour, Invalids and Social Affairs (MOLISA) of Viet Nam trained WIND (Work Improvement in Neighbourhood Development) farmer volunteers. From 2004-2007, MOLISA in cooperation with ministries of health and agriculture trained 480 WIND farmer volunteers in selected 14 provinces. Trained farmer volunteers trained their neighbouring farmers and expanded their networks.
#3194 - Snipes 2017	Snipes, S. A.; Cooper, S. P.; Shipp, E. M.	"The only thing I wish I could change is that they treat us like people and not like animals": injury and discrimination among Latino farmworkers	This article describes how perceived discrimination shapes the way Latino farmworkers encounter injuries and seek out treatment.

#721 - Weichelt 2019	Weichelt, Bryan; Heimonen, Tomi; Gorucu, Serap; Redmond, Emily; Vechinski, Josef; Pflughoeft, Kurt; Bendixsen, Casper; Salzwedel, Marsha; Scott, Erika; Namkoong, Kang; Purschwitz, Mark; Rautiainen, Risto; Murphy, Dennis J.	Redesigning a Sentinel Surveillance System for Collecting and Disseminating Near Real-Time Agricultural Injury Reports: System Usability Study	The study aimed to develop a stakeholder-engaged redesign of the interactive, up-to-date, and publicly available dataset of US AFF injury and fatality reports. Injury data and reports provide valuable information for both public and private organisations to guide programming, policy, and prevention, but in the increasingly complex and dangerous industry of US agriculture, the injury surveillance needed to produce this data is lacking.
#4276 - Rezaei 2019	Rezaei, R.; Jamshidi, N.	Factors affecting the wheat farmers' safety behavior in the central district of the Zanjan Township	To investigate factors affecting the wheat farmers' safety behaviour. The statistical population of the research consisted of wheat farmers in the central district of the Zanjan Township (N=5705).
#1494 - Karttunen 2016	Karttunen, Janne P.; Rautiainen, Risto H.; Lunner-Kolstrup, Christina	Occupational Health and Safety of Finnish Dairy Farmers Using Automatic Milking Systems	The aim of this study was to investigate the occupational health and safety risks in using AMS, compared to conventional milking systems (CMS).; Methods: An anonymous online survey was sent to each Finnish dairy farm with an AMS in 2014. Only those dairy farmers with prior work experience in CMS were included in the final analysis consisting of frequency distributions and descriptive statistics.

#2422 - Blackman 2015	Blackman, A.; Franklin, R. C.; Rossetto, A.; Gray, D. E.	Transforming farm health and safety: the case for business coaching	In the U.S. and Australia, agriculture is consistently ranked as one of the most hazardous industries. The cost of injuries and deaths on Australian farms is significant, estimated to be between AU$0.5 billion and AU$1.2 billion per year. Death and injury in agriculture also place a significant financial and social burden on the family and friends of the injured, the community, and the health system.
#6689 - Guenic 2008	Guenic, M. le; Trou, G.; Jouanne, D.; Jegou, V.; Sansen, Q.; Kergourlay, P.	Hazard control in dairy farms: experience of 15 farmers in Brittany: the "Dairy farmer Pilot group for Quality"	The Dairy farmer Pilot group for Quality is managed by the GIE milk-meat of Brittany, with the support of Brittany Farmers Associations. The project aims at developing global quality in dairy farms that comply with quality and traceability requirements while respecting technical and economic constraints and ensuring good quality of life. A global survey incorporating health monitoring, animal welfare, product quality and safety, environment, economic aspect and work was conducted in 15 dairy farms across Brittany.
#4473 - Cole 2002	Cole, H. P.	Cognitive-behavioural approaches to farm community safety education: a conceptual analysis	While most farmers understand the safety instruction messages they receive, they frequently continue to engage in risky behaviours. They do so even when they are aware of the injury consequences that can result from engaging in risky behaviours during farm work. Consequently, educational programmes for the delivery, of farm health and safety knowledge have been judged to be of questionable effectiveness. However, current political, social, and economic realities suggest that safety and health education will remain a favoured methodology for the foreseeable future.
#1642 - AlwallSvennefelt 2018	Alwall Svennefelt, Catharina; Hunter, Erik; Lundqvist, Peter	Evaluating The Swedish Approach to Motivating Improved Work Safety Conditions on Farms: Insights from Fear Appeals and the Extended Parallel Processing Model	Farm work safety intervention programs based on educating and informing have been criticized for not demonstrably improving work safety. We argue that these criticisms are misplaced and that the problem with educating and informing lies not necessarily in the tool, but rather in its implementation.

#2805 - Lower 2017	Lower, T.; Rolfe, M.; Monaghan, N.	Trends and patterns in unintentional injury fatalities in Australian agriculture	Data from the National Coronial Information System were analysed to assess all unintentional farm fatalities for the 2001-2015 period. A secondary comparison with earlier coronial system data from 1989-1992 was also completed to ascertain historical changes. There was no statistically significant change in the rate of work-related fatalities per 100,000 workers in the 2001-2015 period.
#2750 - Lee 2017	Lee, B. C.; Bendixsen, C.; Liebman, A. K.; Gallagher, S. S.	Using the Socio-Ecological Model to frame agricultural safety and health interventions	The Socio-Ecological Model (SEM) is a conceptual framework depicting spheres of influence over human behaviour that has been applied in public health settings for nearly five decades. Core principles of all variations of the SEM are the multiple influences over an individual's behaviours, the interactions of those influences, and the multilevel approaches that can be applied to interventions intended to modify behaviours.
#6396 - Cigularov 2009	Cigularov, K. P.; Chen, P. Y.; Stallones, L.	Error communication in young farm workers: its relationship to safety climate and safety locus of control	The current study focused on error communication by young farm workers in the light of increasing concerns about young workers' safety and the need to investigate its determinants. Specifically, we examined the effects of safety locus of control and safety climate on young workers' communications about their errors in farm work.
#2446 - Elkind 2002	Elkind, P. D.; Pitts, K.; Ybarra, S. L.	Theatre as a mechanism for increasing farm health and safety knowledge	Theatre was chosen as a method to provide health education and farm safety training to farm workers and their families living in a three county region of Eastern Washington. Methods: The most urgent health and safety education needs of Hispanic farm workers were identified by a series of focus groups and key informant interviews. The resulting data was used to develop four Spanish one-act plays, which were presented in each of the three counties. To test the effectiveness of theatre as an educational tool each of the plays was accompanied by pre- and post-play self-report questionnaires.

#4265 - Neufeld 2004	Neufeld, S. J.; Cinnamon, J. L.	Farm parents' attitudes towards farm safety experts	This article analyses farm parents' attitudes towards the trustworthiness, usefulness, and use of advice from farm safety experts. Qualitative data were obtained through interviews conducted in May-November 2001 with 69 farm parents from the three agricultural regions around Spokane, Washington; Dubuque, Iowa; and Bowling Green, Kentucky. Quantitative data were obtained through a national telephone survey of 411 farm parents with any children under 18 years of age living at home.
#3611 - Kurui 2014	Kurui, N. J.; Gatebe, E.; Mburu, C.	Evaluation of pesticide safety measures adopted by potato farmers in Chebiemit division, Elgeyo/Marakwet county, Kenya	The objective of the study was to evaluate the pesticide safety measures adopted by potato farmers in Chebiemit Division of Elgeyo/Marakwet County. Data was collected through stratified simple sampling where 323 potato farmers were administered with structured questionnaires. The data was analysed using SPSS software. The study found out that 96% of the farmers were aware of pesticide safety labels and the level of awareness was influenced positively by education ($\chi 2=4.08$, $p<0.05$, $df=2$) and training ($\chi 2=3.05$, $p<0.05$, $df=1$). The study established that 64.7% of the farmers had cultivated the crop for more than ten years and had been using pesticides for the entire period at least thrice in every cropping cycle.
#4239 - Wang 2020	Wang, ChangWei; Jiang, PanMei	Farmers' willingness to participate in agricultural product safety co-governance and self-governance in Jiangsu, China: a gender perspective	The purpose of this study was to understand factors that influence farmers' willingness to participate in agricultural product safety co-governance and self-governance based on a survey of farmers in Jiangsu Province, China. The results show that farmers' willingness to participate in the co-governance and self-governance of agricultural product safety must be further improved. Among the sampled farmers, 28.93% consider that other farmers' improper agricultural product safety practices have nothing to do with them, and 17.25% claim that they would not want to take part in agricultural product safety trainings.

#7354 - Becklinger 2021	Becklinger, Nicole	Design and test of an online self-report system for agricultural injuries and near-misses	An online self-report system for agricultural injuries and near-misses was created to address limitations of current agricultural injury surveillance. The self-report system was developed and then followed by three rounds of interviews with agricultural workers and agricultural safety and health professionals which guided revisions to the self-report survey and website.
#7635 - Moradhaseli 2020	Moradhaseli, Somayeh; Ataei, Pouria; Van den Broucke, Stephan; Karimi, Hamid	The Process Of Farmers' Occupational Health Behavior by Health Belief Model: Evidence From Iran	While educational programs have been set up to encourage farmers to behave more safely, many of these programs do not sufficiently take into account the factors that induce farmers to exhibit risky behaviour. The present study aimed to explore the factors underpinning farmers' occupational health behaviour using the Health Belief Model (HBM).
#1031 - Tinc 2019	Tinc, Pamela J.; Sorensen, Julie A.	Marketing Farm Safety: Using Principles of Influence to Increase PTO Shielding	Power take-off entanglements are one example of agricultural events that can lead to death or permanent disability. This manuscript considers the use of marketing techniques to reduce agricultural injuries. Specifically, the "principles of influence" (liking, social proof, authority, consistency, reciprocity, and scarcity) are explored as methods of promoting power take-off shielding among New York farmers.;
#6146 - Yazdanpanah 2016	Yazdanpanah, M.; Tavakoli, K.; Marzban, A.	Investigating factors influence framers' intention regarding safe use of pesticides through health belief model	Increased mortality and morbidity of humans due to unsafe use of these chemicals are the most prevalent and serious occupational hazards faced by farmers and agricultural workers in developing countries. As such, the aim of this article to investigate farmers' intention regarding safe use of pesticides.
#4478 - Vladimirovich 2019	Vladimirovich, S. R.; Vasilievich, F. I.; Stepanovich, S. V.; Vasilievich, K. V.; Gumerovich, E. V.; Vasilievna, S. A.	Characteristic of industrial injuries in modern agro-industrial complex and effective ways of its reduction and elimination	The article describes the characteristics of industrial injuries in modern agribusiness and effective ways of its dynamic reduction and elimination. An objective assessment of the situation in connection with the development of the industry and the presence of injuries and occupational diseases in it is given.

#5193 - Wadud 1998	Wadud, S. E.; Kreuter, M. W.; Clarkson, S.	Risk perception, beliefs about prevention, and preventive behaviours of farmers	In this study, 300 farmers in central Missouri were surveyed to identify beliefs and practices regarding the prevention of respiratory diseases, noise induced hearing loss, and skin cancer. For each problem, farmers who expressed concern about the problem and who also believed it was preventable were more likely to report taking preventive measures than were those who did not believe the disease was preventable, those who were not concerned about it, or both.
#1253 - Stout 2001	Stout, N.; Linn, H.	From strategy to reality: 25 years of planning and progress in occupational injury research	Building the scientific foundation necessary to guide prevention.
#1323 - Kline 2007	Kline, Aaron; Leedom-Larson, Kerry; Donham, Kelley J.; Rautiainen, Risto; Schneiders, Sara	Farmer assessment of the certified safe farm program	This article summarises the qualitative findings from a study evaluating a novel agricultural health and safety program called Certified Safe Farm (CSF). Results are presented from focus groups held in 2002 and 2006 as well as mail-out surveys conducted in 2001 and 2002. Focus group participants and survey responders were farmers involved in CSF intervention studies.
#5911 - Castro 2013	Castro, C. L.; Hunting, K.	Measuring hazardous work and identifying risk factors for non-fatal injuries among children working in Philippine agriculture	We aimed to measure the degree to which Philippine children working in agriculture have a higher risk of injury compared with children working in other industries, and to uncover potential risk factors for their non-fatal injuries. Methods: Using the Philippine Survey of Children (SOC) 2001, we calculated injury incidence rates and relative risk measures across industries, and employed a multivariate logistic regression on the sample of working children in agriculture to ascertain the association of various exposures with the occurrence of work-related injuries.

#6334 - Rudolphi 2021	Rudolphi, J. M.; Barnes, K. L.; Kieke, B.; Koshalek, K.; Bendixsen, C.	Exploring farm parenting styles and child agricultural injury	Parenting styles have been associated with a myriad of child safety and health outcomes. However, the association between parenting style and child agricultural injury has not been explored. This study was conducted among farm parents in Wisconsin and Pennsylvania using a self-administered paper questionnaire. Parents responded to items inquiring about parenting styles, previous child agricultural injuries, personal demographics, and farm characteristics.
#6510 - Mosher 2014	Mosher, G. A.; Keren, N.; Freeman, S. A.; Hurburgh, C. R., Jr.	Development of a safety decision-making scenario to measure worker safety in agriculture	Employee decision-making patterns represent an essential component of the safety system within a work environment. This research describes the process used to create a safety decision-making scenario to measure the process that grain-handling employees used to make choices in a safety-related work task. A sample of 160 employees completed safety decision-making simulations based on a hypothetical but realistic scenario in a grain-handling environment.
#6518 - Reinhart 1996	Reinhart, D. D.; Bean, T. L.; McCaslin, N. L.	Developing an instrument to assess attitudes of agricultural employers and employees toward farm safety	Instruments for assessing attitudes toward farm safety were developed for both farm employers and farm employees. Four subscales were identified for use in the assessment: General Farm Safety; Personal Protective Equipment; Shielding and Guarding of Tractors and Machinery; and the Farm Shop.
#6558 - Silletto 1977	Silletto, T. A.	Implications for agricultural safety education programs as identified by Iowa farm accident survey	The survey included 3,161 farms: one accident was reported per 5.66 farms during the year; the average accident cost 9.68 days lost from normal activities.

#1180 - Firmi 2012	Firmi, A. M.; Bottazzi, R.; Dolara, D.; Longo, S.; Boldori, L.; Bertoletti, M.; Boglioli, V.; Cauzzi, D.; Mastroiorio, S.; Pizzacani, R.; Valcarenghi, M.; Cirla, P. E.	Integrated approach to the promotion of health and safety in agriculture: a pilot study in the Cremona area	In this experience an innovative platform for information and training, in which the agricultural trade unions are privileged partner of public institutions in the road map for continuous improvement, has been tested. In a first phase, the availability of expert technicians to check the consistency of the application of safety standards has been offered by the trade associations free of charge to 100 farms.
#1024 - Colémont 2008	Colémont, A.; Van den Broucke, S.	Measuring determinants of occupational health related behavior in Flemish farmers: an application of the Theory of Planned Behavior	This paper describes the development and validation of a self-report questionnaire, which measures the determinants of occupational health-related behaviours in farmers.
#4225 - Basinas 2016	Basinas, I.; Sigsgaard, T.; Bønløkke, J. H.; Andersen, N. T.; Omland, Ø; Kromhout, H.; Schlünssen, V.	Feedback on measured dust concentrations reduces exposure levels among farmers	The number of intervention studies exploring the effectiveness of exposure reduction strategies through the use of objective measurements has been limited. Objective: To examine whether dust exposure can be reduced by providing feedback to the farmers concerning measurements of the exposure to dust in their farm. Methods: The personal dust levels of farmers in 54 pig and 26 dairy cattle farms were evaluated in two measurement series performed approximately 6 months apart.

#2238 - Rautiainen 2005	Rautiainen, Risto H.; Ledolter, Johannes; Sprince, Nancy L.; Donham, Kelley J.; Burmeister, Leon F.; Ohsfeldt, Robert; Reynolds, Stephen J.; Phillips, Kirk; Zwerling, Craig	Effects of premium discount on workers' compensation claims in agriculture in Finland	The objective of this study was to measure changes in injury claim rates after a premium discount program was implemented in the Finnish farmers' workers' compensation insurance. We focused on measures that could indicate whether the changes occurred in the true underlying injury rate, or only in claims reporting.
#8328 - Perry 2000	Perry, M. J.; Marbella, A.; Layde, P. M.	Association of pesticide safety knowledge with beliefs and intentions among farm pesticide applicators	This study measured knowledge levels concerning pesticide safety and precautionary handling among applicators and examined relationships between knowledge scores and intentions to use handling precautions, perceptions of pesticide safety peer norms, and perceived self-efficacy to prevent personal exposure.
#7298 - Rundmo 2000	Rundmo, T.	Safety climate, attitudes and risk perception in Norsk Hydro	The aims of this paper are to test mental images of risk and to present some results of a survey of safety climate, employee attitudes, risk perception and behaviour among employees within the industrial company Norsk Hydro.
#2206 - Fragar 1996	Fragar, L.	Agricultural health and safety in Australia	Prevention of farm injury has been constrained by: (i) lack of relevant information regarding injury causation; (ii) lack of appropriate education and training in occupational health and safety; (iii) limited applicability of previous occupational health and safety legislation; and (iv) lack of the necessary management tools for farmers to manage risk
#8218 - Seo 2004	Seo, Dong-Chul; Torabi, Mohammad R.; Blair, Earl H.; Ellis, Nancy T.	A cross-validation of safety climate scale using confirmatory factor analytic approach	Given the lack of a consistent factor structure of safety climate, this study tested the stability of a factor structure of a safety climate scale developed through an extensive literature review using confirmatory factor analytic approach and cross-validation.; Methods: A cross-sectional sample of 722 U.S. grain industry workers participated in the questionnaire survey.;

#7660 - Fargnoli 2020	Fargnoli, Mario; Lombardi, Mara	NOSACQ-50 for Safety Climate Assessment in Agricultural Activities: A Case Study in Central Italy	However, safety climate assessment in agricultural activities is addressed scarcely, even though agriculture represents a very hazardous sector. To reduce this gap, the present study proposes an investigation of safety climate among farmers by means of the Nordic Safety Climate Questionnaire (NOSACQ-50).
#2093 - Day 2004	Day, Lesley; Rechnitzer, George; Lough, Jonathan	An Australian experience with tractor rollover protective structure rebate programs: process, impact and outcome evaluation	The purpose of this study was to assess the effectiveness of the tractor rollover protective structure rebate program carried out by the Victorian Workcover Authority (Vic., Australia) in 1997-1998.
#2380 - Chapman 2011	Chapman, Larry J.; Brunette, Christopher M.; Karsh, Ben-Tzion; Taveira, Alvaro D.; Josefsson, K. Gunnar	A 4-year intervention to increase adoption of safer dairy farming work practices	The intervention disseminated information to 4,300 Northeast Wisconsin dairy farm managers about three safer and more profitable production practices (barn lights, silage bags, and calf feed mixing sites) using information channels that these managers were known to rely on.
#1418 - Elkind 2007	Elkind, Pamela Dee	Perceptions of risk, stressors, and locus of control influence intentions to practice safety behaviors in agriculture	This article argues that a combination of factors including risk perceptions, locus of control, and chronic stress influences farmers' intentions to behave safely.
#7077 - Tinc 2018	Tinc, P. J.; Gadomski, A.; Sorensen, J. A.; Weinehall, L.; Jenkins, P.; Lindvall, K.	Applying the Consolidated Framework for Implementation Research to agricultural safety and health: Barriers, facilitators, and evaluation opportunities	In the current study, the Consolidated Framework for Implementation Research is adapted so that it may be used to evaluate and improve the scaling up of this intervention (ROPS Rebate Program).

#5720 - Rommel 2016	Rommel, A.; Varnaccia, G.; Lahmann, N.; Kottner, J.; Kroll, L. E.	Occupational injuries in Germany: population-wide national survey data emphasize the importance of work-related factors	To better understand the occurrence of occupational injuries, sociodemographic factors and work- and health-related factors are tested simultaneously. Thus, the present analysis aims to develop a comprehensive epidemiological model that facilitates the explanation of varying injury rates in the workplace.
#7866 - McNamara 2020	McNamara, John; Kinsella, Anne; Osborne, Aoife; Blake, Catherine; Meredith, David; Kinsella, James	Identifying Farmer Workplace Injury Risk Factors in Ireland Using Farm Accounts Data	Assessing workplace injury risk factors associated with farming is challenged by non-collection, non-reporting, or under-reporting by farmers, particularly those operating family farms in a self-employed manner. A supplementary (or add-on) farm operator (FO) workplace injury survey was undertaken in association with the Irish National Farm Survey (NFS), which is responsible for provision of Irish farm-level data to the European Commission (EC) Farm Accountancy Data Network (FADN).
#5733 - Pollock 2014	Pollock, K. S.; Fragar, L. J.; Griffith, G. R.	Occupational health and safety on Australian farms: 1. Farmers' perceptions of major hazards	NSW n=335 The data collected from participating enterprises clearly demonstrate that there is a disconnect between what farmers perceive as the risks on their farm and what hazards and risks cause the highest rates of fatalities in Australian agriculture.
#7144 - Pawlak 2015	Pawlak, H.; Nowakowicz-Dębek, B.; Huyghebaert, B.; Lorencowicz, E.; Uziak, J.	Agriculture: accident-prone working environment	The article presents the analysis of agriculture as working environmentally prone to accidents
#6897 - Dukeshire 2015	Dukeshire, S. R.; Sanderson, L. L.; Garbes, R.; Wang, X.	Boy or girl: does gender matter when learning to farm safely?	Examining similarities and differences between males' and females' beliefs, attitudes, and adoption of farm health and safety practices. The survey and interview asked participants to recall their experiences growing up on a farm and in particular how they learned to farm safely.

#7948 - Thurston 2005	Thurston, Wilfreda E.; Blundell-Gosselin, Heather Jo	The farm as a setting for health promotion: results of a needs assessment in South Central Alberta	This paper explores the farm as a setting where health promotion and prevention programs can be implemented. We present data from an occupational health and safety needs assessment of 347 farms in the South Central region of the province of Alberta, Canada. The data are used to describe farmers' familiarity with farm living, thoughts on farm safety, the numbers of people working and types of work performed, other work, income, and the availability of resources.
#7946 - Thu 1990	Thu, K.; Donham, K. J.; Yoder, D.; Ogilvie, L.	The farm family perception of occupational health: a multistate survey of knowledge, attitudes, behaviors, and ideas	The survey was conducted in Iowa, New York, South Carolina, and Washington state.
#5079 - Du 2020	Du, ZhiXiong; Lai, XiaoDong; Long, WenJin; Gao, LiangLiang	The short- and long-term impacts of the COVID-19 pandemic on family farms in China - evidence from a survey of 2 324 farms	COVID-19 pandemic provides an opportunity to explore how family farms respond to risks.
#4147 - Andersson 2014	Andersson, E.; Lundqvist, P.	Gendered agricultural space and safety: towards embodied, situated knowledge	The spatial division between on-farm, off-farm, and domestic work is one contributing factor to the situation. The different situations and contexts of agriculture increase the need for knowledge regarding the processes and positions of farming.
#5790 - Hounsome 2006	Hounsome, B.; Edwards, R. T.; Edwards-Jones, G.	A note on the effect of farmer mental health on adoption: the case of agri-environment schemes	The aim of this paper is to explore the possibility that the previously ignored issue of farmer health is an important variable in the adoption process.
#7951 - Cummings 1991	Cummings, P. H.	Farm accidents and injuries among farm families and workers. A pilot study	Two purposes of this descriptive study were to examine, over a 1 year period, the demographic features and types, severity, and mechanisms of injury among farm families and their workers in a representative county in South Carolina, and to develop a two part mail-out questionnaire for data collection relative to farm work related accidents.

#7644 - Witte 1992	Witte, K.; Peterson, T. R.; Vallabhan, S.; Stephenson, M. T.; Plugge, C. D.; Givens, V. K.; Todd, J. D.; Becktold, M. G.; Hyde, M. K.; Jarrett, R.	Preventing tractor-related injuries and deaths in rural populations: using a persuasive health message framework in formative evaluation research	Two key issues impede the effectiveness of farm safety interventions. First, little is known about what farmers think about farm equipment accidents and safety procedures. Second, current safety interventions are typically atheoretical and focus on information exchange, instead of persuasion.
#4850 - Myers 2005	Myers, M. L.	Addressing risks and benefits - emerging technologies assessed for safety and health of farming people	This paper addresses the potential attributes and impact of emerging technologies - science-based innovations that have the potential to create new industry or transform an existing one - on the safety and health of farming people.
#4854 - Storm 2016	Storm, J. F.; LePrevost, C. E.; Tutor-Marcom, R.; Cope, W. G.	Adapting Certified Safe Farm to North Carolina agriculture: an implementation study	From 2009 to 2012, 113 farms participated in at least one component of the CSF intervention, representing a NC farm participation rate of 3.1% in the study area. A major adaptation of NC implementation was the utilization of NC Cooperative Extension as the local driver of implementation in contrast to local AgriSafe clinics in Iowa.
#6834 - Jaspersen 1999	Jaspersen, J.; List, P.; Howard, L.; Morgan, D.; Essen, S. von	The certified safe farm project in Nebraska: the first year	Additional incentives may be needed to reduce fatal and non-fatal events to an acceptable level. The Certified Safe Farm concept was developed in collaboration with two Nebraska health insurance companies. The program consists of combining on-farm safety assessment and occupational health screening with an education program. The incentive to complete this program is to be eligible for a reduction in health insurance premiums, which are a large expense for farmers.
#6573 - Marlenga 2010	Marlenga, B.; Pahwa, P.; Hagel, L.; Dosman, J.; Pickett, W.	Impact of long farm working hours on child safety practices in agricultural settings	To characterize working hours of adult farm owner-operators and their spouses by season, and to examine associations between working hours and farm safety practices affecting children.

#1320 - Gerrard 1998	Gerrard, C. E.	Farmers' occupational health: cause for concern, cause for action	This study examines occupational health and safety provision from farmers' perspectives, to address the question 'Are farmers' health and safety needs being met?'
#5224 - Sprince 2003	Sprince, N. L.; Zwerling, C.; Lynch, C. F.; Whitten, P. S.; Thu, K.; Logsden-Sackett, N.; Burmeister, L. F.; Sandler, D. P.; Alavanja, M. C. R.	Risk factors for agricultural injury: a case-control analysis of Iowa farmers in the Agricultural Health Study	Assess risk factors: A questionnaire sent to 6 999 farmers identified 431 cases who had a farm work-related injury requiring medical advice/treatment in the previous year and 473 controls who had no injury in the previous year.
#4951 - Chapel 2015	Chapel, D. B.; Sorensen, J. A.; Tinc, P. J.; Fiske, T.; Wyckoff, S.; Mellors, P. W.; Jenkins, P.	Validation of self-reported power take-off shielding using on-site farm audits	Sampling from the New York data of the USDA National Agricultural Statistical Service (NASS), at least 200 each of dairy, livestock, crop, fruit, and vegetable farms were surveyed by phone to determine the extent of proper PTO shielding. In the same year, on-site audits were performed at 211 randomly selected New York livestock and dairy farms using a four-point scale to assess PTO shielding. Supplemental data were gathered on farm acreage, number of livestock, principal commodity, and operator experience.
#1192 - Vigoroso 2021	Vigoroso, Lucia; Caffaro, Federica; Micheletti Cremasco, Margherita; Cavallo, Eugenio	Innovating Occupational Safety Training: A Scoping Review on Digital Games and Possible Applications in Agriculture	A literature review was carried out to understand how occupational risks are addressed during game-based safety training in different productive sectors and how this can be transferred to agriculture.

#1196 - Higgins 2011	Higgins, Sheila; Barros, Tanya; Garrison, Herbert G.	Injury and death on the farm: improving prevention through improved surveillance	Work-related injury data suggest that agricultural workers in North Carolina are experiencing high rates of injury and death compared with workers in other occupations. However, current occupational injury data sources are insufficient to calculate accurate injury and mortality rates.
#2325 - Leppälä 2015	Leppälä, Jarkko; Kolstrup, Christina Lunner; Pinzke, Stefan; Rautiainen, Risto; Saastamoinen, Markku; Särkijärvi, Susanna	Development of a Safety Management Web Tool for Horse Stables	Existing industrial or farm production risk management tools are not directly applicable to horse stables and they need to be adapted for use by managers of different types of stables. As a part of the InnoEquine project, an innovative web tool, InnoHorse, was developed to support horse stable managers in business, safety, pasture and manure management.
#617 - Driscoll 2020	Driscoll, Maryellen; Dalton, Deborah; Jenkins, Paul; Tinc, Pamela; Murphy, Dennis; Douphrate, David I.; Lundqvist, Peter; Pate, Michael; Lindahl, Cecilia; Meyerhoff, Anna; Scott, Erika; Carrabba, James; Hagevoort, G. Robert; Sorensen, Julie	A Scoping Review of Safety and Health Interventions in the High-Risk Dairy Industry: Gaps in Evidence Point to Future Directions in Research	A scoping review was conducted to identify published reports of occupational safety interventions in the dairy industry. An additional criterion was that the study included an evaluation of the intervention.

#4661 - Arora 2020	Arora, K.; Cheyney, M.; Gerr, F.; Bhagianadh, D.; Gibbs, J.; Anthony, T. R.	Assessing health and safety concerns and psychological stressors among agricultural workers in the U.S. Midwest	We examined health and safety concerns and psychological stressors among Midwestern farmers. We assessed whether these reports varied by survey mode (mail survey versus in-person survey). The efficacy of two different types of incentives to enhance mail survey response rates among agricultural workers was also investigated.
#3940 - Rudolphi 2015	Rudolphi, J. M.; Donham, K. J.	Increasing the number of trained health and safety professionals in agricultural medicine: evaluation of the "Building Capacity" program, 2007-2013	Agricultural Medicine: Occupational and Environmental Health for Rural Health Professionals - the Core Course (AMCC) is now being offered to health and safety professionals in nine states in the United States, in Australia, and a modified version presented in Turkey.
#3765 - Isaacs 2008	Isaacs, S. G.; Powers, L. A.; Lineberry, G. T.; Scharf, T.	Enhancing cattle handling safety with the work crew performance model	Kentucky farmers and University of Kentucky extension agents applied the principles of the Work Crew Performance Model (WCPM), used previously in mining and construction, to identify and prioritize critical action factors (CAFs) for safe handling of cattle.
#346 - Leitão 2017	Leitão, Sara; Greiner, Birgit A.	Psychosocial, Health Promotion and Safety Culture management—Are Health and Safety Practitioners involved?	This study aims to investigate the HSPs' main tasks and their involvement in activities regarding the management of Psychosocial risk factors, Safety Culture and Health Promotion (HP) within their organisations.
#3095 - May 2006	May, J. J.; Sorensen, J. A.; Burdick, P. A.; Earle-Richardson, G. B.; Jenkins, P. L.	Rollover protection on New York tractors and farmers' readiness for change	Our objectives were: to describe the current prevalence and distribution of rollover protective structures (ROPS) on New York farm tractors, to identify characteristics associated with the absence of ROPS, to explore segmenting the New York farm community on readiness for ROPS retrofitting, and to identify demographic characteristics that might assist in this segmenting.

#829 - AlwallSvennefelt 2019	Alwall Svennefelt, Catharina Elisabeth; Hunter, Erik; Palsdottir, Anna Maria	Work safety interventions and threat complexity - A formative investigation into why farmers do not act safely	Fear appeals are a common tactic used in work safety interventions. However, fear appeals tend to be ineffective when developed without a firm grasp of the cognitive processes underlying behavioural change.
#1875 - Gadomski 2016	Gadomski, Anne M.; Vargha, Marybeth; Tallman, Nancy; Scribani, Melissa B.; Kelsey, Timothy W.	Impact of preparing for OSHA local emphasis program inspections of New York dairy farms: Case studies and financial cost analysis	A total of eight farms were randomly selected for inspection. This case study addresses how dairy farm managers prepared for these inspections, and identifies farm level costs preparing for inspection and/or being inspected.;
#2205 - Liebman 2010	Liebman, Amy K.; Augustave, Wilson	Agricultural health and safety: incorporating the worker perspective	The commentary describes two models to reduce hazards at work that illustrate how workers' perspectives can be incorporated successfully at the policy level and during the intervention development process and puts forth recommendations for employers, researchers, and funding agencies to facilitate the integration of workers' perspectives into occupational health and safety in agriculture.
#6277 - Green 1999	Green, K. L.	Farm health and safety: rural couples' beliefs and practices	This article reports on nine Saskatchewan farming couples' perceptions of farm health and safety risks, the measures they take to reduce these risks, and factors influencing their practices. Participants were part of a purposive sample, aged 30-50, and engaged in grain and/or livestock farming.
#6350 - Yıldırım 2015	Yıldırım, C.; Altuntaș, E.	Evaluation the work accidents depending on the work safety happened by using tractor and agricultural machinery in Tokat province	In this study, tractor and agricultural machinery accidents that occurred during farm and traffic operations in Tokat were analysed and the results evaluated.

#5231 - Zappavigna 2002	Zappavigna, P.; Capelli, G.; Brugnoli, A.; Assirelli, A.	The risk evaluation in agriculture. Results of an investigation by means of check list in the Apennine area of the Emilia Region	This paper presents the results of an investigation carried out using a checklist on 35 farms in the Apennines area of the Emilia region, Italy, to evaluate the risks in operating agricultural machineries and to establish a standardized method for comparing the test results from different research areas.
#4248 - Anderson 2012	Anderson, B. T.; Johnson, G. J.; Wheat, J. R.; Wofford, A. S.; Wiggins, O. S.; Downey, L. H.	Farmers' concerns: a qualitative assessment to plan rural medical education	This study seeks to identify special concerns of farmers in Alabama and explore the need for a medical education program
#8276 - Andrade-Rivas 2015	Andrade-Rivas, Federico; Rother, Hanna-Andrea	Chemical exposure reduction: Factors impacting on South African herbicide sprayers' personal protective equipment compliance and high risk work practices	This study investigated workers' personal protective equipment (PPE) compliance as a risk mitigation measure; particularly workers who apply herbicides for Working for Water (WfW) - a South African invasive alien vegetation control programme. The study aim was to understand workers' low PPE compliance by analysing their risk perceptions of herbicide use, working conditions and socio-cultural context.
#5019 - MacFarlane 2008	MacFarlane, E.; Chapman, A.; Benke, G.; Meaklim, J.; Sim, M.; McNeil, J.	Training and other predictors of personal protective equipment use in Australian grain farmers using pesticides	Objectives: To investigate patterns of use of personal protective equipment (PPE) to reduce pesticide exposure in a sample of Australian farmers and also to assess the influence of possible predictive factors.

#5239 - Kim 2016	Kim, ByoungGap; Lim, SeongYoon; Shin, SeungYeoub; Yum, SungHyun; Kim, YuYong; Yun, NamKyu; Yu, SeokCheol	Risk assessment of a tractor based on accident cases: hazard identification and frequency estimation	Based on the analysis of the surveyed accident cases, a risk assessment of hazards causing accidents, a new approach, was conducted. Hazards were identified by reviewing the accident case records and then confirmed by the results of Delphi survey, of which participants were 27 experts on agricultural machinery accidents. The type of each accident cases were also classified during the case reviews because the estimations of frequency and consequence severity were carried out separately by types. Frequencies of hazards were estimated by following process: (1) estimation of probability of each hazards in each type, (2) calculation of frequencies of each type, and (3) frequency estimations of each hazards.
#426 - Chapman 2010	Chapman, Benjamin J.	Development and evaluation of a tool to enhance positive food safety practices amongst food handlers: Food safety infosheets	As a result, the U.S. Centers for Disease Control and Prevention have called upon food safety communicators to design new methods and messages aimed at increasing food safety risk-reduction practices from farm-to-fork. Food safety info sheets, a novel communication tool designed to appeal to food handlers and compel behaviour change were created and evaluated. These interventions were designed utilizing evidence-based best communication practices including surprise, context and storytelling.
#2016 - Rautiainen 2010	Rautiainen, R. H.; Grafft, L. J.; Kline, A. K.; Madsen, M. D.; Lange, J. L.; Donham, K. J.	Certified safe farm: identifying and removing hazards on the farm	This article describes the development of the Certified Safe Farm (CSF) on-farm safety review tools, characterizes the safety improvements among participating farms during the study period, and evaluates differences in background variables between low and high scoring farms.
#492 - DeRoo 2000	DeRoo, L. A.; Rautiainen, R. H.	A systematic review of farm safety interventions	Papers had to involve a farm safety intervention to be included in the review
#4917 - Chapman 1996	Chapman, L. J.; Schuler, R. T.; Wilkinson, T. L.; Skjolaas, C. A.	Work hazard control efforts by Wisconsin dairy farmers	Agricultural work safety efforts of Wisconsin farmers were examined, along with their perceptions of the farm safety problem. A survey instrument was developed and administered to an opportunity sample of 401 dairy farmers using a standardized mail survey technique.

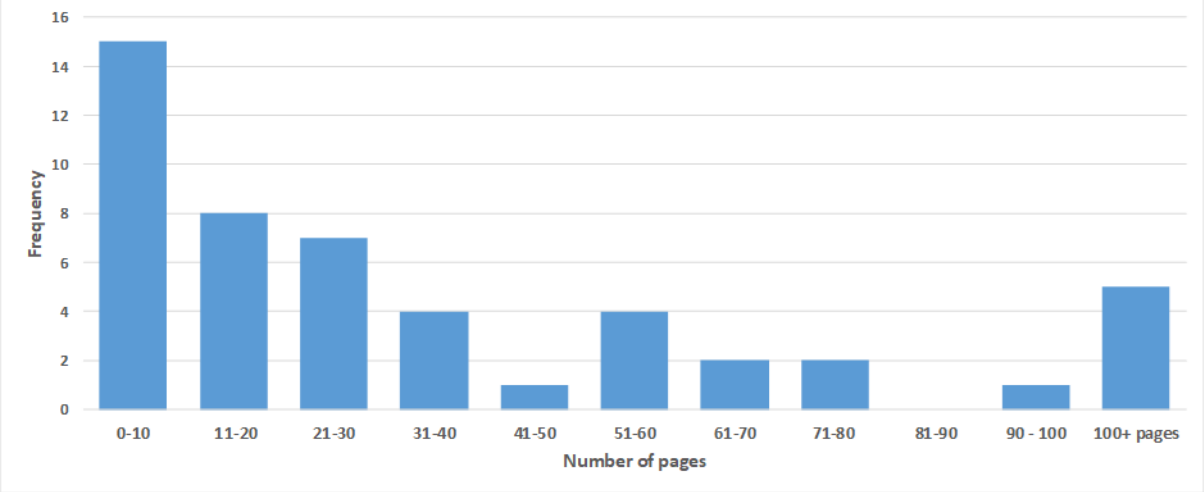
8P	De Ceri, Shea, Cooper, Sheehan & Donohue 2016	A multi-stage validation study to assess an OHS leading indicators tool: Final Report	Leading indicators of OHS can be defined as measures of the positive steps that organisations take that may prevent an OHS incident from occurring. The OHS leading indicators project is a large research project that has been conducted by Monash, Worksafe Vic, Institute of Safety, ISCRR, GM forum and Safe Work Australia.
1P	Butterworth, Leach, Strazdins, Olesen, Rodgers and Broom 2011	The psychosocial quality of work determines whether employment has benefits for mental health: results from a longitudinal national household panel survey	The satisfaction of employment is correlated with job quality.
2P	Lay, A. Morgan, Saunders, Ron, Lifshen, Marni, Breslin, Curtis, LaMontagne, Anthony, Tompa, Emile and Smith, Peter 2015	Individual, Occupational, and Workplace Correlates of Occupational Health and Safety Vulnerability in a Sample of Canadian Workers	A survey was administered to 1,835 workers employed more than 15 hrs/week in workplaces with at least five employees. Adjusted logistic models were fitted for three specific and one overall measure of workplace vulnerability developed based on hazard exposure and access to protective OH&S policies and procedures, awareness of employment rights and responsibilities, and workplace empowerment.
3P	Tracey Shea, Helen De Cieri, Ross Donohue, Brian Cooper, Cathy Sheehan 2016	Leading indicators of occupational health and safety: An employee and workplace level validation study	There is growing interest in advancing knowledge and practice on the use of leading indicators to measure occupational health and safety (OHS) performance in organisations. In response we present psychometric analysis of the Organisational Performance Metric – Monash University (OPM-MU), which is a recently developed measure of leading indicators of OHS with several adaptations made as part of our investigation.

4P	Griffin, M and Neal, A 2000	Perceptions of Safety at Work: A framework for linking safety and climate to safety performance, knowledge and motivation	The model of antecedents of safety performance, determinants of safety performance and components of safety performance is quite a good visual to understand the relationships of safety climate and performance.

Appendix 4. Document analysis of farm safety checklists, health and safety plans and guidelines

Some of the self-assessment tools are sizable manuals or safety guidelines. Figure 12 shows the distribution of document lengths. The average length is 39 pages. Five of the tools were over 100 pages each.

Figure 14: The length in page numbers of self-assessment tools from the grey literature dataset (N = 49).



The distribution of assessment tool lengths (ie. number of pages) shows the range of techniques within industry to influence farm safety culture. Most of the documents that exceed 20 pages in length (n=26) are of high quality and are likely to have been printed and given to farmers; they are now accessible to download as PDF files.

As a consequence, the form in which assessments are provided to farmers – paper-based, digital, theoretical only, is relevant in demonstrating how and where the assessments are being performed on farms.

Thirty percent (n=15) of the documents are 10 pages or less in length (refer to Figure 7) which suggests transportability and outside use. Analysing this group, 7 are paper-based or print-friendly farm safety checklists. These forms facilitate farmers and employees to perform active assessments around the farm. The other assessment tools in this group include two brochures to engage farmers in hazard management, three safety theory tools for managing COVID on farm, augers and power tools, a brochure using a dairy farm safety case study, a lesson plan, and a safety culture assessment tool.

Appendix 5. Safety benchmarking framework by Fragar and Pollock (2008)

Level	Dimension	Measures/s	Comment
Farm enterprise/ business	For each business:		
	• Safety climate	XXX item questionnaire that includes: • Personal motivation for safe behaviour • Positive safety practice • Risk justification • Fatalism • Optimism	Based on papers by: • AM Williamson et al, 1997 • W Williams et al, 2005
	• Safety management	14 item questionnaire that includes: • Engagement • Hazard and risk assessment • Plans and actions • Information • Monitoring	Can be self-assessed and also externally validated Based on: • Farmsafe Australia criteria • OHS legal requirements • Rulings of courts under OHS Acts
	• Management of major hazards		Based on: • Injury data Australia-wide • Availability of effective controls
	• Injury performance	• Business injury records • Workers compensation claims	
Local/ industry collective	Grouped enterprise results for collective:		Can be used to establish industry/sector norms
	• Culture of safety	As for farm enterprise	
	• Safety management	As for farm enterprise	
	• Management of major hazards	As for farm enterprise	
	• Injury performance	As for farm enterprise	
Industry sector	For each definable agriculture sector:		Using nationally available workers compensation data
	• Workers compensation claims	Rates per 1000 workers	

	• Compensable fatalities	• Fatality rate per 1000 workers • Case fatality rate	
	• Duration of absence for compensable injury	• Mean duration of absence from work	
State	For each state: • Fatalities frequency	Number of injury deaths by occupation over time	Using: • ABS data by occupation • NCIS data when available
	• Fatalities rate	Fatality rate per 1000	
	• Death rate per production volume and value		Measure to be developed
Country	For Australia:		
	• Fatalities frequency	As for state	Trend over time
	• Fatalities rate	As for state	Using international measure of fatality rate
	• Rate of death per production volume and value	As for state	

Appendix 6. Indicators (measures) found in the abstracts and titles of the peer and grey literature

SEM level – the Individual (n=67)

Peer review
Working while injured
Working while depressed
Prompts and drivers to changes on farm
Desire to improve safety
Safety awareness
Legislation compliance
Risk identification
Risk perception
Tractor population, age of tractor and ROPS
Safety climate
Reporting in organisations (age, gender, role and climate safety)
Distance from home to workplace
Gender and risky behaviour on farm (hearing, respiratory protection and tractor use)
The effectiveness of outreach on farms for safety
Guidelines for children
Effectiveness of safety promotion and farm improvements
Review of Agricultural Safety and Health Best Management Practices (ASHBMP) Manual
Predicting using PPE based on intention
Behavioural performances in farm machinery manufacturing
Pass rates in community training
Regulatory standards compliance
Literature review
Health of farmers
Resistance to adopt safe practices
Changes on farm
Risk

Optimism
Contentment
Perceptions of work safety climate
Personality
Stress
Attitude
Farm audit
Injuries
Adoption of protective measures
Evaluation of membership to an OHS service
Mobile phone messaging for motivation of PPE use
Tractor based risks
Storage of pesticides on farm
Adaptions to environment
Exposure to noise, sun, pesticides and tractors
Economic worry
Psychometric properties
Demographics
Agricultural experiences
Health locus of control
Content analysis for deaths and injuries
Eye injuries
The effects of interventions in farm safety
Injury experiences
Knowledge and literacy level
Pesticide safety measures
Strain, injuries and disease
Injuries and near misses
Illness
How farmers conceptualise accidents
OHS training and incentivisation
Dust concentration
Employee attitudes, risk perception and behaviour

Heavy carrying, skewed posture, environmental stress, working under pressure, physical inability, obesity
Workplace injuries
OHS need assessment
Participation in CSF
Working hours (children)
Perceptions of PTOs
Costs of becoming safety compliant
Risk perceptions of herbicide use

SEM level – Interpersonal (n=10)

Peer review
Roll over protection, signage, hearing protection, machinery guides and injury rates on farms
Family based intervention in decreasing riding on tractors
Individual and structural role of handwashing practices
Walk through farm walks and peer and peer learning with questions
Questionnaires about tractor driving and training to measure the number of youth on tractors
Communication about farm workers' errors in farm work
The values of trust in experts
Parenting styles measured against children's accidents
Employee decision making processes
Responses to COVID

SEM level – Organisational (n=13)

Peer review
Investment into labour including training, workplace discipline and recognition of safety
Trust
Farm safety in dairies using checklists
Low cost modifications for safety
Injury outcome, reported and not reported to supervisors

Sexton's safety climate questionnaire
Copenhagen Psychosocial Questionnaire
Coaching model
Changes in injury claim rates
InnoHorse – a web tool to help stable safety
Dairy safety occupational interventions
The main tasks in involvement and activities regarding the management of safety culture
Measuring the effectiveness of messaging to change behaviour

SEM level – Community (n=47)

Peer review
Instruments used to measure safety climate
Checklists
Injuries
Training
Safety knowledge
Behaviours
Mental health
Attitude
Exposure to pesticides
Sources of information
Certification in training
Public health perspectives
Anthropological views
Father led interventions in farm safety
Risk indicator database
Safety training
Psychological behavioural and situational elements of safety culture for children
Human safety measures
App development to improve health and safety
Role of discussion groups in OHS

State injuries on farms to direct training intervention
Theory
Leading indicators
Written pre-tests and post tests on course participants
Protocols
Media content analysis on injury and fatality
Effectiveness of training
Working Environment Screening Tool in Agriculture (WEST-AG)
Eye injuries
Operational solutions
Surveillance systems to provide scientific assessments of occupational hazards
Survey of perceptions
Insurers' and bankers' roles in safety programs
Behaviours and non-behaviours and injuries
Action planning
Handling components and design and rates of incidence with farmers' anxiety of changing stock handling equipment
Health insurance premiums, coinsurance and deductibles based on injury
Students' safety climate attitudes
Fatalitiy Assessment and Control Evaluation (FACE) program
Number and severity of accidents, safety behaviour and farm site safety audits
Rapid Clinical Assessment Tool
Zoonotic disease as work hazards
Changes in hazards
AgInjury News
Fears, threats of injury and death, threats and targets and good training
Putting children in the centre of the SEM framework
Theatre to influence safety culture as a tool
Factors that influence farmers' willingness to participate in co-governance
Knowledge levels of pesticide safety
Measures for farm safety in Australia
Safety climate scale
Evaluation of the ROPS rebate scheme as an intervention

Measuring training professions ag medicine
Death and injuries from tractors and ag machinery based on gender, machine, time, environmental conditions, education and age
Using Delphi to classify hazards by reviewing deaths
Scoring farm safety accreditation
OHS leading indicators study

SEM level – Public Policy (n=9)

Peer review	Grey literature
Who is vulnerable and what this means in working age groups	Guidelines
Improvements to work safety	Planning tools
Farm fatalities	Research
Rebate data on tractor ROPS – and the cost of the program versus the cost of life	Health and safety plans
	Investment plan

Appendix 7. Leading indicators found in the key literature (n=20) applied to the socio-ecological model to demonstrate where FSC is measured.

ALL SEM levels	Research identifier
Exposure to uncovered or ungrounded electrical outlets in close proximity to livestock watering equipment	#3137 Geng
Weight given to risk differs between observers and researchers (Indiana V Sweden - cultural differences)	#3137 Geng
Benchmarking health and safety systems for an organisation	#3233 Pollock
Direct observations of working conditions and employees' behaviour and practices to gauge experiences	#3233 Pollock
Presence of support, commitment and promotion by industry to change the social norms around safety	#3233 Pollock
Necessary and sufficient initiatives to instigate behaviour change	#3233 Pollock
Practical information, guidelines and templates about how to implement the solution into a farm setting with an estimated cost and sourcing solutions	#3233 Pollock
tools designed to improve health, reduce safety risks and prevent injuries	#2325 Leppala

Public Policy SEM level	Research identifier
Voluntary consensus standards for manufacturing to make new machinery safer	#4917 Chapman
Safety standards	#4917 Chapman
Risk types	#3137 Geng
Different social, cultural and regulatory forces	#3137 Geng
Regulations that vets can only vaccinate cattle with increased training in administering vaccines	#3137 Geng

increasing severe standards and regulations concerning occupational safety	#7660 Fargnoli
Industry reputation for safety (eg. Cotton BMP)	#3233 Pollock
Food safety and quality reassurance programs with safety as criteria to access the market	#3233 Pollock
EUREGAP compliance for risk assessment, employee training, hazard warnings, emergency plans, product handling etc	#3233 Pollock

Community SEM level	Research identifier
Extension agents, public health nurses and agricultural education instructors	#4917 Chapman
Outlet for Critical Action Factor checklists	#3765 Isaacs
larger farms are associated with greater risk	#5603 Irwin and Poots
Recognized risk assessment tool	#3137 Geng
risk metric developed	#3137 Geng
Screening for risk of injury	#3137 Geng
Public pressures (eg. Greater emphasis on animal welfare issues and compliance with regulatory requirements)	#3137 Geng
safety related initiatives to reduce occupational accidents and illness	#7660 Fargnoli
implementing technical solutions aimed at improving safety levels of farmers	#7660 Fargnoli
Identifying the neglect of the importance of safety laws and regulations	#7660 Fargnoli
Review and examination of organisational reports, documents and records	#3233 Pollock
Training	#3233 Pollock

Guidance	#3233 Pollock
Completion of a safety audit with timelines for amendments	#3233 Pollock
Audits with benchmarks	#3233 Pollock
Safety climate scores	#3233 Pollock
Safety Management System score	#3233 Pollock
Control of major hazards score	#3233 Pollock
Market demands compliance in safety in commodities for access with accreditation process	#3233 Pollock
Identify new practical solutions for risk and safety management	#2325 Leppala
Provision of knowledge and practical tools to prevent injury incidents and occupational disease	#2325 Leppala
Provision of safety information, safety checklists and safety management practices	#2325 Leppala
Systematic checklists and self-assessment tools for identifying and management risks in various tasks	#2325 Leppala
Safety checklists enable the screening of possible risk sources	#2325 Leppala
Ergonomic tools to reduce workload	#2325 Leppala
Measure the organisational material factors conditions, to find what can influence OHS safety culture	#5160 Terjek

Organisation SEM level	Research identifier
Critical Action Factors are known where safe performance requires adherence to proper completion of a set or sequence of sub-tasks	#3765 Isaacs
Improved training or coaching for job/equipment/conditions	#3765 Isaacs
Ability to offer more specific guidelines for human resource development	#3765 Isaacs

Identified conflicting knowledge about procedures	#3765 Isaacs
Practical training intervention	#3765 Isaacs
Identified adequacy or inadequacy of handling facilities	#3765 Isaacs
Incorporation of a critical action factor checklist into farm business	#3765 Isaacs
Feedback from training is positive	#3765 Isaacs
working conditions	#5603 Irwin and Poots
job strain	#5603 Irwin and Poots
duration spent in close proximity to cattle	#5603 Irwin and Poots
financial issues that may prevent investment in safety equipment	#5603 Irwin and Poots
financial issues that may cause working longer hours which causes fatigue	#5603 Irwin and Poots
direct exposure of the farmers to unrestrained cattle, especially breeding bulls	#3137 Geng
Overhead storage for hay and feed	#3137 Geng
Potential for needlestick injury	#3137 Geng
Under-utilized and residual ag equipment in poorer conditions or obsolete used occasionally with high risks due to emphasis on animal health	#3137 Geng
Extensive pesticide storage and usage	#3137 Geng
Affordability of safer technologies to restrain cattle	#3137 Geng
Assessing workers' safety climate	#7660 Fargnoli
Identifying workplace dynamics and behaviours relating to safety to be used to implement effective measures	#7660 Fargnoli
Average age of the farm machines	#5160 Terjek

New and old farm technology exists together resulting in a powerful risk challenge for machine operators and maintainers	#5160 Terjek
Health and safety management system	#3233 Pollock
Ability to compare/benchmark changes to their management system or day to day farm management from a health and safety perspective	#3233 Pollock
Participation in best management practices	#3233 Pollock
Machinery purpose (field work v yard work) and the financial position of the farmer govern the risks involved	#3233 Pollock
Good risk management tools and safety practices	#2325 Leppala
Good clothing, proper equipment and use of PPE combined with good working conditions	#2325 Leppala
Rubber mats on the corridors, good electric lighting and ergonomics	#2325 Leppala
Fire safety, rescue skills and worker safety management	#2325 Leppala
Show and train workers in safe working habits and communicate why safety is important	#2325 Leppala

Interpersonal SEM level	Research identifer
Leadership	#5603 Irwin and Poots
Teamwork	#5603 Irwin and Poots
Role model for employees	#2325 Leppala

Individual SEM level	Research identifier
farmers' recognition that injury and disease risks are higher	#4917 Chapman
Safety knowledge	#4917 Chapman, #5603 Irwin and Poots

precautions taken during work	#4917 Chapman
use of extension safety and health programming	#4917 Chapman
use of recommendations for reducing farm related injuries and illness	#4917 Chapman
Awareness of the environment	#5603 Irwin and Poots
Communication	#5603 Irwin and Poots
Decision-making, situation awareness and task management	#5603 Irwin and Poots
Engagement in planning and preparation prior to beginning a task	#5603 Irwin and Poots
Safety motivation	#5603 Irwin and Poots
safety climate	#5603 Irwin and Poots
Adherence to procedures	#5603 Irwin and Poots
Taking initiative	#5603 Irwin and Poots
perceived work stressors and stress	#5603 Irwin and Poots
Safety behaviour	#5603 Irwin and Poots
Age and experience	#5603 Irwin and Poots
Working alone	#5603 Irwin and Poots
Direct physical contact with cattle	#3137 Geng
Cattle raised on pasture exhibit more and a wider range of unpredictable behaviour and act aggressively	#3137 Geng
Cows that have recently birthed can exhibit unpredictable behaviour	#3137 Geng
Identifying conditions that could result in an injury	#3137 Geng
Judgement takes into account both probability and consequence	#3137 Geng

Weighting to certain subjective hazards	#3137 Geng
Potential of injury due to exposure	#3137 Geng
Using hand tools inappropriately	#3137 Geng
ATV usage on rough terrain	#3137 Geng
Travelling in pastures in a vehicle without seatbelts	#3137 Geng
Vaccination of own cattle and exposure to risk	#3137 Geng
Workers' perception of different aspects ranging from management attitudes towards safety	#7660 Fargnoli
Workers' perception of towards safety training	#7660 Fargnoli
Workers' perception towards the effectiveness of enforcement versus guidance in promoting safety	#7660 Fargnoli
Poorly motivated worker operating an extremely valuable instrument	#5160 Terjek
Farm workers perceive a suitable payment to undertake more complicated and more knowledgeable demanding work as a risk factor	#5160 Terjek
Young persons' life situation is too easy to motivate to take risks and reduces their freedom of choice	#5160 Terjek
Personal motivation for safe behaviour	#3233 Pollock
risk justification	#3233 Pollock
Perception of the role and commitment of management to safety	#3233 Pollock
Fatalism	#3233 Pollock
Optimism	#3233 Pollock
General health behaviours	#3233 Pollock
Use of PPE	#3233 Pollock

Alignment of judgement with work safe compliance	#3233 Pollock
Manual handling in yards	#3233 Pollock
Lifting and dragging sheep	#3233 Pollock
Desire for change that suits own values and importance and must be achievable	#3233 Pollock
Awareness of the possible risks and proper knowledge and skills	#2325 Leppala

Appendix 8. Summary of key literature (n=20) used to underpin the recommendations in the review.

Author & Year	Butterworth et al (2011)
Research identifier	1P
Industry	Any (workplace structure)
SEM level	Individual
Country of origin	Australia
Description	The Psychosocial Job Quality survey measured workers' mental wellness to occupational health and safety. This research links the poorest quality jobs with worsening mental health.
Measurements	The Household, Income and Labour Dynamics in Australia (HILDA) survey and the Mental Health Inventory (MHI), plus covariate factors (gender, education, age etc.) were used in this analysis. There are 4 dimensions, 11 questions: Job demands and complexity - My job is more stressful that I ever imagined - My job is complex and difficult - My job require learning new skills - I use my skills in my current job Job control - I have freedom to decide how I work - I have a lot of say about what happens - I have freedom to decide when I do work Job security - I have a secure future in my job

	- Company I work for will be in business in the next 5 years - I worry about the future of my job Effort, reward and fairness - I get paid fairly for the things I do in my job
Applicability to agriculture	For workers employed in menial tasks on farm measuring mental health should be a component of any indicator /measurement of farm safety culture. But menial tasks on farm change due to weather and seasons that alter the daily tasks of farmers. This tool demonstrates modelling based on existing survey data.
Author & Year	Chapman et al (1996)
Research identifier	4917
Industry	Agriculture – dairy farming
SEM level	Individual
Country of origin	Wisconsin, USA
Description	A survey instrument was designed and administered to a sample of dairy farmers to learn about perspectives of work hazards and prevention.
Measurements	Questions related to 3 themes containing 28 items: Self-protective activities: - Annual inspections for hazards - Annual inspection of structures - Annual inspection of storage - Would you use an inspection form if one was provided? - Do you hold safety meetings for family employees? - Do you hold safety meetings for paid employees? Willingness to pay: - How much would you pay for an inspection by an outsider? - How much would you annually budget for hazard corrections?

	Knowledge: - You agree hazard correction outperforms working safety near hazards - Do not ride or as allow extra riders on tractors - Wear seat belts while operating motor vehicles on public highways
Applicability to agriculture	A questionnaire was developed from an adaptation of Wisconsin extension agents' and a pilot, followed by a review from experts at the US National Institute for Occupational Safety and Health. It was 6 pages in length and required 10 – 20 minutes to complete. This research is early evidence (mid 1990s) of developing a questionnaire specifically to measure safety culture on dairy farms in Wisconsin.
Author & Year	Certified Logging Professionals (CLP)
Research identifier	38S
Industry	Forestry
SEM level	Individual, Organisational and Community
Country of origin	Maine, USA
Website	https://clploggers.com/
Description	CLP was founded in 1991 as a multi-sectoral effort to establish a standard for professionalism. A goal was to combat high rates of accidents. As a result injury and illness is 83% less than it was when the program began and CLP loggers pay 48% less for workers' compensation than non-certified mechanical loggers. The board of directors are logging professionals which demonstrates ownership to members.
Measurements	CLP is essentially and education and professional association /accreditation systems and uses reductions in injuries and deaths (lagging indicators) to measure changes in industry, organisational and individual trader safety culture.

Applicability to agriculture	CLP greatly reduced logger injury rates though initially there was considerable resistance. Ultimately it greatly professionalised loggers which drove shifts in attitudes about safety and other aspects of logging. This is a needs-based and ground up model from industry that demonstrates how to change attitudes of farmers on safety and good practices, and how to professionalise the sector to improve safety practice and increase farmer sense of professionalism and pride.
Author & Year	Dairy Australia (2017)
Research identifier	78G
Industry	Agriculture – dairy farming
SEM level	Individual
Description	The Power of People on Australian Dairy Farms is both a longitudinal study and a database that measures farm safety indicators. It takes into account the role of paid and unpaid labour, the attraction and retention of workers to the industry, and what this means for dairy farm businesses.
Measurements	This report uses survey data collected every three years from Australian dairy farmers. Safety indicators in this report include dairy farmers' responses to their written health and safety plan, ROPS on the quad bike, written or informal operating standards in the tractor, updates to safety plans, helmet wearing, involvement of staff in safety scans and hazard ID, and the number of days taken off farm due to an injury.
Applicability to agriculture	This is a leading Australian farm industry example that has great potential to evolve as dairy-specific FSC measurement instrument. Evidence suggests that this longitudinal survey is reviewed and modified prior to re-surveying farmers. Exactly how this information about dairy farmers' health and safety is used is unclear, but it most likely guides future investment, supports funding applications,

	develops new safety materials, and strengthens extension initiatives for the industry.
Author & Year	Fargnoli and Lombardi (2020)
Research identifier	7660
Industry	Agriculture
SEM level	Individual
Country of origin	Nordic origin for questionnaire, Italy for research application
Description	The purpose of the research was to reduce the scarcity of knowledge on safety climate in agriculture. The Nordic Safety Climate Questionnaire (NOSACQ-50) was used to screen different perceptions of workers and employees, taking into account gender and age.
Measurements	The questionnaire consists of 50 items across 7 safety climate dimensions, i.e., group members' shared perceptions of: **1.** Management safety priority, commitment, and competence **2.** Management safety empowerment **3.** Management safety justice **4.** Workers' safety commitment **5.** Workers' safety priority and risk non-acceptance **6.** Safety communication, learning, and trust in co-workers safety competence **7.** Trust in the efficacy of safety systems The results of safety climate are presented as a radar diagram.

Applicability to agriculture	Nordic network of OH researchers developed the questionnaire in 2011 and it is available online in 40 different languages. NOSACQ-50 is a validated assessment tool used across industries, and it brings with it comparable results. Trialling this questionnaire in a Victoria farming setting would be meaningful but there are still challenges that this tool is designed for large organisations, rather than smaller family farming businesses.
Author & Year	Geng, Field & Salomon (2015)
Research identifier	3137
Industry	Agriculture – cattle handling
SEM level	Individual
Country of origin	Indiana, USA & Sweden
Description	A Swedish industrial risk assessment model was applied to a sample of Swedish and Indiana farmers by independent agricultural safety professionals to demonstrate the relationship between recognised cattle handling hazards and increased risk of injury. This tool was trialled on 19 farms with small herd sizes.
Measurements	WEST-AG is metric based on probability and consequence score. Following an interview and field observations of the farmer, the second phase is an assessment using an 11-degree linear scale (0 = no/trivial risk to 10 = extremely high risk) for 15 components of risk injury: - Exposure to operating machinery - Being struck by flying objects - Overexertion of body parts - Using hand tools - Injury due to poor housekeeping

	- Motor vehicle/ATV incident - Fall on the same level - Fall from a higher level - Misstep or trip due to rough or uneven terrain - Chemical exposure - Burn or frostbite - Electrical contact - Explosion or fire - Contact with dangerous animals
Applicability to agriculture	The WEST-AG tool had been previously applied to pig operations and Swedish beef farming in open areas and feedlots. Limitations between Swedish farm practices to Indianan practices meant that the tool was only used for risk of injury. The results showed there was a greater diversity of risk types between Indiana and Swedish farmers, suggesting that Australian beef farmers are most likely to have their own unique, or different, set of risk types as well.
Author & Year	Griffin and Neal (2000)
Research identifier	4P
Industry	Any (workplace structure)
SEM level	Individual and organisational
Country of origin	Australia
Description	Framework is based on the integration of work performance with theories of organisational climate. This was developed to address the process through which safety climate translates into safety outcomes. The results support the proposal

	that knowledge and motivation mediate the impact of the safety climate on individual safety behaviour.
Measurements	A questionnaire consisting of 81 items was used to assess a wide range of attitudes, behaviours and safety procedures. Two workplace surveys were undertaken, with the second survey revised and dimensions adjusted. The path estimates leading to a model in Study 2, factors the following attributes: - Manager values - Safety communication - Safety practices - Safety training - Safety equipment - Safety knowledge - Compliance motivation - Participation motivation - Safety compliance, and - Safety participation.
Applicability to agriculture	This model contributes to linking safety climate to safety in the workplace. It is set in Australian manufacturing and mining organisations, yet the data relied on archival records in quality assurance auditing, which is not available in farming.
Author & Year	Grimbuhler & Viel (2019)
Research identifier	2331
Industry	Agriculture - vineyards
SEM level	Individual
Country of origin	France
Description	This research aimed to improve safety culture by raising farmers' pesticide risk awareness in the Bordeaux region in France. Complementing the work of Isaacs

	et al (2008) this instrument is specifically targeted to measuring safety climate in the vine-growing industry.
Measurements	A literature review was used to scope the framework for questionnaire resulting in 7 dimensions and 20 items: Management commitment - Pesticide safety is given a high priority by farm management - Actions are undertaken to reduce pesticide exposure in the farm - Actions taken by health promoters aim at reducing exposure to pesticides - I have been consulted about safety issues when using pesticides - I am encouraged to become involved in pesticide safety matters - I am encouraged to attend safety training programs regularly Communication and feedback - I know the incident reporting system to health organisations - I am encouraged to report any safety matters to improve my protection during pesticide use - After an incident during pesticide handling, I have made / will make improvements Rules and best practice - Safety regulation and good practices are useful to prevent risk - I attach particular importance to the maintenance of work area, equipment and machinery Knowledge - I know when to use personal protective equipment - I know safety regulation - I have a "zero incident" goal Safety compliance - I use all necessary safety equipment to do my job. - I respect good practices that protect me from pesticide exposure - Personal protective equipment is adapted to my work activities

	Safety participation - I put in extra effort to improve my safety when using pesticides Teamwork climate - My co-workers share the same concerns as me about workplace health - My co-workers comply with good practices
Applicability to agriculture	Following content validity with 16 farm managers or pesticide operators the framework was reduced from the original 9 dimensions and 49 items. A total of 312 eligible participants completed the safety climate questionnaire. Owing to its psychometric properties, the score is used to plan interventions aimed at improving safety culture. This approach is feasible for specifically measuring safety culture/climate for pesticide use in Victoria, but it could be modified and applied more broadly.
Author & Year	Irwin & Poots (2018)
Research identifier	5603
Industry	Agriculture
SEM level	Individual
Country of origin	United Kingdom and Ireland
Description	An exploratory study sought to improve our understanding of factors influencing non-technical skills (NTS) attitudes to contribute to enhancing farmer NTS and safety. Two sub-sets of NTS, team-based and lone worker, were considered because the skills used when working alone are important in farming.
Measurements	The questionnaire has 7 sections: Section one - Demographic information, including age, training, years of experience farming, type of farm, and size of farm.

	Section two - Five-item version of the General Health Questionnaire. This scale was designed to assess current levels of stress and well-being. Section three - Ten-item version of the Big Five Personality Inventory. The scale was designed to assess participants on five personality factors: Extraversion, Openness, Conscientiousness, Neuroticism, and Agreeableness. Each factor was measured using two summed items. Section four - Perceptions of safety climate, motivation, behaviour and risk tolerance. Safety climate assessed the extent to which safety was valued on the farm, safety motivation assessed the extent to which farmers felt safety was an important part of their work, and safety compliance indicated the extent to which participants complied with safety regulations. - Risk tolerance assessed the extent to which farmers were prepared to bend the rules, or take shortcuts to achieve performance targets. Section five - Concerns about four environmental, or task based, stress factors (stressors): workload, costs and profit margins, problems caused by weather or equipment, and work-life imbalance. Section six - Five sub-scales, each containing six items designed to assess attitudes toward team-based non-technical skills. The five sub-scales included were: Situation awareness, Teamwork and communication, Leadership, Task management, and Decision making. All items were derived from interviews conducted in an earlier study. The format and presentation of the items mirrored that of the TeamSTEPPS Teamwork Perceptions Questionnaire (T-TPQ). Section seven - Three sub-scales, each containing four items designed to assess attitudes to non-technical skills used while alone. The three sub-scales

	were: Situation awareness, Task management, and Decision making. As for section six, items were based on the format of the T-TPQ and derived from the earlier interviews.
Applicability to agriculture	This is a study of 170 farmers from the UK and Ireland, with a mean farm size of 971 acres. It relates to the attitudinal elements of farm safety to support researchers in recommending how training initiatives can be more engaging for particular personalities, to be most effective to reduce the number of farming accidents.
Author and year	Isaacs et al (2008)
Research identifier	3765
Industry	Agriculture – cattle handling
SEM level	Individual
Country of origin	Kentucky, USA
Description	The Work Crew Performance Model (WCPM) has been applied successfully to mining and construction activities where known sequences of tasks produce known risks. These are called critical action factors (CAFs). Tenets of this model provide a framework for better evaluation of training and performance.
Measurements	In this study facilitated farmer focus groups, plus an expert review, included 32 critical action factors in 4 categories. Environmental conditions - Today's weather, today's surface conditions, wear appropriate footwear and clothing, avoid handling animals during extreme hot and humid or cold weather Animal behaviour - Understand gender and breed behavioural differences, take advantage of your knowledge of the animal's historic behaviour, assess the degree

	of animal's agitation and anxiety, operate within the animal's natural daily patterns, increase caution around mothers with offspring, and bulls, understand and utilize the animal's flight zone, take advantage of the animal's herding instinct, avoid lone animals. Handling equipment and facilities - Lay out facilities to take advantage of animals' natural responses (and behaviour), design and operate for appropriate capacity and expansion, construct sturdy and durable handling facilities, provide escape gates and barriers, match cost and complexity to herd composition, size, and location(s), judiciously use proper handling aides (cattle prods), use proper and adequate restraining devices (chutes, ropes, headgates), organize and have available appropriate tools, medications, and equipment, make sure there are no sharp edges that may cause injuries, do not use, or make minimal use of, electric prods and sticks, do not hit an animal if he/she does not have a place to go, maintain latches on squeeze chutes. Handling techniques - Match age, experience, and skill of the handler(s) to the task, be especially cautious around animals that are handled less frequently or are agitated, minimise unwanted noise and visitors during animal handling, use extra caution when loading, transporting, or unloading animals, plan an escape route, dedicate appropriate number of workers to task (too many or too few), use a calm voice, deliberate actions, and confident approach, don't trust or take animals for granted or become complacent with routine jobs, use proper lifting techniques, know when to seek assistance (veterinarian, additional worker), alternate tasks to avoid repetitive stress/motion injuries, take special precautions to avoid cuts and needle pricks, minimize exposure in the “kicking zone”, try to handle cattle in groups rather than individually, never tie a lead rope to yourself.
Applicability to agriculture	The process of using an existing model and adapting it by cattlemen for cattle handling, resulted in the development of a cattle safety handling checklist that has been used with success in Master Cattleman educational workshops conducted for approximately 1500 Kentucky farmers. This is an excellent

	example of where a high risk farming activity has received needs-based attention and intervention from those who are affected most from policy.
Author and year	Lay et al (2015)
Farming specific	No
Industry	Any (workplace structure)
Research identifier	2P
SEM level	Individual
Country of origin	Canada
Description	This study measures and analyses how workplace resources and mechanisms such as training, and protective policies and procedures shape OH&S risk for certain labour market sub-groups. This study defines vulnerability as exposure to on-the-job hazards in conjunction with inadequate access to resources to mitigate the effects of these hazards.
Measurements	Gender, age, location of birth, first language, P/T or F/T status, workplace size and job tenure were collected together with the Hazard and Vulnerability Questions in the survey: Hazards: How often do you . . . 1. Have to manually lift, carry, or push items heavier than 20 kg at least 10 times a day? 2. Have to do repetitive movements with your hands or wrists (packing, sorting, assembling, cleaning, pulling, pushing, typing) for at least 3 hr during the day? 3. Have to perform work tasks, or use work methods that you are not familiar with?

	4. Interact with hazardous substances such as chemicals, flammable liquids, and gases? 5. Have to work in a bent, twisted, or awkward posture? 6. Work at a height that is 2m or more above the ground or floor? 7. Work in noise levels that are so high that you have to raise your voice when talking to people less than 1m away? 8. Have you been bullied or harassed at work? 9. Have to stand for more than 2 hr in a row? Policies and Procedures: At my workplace . . . 1. Everyone receives the necessary workplace health and safety training when starting a job, changing jobs, or using new techniques. 2. There is regular communication between employees and management about safety issues. 3. Systems are in place to identify, prevent, and deal with hazards at work. 4. Workplace health and safety is considered to be at least as importance as production and quality. 5. There is an active and effective health and safety committee, and/or health and safety representative. 6. Incidents and accidents are investigated quickly in order to improve workplace health and safety. 7. Communication about workplace health and safety procedures is done in a way I can understand. Awareness: At my workplace . . .

	1. I am clear about my rights and responsibilities in relation to workplace health and safety. 2. I am clear about my employer's rights and responsibilities in relation to workplace health and safety. 3. I know how to perform my job in a safe manner. 4. If I became aware of a health or safety hazard at my workplace, I know who (at my workplace) I would report it to. 5. I have the knowledge to assist in responding to any health and safety concerns at my workplace. 6. I know what the necessary precautions are that I should take while doing my job. Empowerment: At my workplace . . . 1. I feel free to voice concerns or make suggestions about workplace health and safety at my job. 2. If I notice a workplace hazard, I would point it out to management. 3. I know that I can stop work if I think something is unsafe and management will not give me a hard time. 4. If my work environment was unsafe, I would not say anything and hope that the situation eventually improves (reverse scored). 5. I have enough time to complete my work tasks safety.
Applicability to agriculture	This research recognises that the factors affecting injury and illness risk are broader than simply unsafe actions by workers ie. culture. It focusses on specific vulnerable sections of the community as they are likely to have more work injuries (physical and mental) which can be applicable to farming when we consider unskilled labour, child and teenage labour and unpaid family labour. Pre- and post-implementation measurement could reveal the impact of population- or workplace-wide education initiatives across all three specific types

	of vulnerability, with particular focus on changes to the awareness dimension in agriculture-dependent communities.
Author and year	Leppälä et al (2015)
Research identifier	2325
Industry	Equine
SEM level	Individual and organisational
Country of origin	Finland and Sweden
Description	The InnoHorse web tool was designed to assist in horse stable management by providing safety information, safety checklists, safety management practices and a stable safety map. The researchers used an iterative development cycle and constructive analysis. The literature review, analyses of insurance claims for horse injuries, internet searches, comparison of safety tools and discussions with equine stakeholders contributed to the model to create the tool. The tool was designed using a customer survey (n = 1325), followed by an expert workshop (n = 10) to identify the major risk categories. Farm case study interviews were conducted (n = 20) as well as a literature review of legislation for multiple countries.
Measurements	The Horse Stable Safety Map is a framework which takes into account outside impacts (regulatory, infrastructure, network and areal safety) and impacts from stable activities (customers and visitors, neighbour and public safety, environment) that influence 7 measures of safety with 41 checks for stable managers: 1. Walkways and corridors 2. Safety of horse enterprise building facilities 3. Ergonomics, tools and machines

	4. Personal protective equipments 5. Fire safety and rescue planning 6. Employee and customer safety 7. Other safety issues
Applicability to agriculture	The web tool is a user-designed framework that aims to help in organising and managing safety activities in horse and stable facilities. The process provides a practical model of a needs-driven, and statistically validated, project to address a safety issue by referring to experts and customers who are most at risk around horses.
Author and year	Lingard et al (2014)
Farming specific	No
Industry	Construction
Research identifier	22S
SEM level	Organisational
Country of origin	Australia
Description	H&S Culture Framework was developed with two elements: The H&S Culture Maturity Model, and the H&S Climate Assessment Tool. The framework is a 5 step process, resulting in the climate survey questions. The authors recommend the tool and model be validated in the Australian construction context.
Measurements	The H&S Climate Assessment Tool is a multilevel questionnaire for surveying construction workers. It has 9 dimensions across 3 levels (organisation or principal contractor, the project, and the workgroup) to measure climate within an organisation at any given time. The H&S Climate Assessment Tool is four pages in length containing a 'pool' of potential questions.

	The dimensions, reflecting the literature, include: • Leadership • Communication • Organisational goals and values • Supportive environment • Responsibility • Learning • Trust in people and systems • Resilience
Applicability to agriculture	As safety climate can change on construction sites, the tool is designed to measure multiple groups within an organisation. This can be assimilated with farmers relying on contracting services (eg. Baling, harvesting, windrowing etc.) where outsiders may bring a different safety culture to the organisation. It lacks an organisational example of how the tool and model measure organisational safety culture in a complex work environment, and applicability to farming at this point.
Author and year	Pollock, Fragar, and Griffith (2016)
Research identifier	16G
Industry	Agriculture – broadacre
SEM level	Individual
Country of origin	NSW
Description	The Australian Centre for Agricultural Health and Safety established a longitudinal study of 335 NSW farm enterprises to derive data on farm health and

	safety management and how it relates to farmer perceptions. The specific objective was to develop scores for measures of Safety Climate, Safety Management Systems and Control of Major Hazards, and to try to explain the determinants of those scores.
Measurements	The benchmarking questions had three dimensions: - Safety Climate questions (n=20) were based on Williamson et al (1997) that covered the perceptions of the informant completing the questionnaire as a representative of the farm enterprise. The perceptions of safety within an organisation are commonly referred to as safety climate which has 5 dimensions: - Personal motivation for safety: factors that would promote safer behaviour, - Positive safety practices: reflecting safety activity within the workplace, - Risk justification: instances or reasons why an individual worked unsafely or took known risks, - Fatalism: the concept that accidents are natural consequence of the working environment, and - Optimism: reflecting a favourable view of personal accident or safety risk (Williamson et al., 1997). - Safety Management Systems (n=35), were based on a series of questions developed by Temperley (2005) relating to safety management systems on farms and were included in the audit process for participants in the WorkCover NSW Cotton Premium Discount Scheme. The questions reflecting the dimensions of managing farm safety included: - The engagement of workers and management in safety on the farm, - Assessment of hazards and risks, - Safety plans and actions, - Information, training and resources on workplace safety and systems, and - Monitoring and recording of health and safety incidents, situations and processes (Temperley, 2005).

	- Control of Major Hazard questions (n=15) related to actual processes and practices on the farm enterprise. These hazards were selected by Farm Safe Australia as key priorities in their safety promotion and awareness activities due to the potential for serious injury and/or death stemming from their use. - Relating to tractors - PTOs - Augers - Residual current devices (RCDs) - Chemicals - Silos - Safe play areas for children - Vehicle safety - Helmets and PPE - Each hazard also has a control measure available to reduce the level of risk associated with it. The questions were validated and included as part of the audit process for WorkCover NSW Cotton Premium Discount.
Applicability to agriculture	This is a superior, Australian example of how to measure safety climate, safety management systems and control major safety hazards on farms as a triangulation of comparable scores, and to use the scores to prioritise interventions. The research uses total factor productivity (TFP) to test the scores against productivity in each sector to look for trends of lost productivity from farm related accidents. The use of weighting and influencing variables brings statistical rigor to the results showing interactions between age, enterprise and attitudes. The authors have used existing questionnaires, bringing together support from 335 farmers, independent facilitators, and WorkCover NSW to achieve a scoring system that is most applicable to Australian agriculture.
Author and year	Safe Work Manitoba (n.d)
Research identifier	23S
Industry	Any

SEM level	Organisational
Country of origin	Canada
Description	The Safety Culture Assessment (SCA) is a tool comprised of 12 questions that assesses a workplace's safety culture. It is relevant to all sectors and organisational sizes and is able to track change over time.
Measurements	The Safety Culture Assessment asks the workplace delegate to score each statement based on the percentage of time each practice takes place. **1.**Formal safety audits at regular intervals are a normal part of our business. 2. Everyone at this organisation values ongoing safety improvement in this organisation. 3. This organisation considers safety at least as important as production and quality in the way work is done. 4. Workers and supervisors have the information they need to work safely. 5. Employees are always involved in decisions affecting their safety and health. 6. Those in charge of safety have the authority to make the changes they have identified as necessary. 7. Those who act safely receive positive recognition. 8. Everyone has the tools and/or equipment they need to complete their work safely. 9. Actions are taken to prevent future incidents. 10. Top management is actively involved in the safety program. 11. Communication is open and employees feel free to voice concerns and make suggestions. 12. There is a high level of trust in the employee/employer relationship at your company.

Applicability to agriculture	NCFH directly contacted Safe Work Manitoba to the interest in FSC. They responded that there has not been a lot of uptake to date from farmers or ranchers with the Safety Culture Assessment linked with the SAFE Work Certification program. Their reason was that many farmers feel they are not ready for safety and health certification. Safe Work commented there is still a lot of work to do in engaging the farmer or rancher in understanding that safety and health legislation and workplace injury prevention applies to them.
Author and year	Shea, De Ceri, Donohue, Cooper and Sheehan (2016)
Research identifier	3P
Industry	Broad application for organisations with corporate structures
SEM level	Individual and organisational
Country of origin	Australia
Description	This paper represents an important advancement in the field of leading indicators of OHS performance and demonstrates that the OPM-MU is a promising new tool with demonstrated reliability and validity. This paper provides a comprehensive comparison of existing measures of OHS leading indicators reported in the literature including Hahn and Murphy (2008), Griffin and Neal (2000), and Kines et al (2011).
Measurements	Based on a literature review the authors propose that the construct of leading indicators of OHS performance encompasses 10 areas: - OHS systems (policies, procedures, practices), - Management commitment and leadership, - OHS training, - Interventions, information, tools and resources, - Workplace OHS inspections and audits, - Consultation and communication about OHS, prioritization of OHS; - OHS empowerment and employee involvement in decision making,

	- OHS accountability, - Positive feedback and recognition for OHS, and - Risk management.
Applicability to agriculture	The OPM-MU could be used as an initial 'flag' of the leading indicators of OHS and has the potential to be a benchmarking tool for workplaces both within and across organisations. The OPM – MU has utility as a short practical measure of leading indicators of OHS and the questionnaire appears to be suitable for a small or singleton group of individual farmers that could then be possibly considered in a group/community format.
Author and year	Regional Wellbeing Survey, University of Canberra (2021)
Research identifier	39S
SEM level	All levels
Country of origin	Canberra
Description	The aim of the survey is to: — improving understanding how wellbeing, resilience and liveability are changing across Australia; and — help organisations across Australia access the data they need. Some years, there is more than one questionnaire. Researchers divide the survey into 'panels', each of which contain a set of core questions asked of every participant, as well as a unique 'panel' of questions which are asked of only the subset of participants (eg. Farmers) who receive that panel of questions.
Measurements	There are seven parts to the survey: - Part 1 – Your Community: how do respondents find/feel about the place where they live. - Part 2 You and your wellbeing.

	- Part 3 Your household – including key demographic questions - Part 4 Staying in touch: how you're going at the moment with staying in touch with other people, with community activities, and with volunteering (ie. if you volunteer). - Part 5 Balancing life, work and responsibilities. - Part 6 Your workplace – these questions address work satisfaction, and sector specific information. They were developed with the NCFH in 2020 to address workplace safety on farms and individual and community safety culture. - Part 7 Your Farm: This section asks about the farm – what is done on it, and what is going well and less well. - Part 8 Challenging Events: This section asks about the different types of challenging events individuals and their community and/or your friends and family may have experienced in the last 12 months (or in the case of drought, over a longer period).
Applicability to agriculture	This survey is most applicable to agriculture – specifically the questions that are included in Part 6 of the 2020 survey. These questions were designed to collect data to measure health, safety and wellbeing on farms.
Author and year	Sacurima COST (Safety Culture and Risk Management in Agriculture)
Research identifier	5G
Industry	Agriculture
SEM level	All levels
Country of origin	33 European countries, one participant from Jordan and nine international country participants from USA, Iran and Australia.
Description	The aim of Sacurima is to understand the determinants of safety behaviour in agriculture, taking into account individual determinants (safety literacy), contextual/environmental determinants (safety culture) to produce an innovative tool to measure:

	- Knowledge, attitudes, perceived risks, norms and behaviors and to measure safety culture on farms, and - Measure determinants of safe behaviour among farmers, and use it for benchmarking national performance.
Measurements	To measure safety behaviour the survey ask for: - Background information (age, gender, type of farm, …) (8 items) - Injury history (3 items) - Safety practices (falls prevention, machinery handling, pesticides and chemicals handling, animal handling) (17 items) - Attitudes, norms perceived behavioural control, and intentions (35 items) - Safety culture in the farmer community (5 items) - Obstacles to safety behaviour (tiredness, stress, workload, weather conditions, …) (7 items)
Applicability to agriculture	This survey is most applicable to agriculture, noting that all of the participating EU countries have adjusted it to their own language, and operating environment.
Author and year	Terjék (2013)
Research identifier	5160
Industry	Agriculture (many employees)
SEM level	Organisational
Country of origin	Hungary
Description	The author presents a scientific investigation of occupational safety and health (OSH) related safety culture in the area of Hajdu-Bihar county. The objective was to develop complex research and measurement-method which is suitable for the measurement of safety culture and safety climate dimensions in agricultural businesses (n = 18) with farm workers (n = 1220) and managers (n = 164).

Measurements	Safety culture forming dimensions were characterised by firstly analysing OSH related national secondary statistical database and injury certificates, and secondly, findings from questionnaires. Influencing variables included gender, age, educational level, job position, and working experience. The author developed 3 questionnaires: - General questionnaire – 72 items, - Farm leader questionnaire – 22 issues with 178 items, - Farm worker questionnaire – 26 issues with 171 items. The questions were structured on the previous work by Cseh-Szombati (1971), Babbie (1998), Hewstone et al (1999), Triandis (1999), Segall et al (1999), Shwartz (1999) and Malhotra (2005). In the compilation of general questionnaire the author referred to Szendro and Szijjarto (1979). The safety culture dimension model (SCDM) represents the correlations among acting factors, which have direct or indirect influences on agricultural organisational OSH related safety culture. The leaders' estimation of managing-mistakes impact on safety at work was correlated with farm employees' risk assumption attitude to result in a table that examined contentment regarding OSH situations by farm leaders and farm workers.
Applicability to agriculture	The author found that decreasing tendency of the number of agricultural employees is clearly an effective factor and that agriculture is still the same high-risk industry as it was 25 years ago. This is a good example of an organisational model for agriculture. The analysis of influential material factors and infrastructural challenges, using tractor age as the example, shows how thorough and calculated this research project is.
Author and year	Whitman & Clark (2010)
Research identifier	73G

Industry	Agriculture – dairy farming
SEM level	Individual, Organisational and Community
Country of origin	Maine, USA
Description	This Vital Capital Index and Tool Kit for Dairy Agriculture provides farmers with a benchmarking checklists for a range of farm business indicators. The aim of the tool is to help farmers to identify opportunities for improvement to their farm and to communicate these improvement in stewardship to their stakeholders and supply chain.
Measurements	The tool is structured under 3 dimensions: Prosperity, People and Plant. Farmers are given guidelines of how to score each criteria for self-assessment of their culture. Safety culture relates to two criteria: People: Dairy Producer Quality of Life - Dairy producers' quality of life is an essential component if dairy farms are to be sustainable. Quality of life includes economic standard of living, as well as job satisfaction; personal health; time for family, friends, and leisure; and achieving life goals. People: Farm Employees Managing farm employees to ensure their rights are respected and the work environment is kept safe assists in promoting quality dairy production and supports a high quality work place.
Applicability to agriculture	This is an applicable and in depth benchmarking tool for dairy farmers that demonstrates a way of self-assessing farm culture, not only OH&S. The NCFH has contacted directly to learn of the success of the VCI and whether dairy farmers used the tool to track changes over time. To date they have tested the safety portions of the version 1.0 VCI with 30 farms and field tested version 4.0 with 15 farms. Progress has been slow to the US policy focus on measuring

	supply chain pressures for farmers (Andrew Whitman, personal communications July 2021).

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