Rural and Remote Health
MEDLINE listed
Impact factor .820
The International Electronic Journal of Rural and Remote Health Research, Education, Practice and Policy
ISSN 1445-6354

REVIEW ARTICLE

Suicide and accidental death in Australia's rural farming communities: a review of the literature

A Kennedy[1,2], MJ Maple[1], K McKay[1], SA Brumby[1,2]

[1]*University of New England, Armidale, New South Wales, Australia*

[2]*National Centre for Farmer Health, Deakin University, Hamilton, Victoria, Australia*

Submitted: *1 February 2013;* ***Revised:*** *13 June 2013;* ***Accepted:*** *20 July 2013;* ***Published:*** *20 February 2014*

Kennedy A, Maple MJ, McKay K, Brumby SA

Suicide and accidental death in Australia's rural farming communities: a review of the literature
Rural and Remote Health **14: 2517. (Online) 2014**

Available: http://www.rrh.org.au

ABSTRACT

Introduction: Australia's farmers constitute a heterogeneous group within the rural population. This literature review incorporates four broad areas: an understanding of farming communities, families and individuals and the contexts in which they live and work; an exploration of the challenges to morbidity and mortality that these communities face; a description of the patterns of suicide and accidental death in farming communities; and an outline of what is missing from the current body of research. Recommendations will be made on how these gaps may be addressed.

Methods: In developing this comprehensive literature review, a snowballing and saturation approach was adopted. Initial search terms included suicid*, farm*, accident*, fatal*, death, sudden death, rural OR remote, Australia and NOT Australia. Databases searched included SCOPUS, PubMed, Proquest and SafetyLit; research from 1995 onwards was examined for relevance. Earlier seminal texts were also included. Reference lists of retrieved articles were searched and citations explored for further relevant research material. The primary focus was on Australian peer-reviewed research with supplementary grey literature. International material was used as examples.

Results: The literature variously describes farmers as members of both rural farming communities and farming families, and as individuals within an occupational classification. Within each of these classifications, there is evidence of the cumulative impact of a multiplicity of social, geographical and psychological factors relating to work, living and social arrangements that impact the health and wellbeing of Australia's farmers and their families, particularly accidental death and suicide. Research consistently demonstrates traumatic death to be at a greater rate than in the general Australian population, with reductions found more recently in some modes of farming-related accidental death. Patterns of accidental death and suicide are commonly linked to the changing shape of contemporary farming. Suicide rates are also frequently described in relation to lethality and accessibility of means. The limitations of suicide and accidental death data are considerable.

Rural-and-Remote-Health
The International Electronic Journal of Rural and Remote Health Research, Education Practice and Policy

Conclusion: While there is consistent reporting of heightened levels of risk for suicide and accidental death in farming communities the limitations of the research remain significant. There are substantial gaps in current knowledge, and the body of research to date lacks clarity, inclusiveness and contextual specificity. Absent from the literature is any investigation of the impact of these frequently preventable deaths on the families and communities in which they occur. Recommendations for future research are suggested.

Key words: accident, Australia, death, farming, review article, rural communities, suicide.

Introduction

Almost one-third of Australians live in areas outside major cities, with just 2.3% of the population living in remote or very remote areas[1]. Similar patterns are found in other developed countries including New Zealand, North America and the UK. Within the research examining rural Australia, a number of common themes have emerged, including low population numbers and density, geographic isolation, a limited diversity of labor, small but intense social connections, a reluctance to share local problems, and conservative attitudes and values[2]. Rural Australia, however, must also be recognized as heterogeneous. Populations in many rural and remote settings are not replicated microcosms of the wider Australian society. Rather, diversity based on social, economic, agricultural, mining and culture is extensive across vast geographic areas.

Overall population growth is relatively consistent within major cities. However, a wide variability exists in rural and remote areas. Coastal areas with relative ease of access to populated areas frequently experience growth – particularly attributable to retirees – while population decline continues to be experienced by areas of inland rural Australia[3]. This is pronounced in areas where prolonged drought has been experienced[1]. In stark contrast, small pockets of extreme growth have been experienced in parallel to the mining boom over the last decade. Yet, much of the literature uses the term 'rural' to encompass all non-metropolitan communities[4,5], making analysis between and within discrete groups challenging.

Of the many varied people living in heterogeneous rural populations, the group on which this review will focus is farmers. A noted exclusion is where mining boomtowns and farming communities coexist; this unique situation is beyond the scope of this review. Once a collective enterprise to produce food for a community's survival, farming has globally diversified to include variations from subsistence farming by individuals to massive commercial production enterprises by multinationals, and a whole range in-between. Consequently, farming communities have diversified, leading to further variation within and between regions.

Given the diversity experienced by both rural, and specifically farming, communities, this review will explore the population characteristics and unique socially constructed elements of life and work in Australian farming communities, particularly in relation to health and wellbeing, morbidity and mortality. Premature death is a definitive indicator of the health and wellbeing of any community allowing for the consideration of both physical and mental health influences. Premature death rates through suicide and accidental death have been identified as particularly high in rural areas, with the majority of these deaths considered preventable[6]. Thus, the focus here is on preventable deaths leading to premature loss of life.

In small, close-knit farming communities, any death has an enormous impact on immediate family members, and extends across the community. Thus, the aim of this literature review is to explore and critique the current knowledge base related to the occurrence of death by suicide and accidental death in rural farming communities. The dominant focus will be on

Australian research, with international research as examples. This review will incorporate four broad areas:

- an understanding of farming communities, families and individuals and the unique social, geographical and psychological contexts in which they live and work
- an exploration of the challenges to morbidity and mortality that these communities face
- a description of the patterns of suicide and accidental death in farming communities
- an outline of what is missing from the current body of research and recommendations on how these gaps may be addressed.

Methods

In developing this comprehensive literature review, a search strategy was developed using key words to meet the aims of the review. Initial search terms used were suicid*, farm*, accident*, fatal*, death, sudden death, rural OR remote, Australia and NOT Australia. Boolean operators 'AND', 'OR' and 'NOT' were included to cover all possible combinations of these search terms. Databases searched were SCOPUS, PubMed, Proquest and SafetyLit, covering research from 1995 to February 2012. Searches were conducted within the title, abstract and keyword lists of each database. Duplicates were removed. This initial search yielded 1986 articles. Articles were then assessed on the basis of title and abstract in order to ascertain their relevance to this review. This second step reduced the total number of articles to 149. A more thorough evaluation of relevance was then conducted by accessing full-text versions of the literature according to the following criteria:

- The research reported on human subjects.
- The full text of the research article was in English.
- Research was either peer-reviewed or grey literature.
- Research focused on people residing and/or working in rural farming communities, as opposed to those on the urban fringes.
- Research focused on externally caused suicide or accidental death and excluded both injury not resulting in death and naturally caused death.
- Research focused on mortality patterns and/or contextual contributors to these patterns.
- Where data was covered in both the grey literature and peer-reviewed publications, preference was given to the latter format.

Due to the extensive amount of research internationally, the literature focus was necessarily limited to that originating in Australia or discussing the Australian context.

At this point a snowballing and saturation approach was adopted. Reference lists of retrieved articles were searched and citations explored for further relevant research material, to ensure both broad and deep coverage. Earlier seminal texts were also included. While the major focus of the review was on Australian peer-reviewed and grey literature, international research from North America and the UK has been selectively included within the review to provide contextually similar examples.

Results

The focus on Australia's farmers: communities, families and by occupation

Australia's farmers have been described within the literature in three main ways: as members of rural farming communities, as members of farming families and as individuals within an occupational classification. Each of these perspectives will be described in turn.

First, farmers live in rural communities. The small, tight-knit structure of rural farming communities creates an environment in which anonymity is rare, the consequences of social disruption are likely to be severe, and effective

adaptability to change is poor[7,8]. The progressive decline in population density within many farming communities – due largely to vulnerability to unpredictable climatic extremes and long-term agricultural restructuring[4,8] – has seen a gradual amalgamation of agricultural holdings, an increase in single-household properties and a reduced opportunity for social interaction and mutual support[9]. The cumulative flow-on effects include decreasing numbers of seasonal workers; threats to the viability of small business; reducing employment opportunities; higher rates of poverty; the withdrawal of critical services such as banks, business and healthcare; and the population drift of young community members towards metropolitan areas[8,10-12]. It is this collective impact of disadvantage that is considered to have the greatest impact on health and wellbeing[13].

Second, farmers belong to families. Despite the number of Australian farms reducing[14], approximately 99% have been classified as family-run enterprises, making them the dominant form of primary production[15]. Farming families also include those who may not classify themselves as 'farmers'[16-18]. This includes children and self-classified 'farmer's wives', 'farmer's husbands' and 'retired farmers', as well as those who may derive income off-farm[17]. Consideration of this last group is particularly important, given the increasing reliance of family-run farms on off-farm income[19]. Research identified 72% of women as working off-farm to secure income for their family in drought-stricken areas[10]. Farming families frequently display unique living and working arrangements, and unique family structures. Female farmers are more likely to marry into rural areas while male farmers tend to live and work in the same rural area all their lives[4]. The common practice of farming with multiple generations of the one family contributes to hierarchical and patriarchal familial bonds, the persistent adoption of traditional (frequently unsafe) work practices, and the challenges of succession planning[20]. Multi-generational farm families may also have older generations who, while no longer officially employed on the farm, continue to contribute to farm work[4,21]. Given the context of family farming, divisions between work and family are often blurred. For example, work does not occur within a set 9 am to 5 pm timeslot, and often weekends are simply extra workdays, perhaps with more helping hands as children and spouses may be available to assist[22].

Third, farming is classified as an occupation. A common focus of farmers as an occupational group has resulted in research on those who derive their main source of income from farming[16]. When described as an occupational group, Australia's farmers are a male-dominated[18] ageing population[15] in an industry with no clear designated retirement age[23]. While the numbers of farmers rise with increasing remoteness, the income they earn decreases[18]. For those farmers with co-located living and working arrangements, isolation – both geographic and social – has been reported[24]. Farmers work long irregular hours, and frequently labor on their own[25], adding to their social isolation. As farms grow in size and stretch further apart, farmers increasingly rely on large scale mechanization[26]. This further reduces direct social contact[27] in favor of more 'virtual' forms of communication[28]. Perhaps as a consequence of this isolation, farmers have been identified as physically tough and stoic[29]; features reinforced by strong traditional male gender roles[4].

It is clear from the preceding paragraphs that it is the cumulative impact of a multiplicity of factors relating to work, living and social arrangements that impact the health and wellbeing of Australia's farmers and their families. This impact can be best understood through an examination of morbidity and mortality patterns, particularly in relation to deaths that are premature and often preventable.

Exploring the morbidity and mortality of Australia's farmers

The unique geographical, social and psychological contexts within which farming families exist pose a significant challenge to morbidity and mortality. The following section will briefly examine threats to morbidity and mortality among rural communities generally, and then focus more specifically on farming families.

Although there are benefits to living outside of major cities, there are also disadvantages that can be masked by unrealistically positive visions of rural life[30]; what some may consider an advantage, others may see as a drawback. For example, wide open space may be seen as liberating by some yet isolating and intimidating by others[31]. The health and wellbeing statistics relating to rural populations frequently paint a bleak picture. According to the Australian Bureau of Statistics[3], people in rural areas have a life expectancy 4 years lower than those in major cities. Outside of major cities, obesity levels increase along with risky health behaviors such as smoking and alcohol misuse. High-risk alcohol consumption is linked to greater associated risks in rural areas – such as alcohol-related violence, chronic health conditions and drink driving. Alcohol-related vehicle fatalities are seven times higher in rural areas when compared with urban areas[32]. Road traffic crashes are consistently identified as elevated in rural areas with recorded rates approaching four times the national annual fatality rate[3,33] and the rate for major cities[34]. Local residents account for the majority of these road traffic deaths[35]. A number of other causes of accidental death have been identified as elevated within rural areas. These include rising rates of fatality due to fire, drowning and poisoning (due to alcohol, agricultural chemicals, motor vehicle exhaust gas, petroleum products, food and toxic plants); rates also appear to increase with remoteness[33]. Rural populations have also been identified as having an elevated risk of suicide[24], with a 66% higher risk of death than those in metropolitan areas[3].

Increased morbidity and mortality in farming families

As a unique group within the broader rural population, farmers and their families face a range of specific challenges to morbidity and mortality. Farmers suffer high levels of chronic body pain[30]. When compared with Australian national averages, elevated levels of obesity and alcohol misuse and heightened risks for hypertension and diabetes are also reported[36].

Intense seasonal work patterns and a tendency towards high-risk behavior combine in rural areas[2], particularly for farmers[13,37]. With this comes a belief in the inevitability of farm injuries[38]. International research has identified a fatalistic culture in farmers who recognize their occupation to be dangerous and unpredictable yet believe that little can be done about farm safety and health[39]. These characteristics are thought to stem from the traditional isolation associated with rural and remote settlements and have resulted in an expectation of being able to meet your own needs without outside assistance[5]. Such accepting attitudes regarding injury form an inherited pattern, as children are frequently exposed to a range of hazards – both natural and work-related – that are unique to the farming environment[22]. Boys, in particular, are taught to adopt risk-taking behaviors in order to demonstrate masculinist ideals[40]. Risky masculinist practices include learning to drive farm vehicles and machinery from a very young age, as well as the use of firearms[37]. The outcome of presumed injury inevitability is arguably realized in high levels of farming-related accidental fatalities[41,42].

Accidental death

Quality information relating to farming deaths is a relatively new phenomenon. No satisfactory records of accidental injury or death occurring in agricultural production existed until late last century[43]. Commencing in the early 1980s, farming-related fatalities were investigated as part of a broader investigation of all work-related fatalities in Australia through an examination of coroner's files[44]. This focus has changed over time from one of farming as an occupation to one where the farm is viewed as a working environment, primarily in response to changing data collection methods[45]. Accidental occupational farm deaths have tended to be most prevalent among ageing males[46] who are residents of the farm[45]. These deaths frequently involve tractors[47,48] and, more recently, include growing rates of quad-bike fatalities[43]. Deceased workers are most likely to have been working alone and be found by co-workers, relatives, or people who are both co-worker and relative[45]. Bystander deaths are also reported on farms and commonly involve young children[44]; these deaths are more likely to be drowning or, increasingly,

quad-bike fatalities[41,42]. The majority of children dying from accidental farming-related injuries are residents on the farm[49]. However, 30% were visiting the farm at the time of their death.

However, in recent years, farming-related fatalities have been identified as generally decreasing[41,45]. Such patterns have been explained in a number of ways. Declining tractor deaths have been attributed to national safety programs[45] that included compulsory and subsidized retrofitting of roll-over protection (ROPS). Despite the implementation of safety features on many tractors, there remains a commonly adopted practice of retaining at least one 'old' tractor on the farm for 'odd jobs'. These tasks frequently have the greatest risk of resulting in an injury event[48].

While general rates of farming-related accidental death may be decreasing, some patterns of death remain at high levels and others are still increasing. For example, while tractor roll-over deaths have reduced, run-over accidents persist[45,48] and quad-bike deaths are reported as either remaining high or increasing[42,43]. Quad-bike deaths have risen from one to ten deaths per year in Australia within the space of two decades[50]. Of the 76 registered quad-bike deaths for the period 2000–2005, 53 were farm-related, 15 non-farm-related and 8 unknown[50]. Children account for 17% of all farm fatalities, with drowning constituting almost half of all child farm deaths. A total of 25 child drowning fatalities have so far been recorded for the period 2003–2006[42]. Farm fatality statistics may be underestimated due to current data collection procedures[42].

The changing practices of contemporary farming are reflected in the shifting patterns of farming-related accidental deaths. These changes in both farm practice and farm-related accidental deaths place a significant burden on the mental health of individuals and families involved in primary production, the implications of which are the focus of the next section.

Farmer mental health and wellbeing

The economic, health and climatic struggles of Australian farming communities in recent decades – and the flow-on effect to the broader rural community – have been exhaustively described[8,12,51]. Australian findings have also been supported by international research[52]. In brief, these include a decreasing income combined with higher workload demands, extreme and unpredictable climatic patterns, an increasing burden of government-imposed regulatory requirements and a decline in rural infrastructure and subsequent opportunities for social connection[12]. Of concern is Australian farmers' resistance to change when confronted by adverse conditions, predominantly due to their strong connection with traditional, rural ideologies[53]. Rising rates of families leaving long-held farming enterprises and increasing levels of self-reported psychological distress have been reported among farmers[12,36]. In reviewing the literature, McKay et al[54] described farmers' aversion to seeking help for mental health issues in relation to a number of factors. These included the stigma reinforced by the traditional masculinist paradigm of farming, heavy and unrelenting work demands, lack of access (because of both tangible and psychological barriers) to physical and mental health services, and a traditional focus on 'practical' problem solving as opposed to 'seeking help'. An extreme outcome of these characteristics is elevated suicide rates[18], the research focus of the next section.

Farmer suicide

Australian farmer suicide research is based on data regarding farmers as an occupational group[21,55,56] and as residents of farming enterprises[57]. Within the occupational focus, further differentiation has been made between suicide among farm managers and farm/agricultural laborers[21]. Compared with other occupational groups, those involved in farm work have been identified as a risk group for suicide death[21,55]. Both agricultural laborers and farmers/farm managers have higher suicide rates than those in other occupational groups[55]. Page and Fragar's[21] analysis of the period from 1988 to 1997 identified 921 farm suicides, 97% of whom were male. Age-standardized rates of suicide for farm managers were as high as 51.4/100 000 – 2.19 times the comparative national rate. Of the 621 farm manager suicides, almost half occurred in ageing farmers 55 years and over. The identified patterns of

suicide death were reversed in agricultural laborers, with over half of the 300 suicides occurring in the 15–39 years age bracket. This younger farming population had age-standardized suicide rates of up to 41.9/100 000. Firearms accounted for 51% of farmer suicides, compared with 23% of suicides among the general Australian male population during the same time period[21]. Higher rates of firearm suicide among farmers when compared with the general population is a trend supported by international research[58]. This pattern has been attributed to the easy accessibility of firearms for farmers who commonly use guns for pest reduction and livestock euthanasia[21]. This trend is supported by other Australian[59] and international[60,61] research identifying links between occupationally specific suicide patterns, familiarity with death and ready access to means (for example, veterinarians and medical doctors). The accessibility and lethality of firearms has also been posited as increasing the risk of death from an impulsive suicidal act[58]. Accessibility and lethality of means, along with a decisive and practical approach to problem solving and a functional attitude towards death, combine to make suicide a potentially 'logical' course of action for farmers[16,62].

It should be noted that female suicide patterns have been largely ignored in occupational research, other than admitting that recorded rates are small, yet likely to be underestimated, and subsequently eliminating them from further analysis[21]. In many instances, farm family members and other farm residents who are equally exposed to the vagaries of the rural economy, and the stresses and strains of farm life – including women and older generations of the family who are technically retired but still contribute to farm work – are not identifiable in agricultural occupational classifications[21]. Miller and Burns'[57] approach to farmer suicide came as a reaction to the failure of previous research to consider the broader impact of farming–related suicide beyond an occupational hazard. Using a combination of techniques, both the number of people living on farms and the corresponding rate of suicide deaths for this population was calculated. Measured during the same time period, the suicide rate of farm residents was reported to be 21.6 deaths/100 000; this was 1.66 times the suicide rate of the general population, which was 13/100 000[57].

However, there is some indication that farmer suicide patterns may have changed over recent years. While firearms remain the most commonly used suicide method among farmers (39.0%), Victorian data for the period 2001–2007 has identified an increased use of hanging (34.6%), another highly lethal and readily available means[56]. Tightening gun control may explain this shift in suicide method, although evidence is inconclusive as to whether such legislation reduces the overall incidence of suicide or results in the use of an alternative method[63,64]. Research reported by Guiney[56] detected no increase in the rate of farmer suicide during a period of extreme drought and suggested the possible influence of an increase in effective management of suicide risk for farmers through improved services and resilience-building strategies.

This focus includes farmers living on-farm and their families; however, it fails to consider farmers who live off-farm but may also be exposed to the stresses and strains of farming. This sub-population of farmers may have a different pattern of risk and support factors than those for whom living and work are co-located. It seems likely that the greater proportion of those farmers not living on-farm may fall into the occupational classification of farm/agricultural laborers. Consequently, this may go some way to accounting for the different patterns of suicide mortality between farm owners/managers and farm/agricultural laborers.

The limitations of mortality data

In developing a representative picture of suicide and accidental death in farming communities, it is necessary to also understand the limitations of the data utilized within the literature. A range of factors limit the accuracy, relevance and generalizability of mortality data within farming communities, most notably when considering accidental death and suicide. Issues relating to data management impact the reporting of all accidental and suicide deaths, including coding practices, data amalgamation procedures and data-reporting practices. Australian Bureau of Statistics coding

practices, particularly for data between 2002 and 2007, have led to significant recording errors of both suicide and accidental death rates[65]. This has had the effect of under-reporting suicide deaths[66] and over-counting accidental deaths[33]. Changes to the collection procedures of coroner's data[45] also impact the comparability of data over time. New coding and revision processes introduced by the Australian Bureau of Statistics in 2007 are expected to improve data accuracy but maintain the problem that the availability of data is delayed for several years following a reference year[41]. The utilization of mortality data for accidental death and suicide research specifically within farming communities has a number of unique problems. The data on which much of the accidental research has been based were originally collected for the purposes of coroners' inquiries and not to examine epidemiological aspects of agricultural or on-farm fatalities, which may be relevant to understanding the death[45]. Changes to occupational coding[41] and the focus from accidental deaths as an outcome of occupation to one of location[45] restrict comparability of farm-fatality data over time. Further restricting comparability is a combination of data sources ranging from the national databases of the Australian Bureau of Statistics[33,67] and the Australian Institute of Health and Welfare[68-70], to data from state-based health services[34] and road authorities[32,35]. While some mortality data may originate from a single source it is then frequently supplemented by a range of other data to compensate for limitations in data availability and quality[34]. While this may improve the ultimate quality of the data, it does lead to restrictions in data generalizability. The use of varying accidental death data sources has resulted in the exclusion of some sample sub-groups from some farming-related research. For example, children were excluded from one Victorian study[71] despite the identification of significant death rates among the very young by other researchers[44,49]. A further example is the inclusion of members of the forestry and fishing industries in some samples[72], who are then excluded in others[71]. This irregularity is exacerbated by inconsistent definitions. For example, despite the increasing involvement of quad-bike deaths in accidental farming-related death, motorbike fatalities are not always specifically defined as involving two or four-wheel bikes[71]. Further, 'farm' and 'farm worker' are also particularly inconsistently defined[45]. The reclassifications of farms in 1990[45] and 2006[41] have led to an increase in the number of recognized farming establishments. This not only influences the calculation of rates of death per establishment, but masks the influence of reducing farm (and farmer) numbers – due to factors such as ongoing drought and economic decline – on fatality rates.

Given the large scale of some farming areas, small absolute numbers of accidental or suicide deaths in some areas create a number of challenges, including small suicide population-based rates as well as the risk of potentially identifying information being published. Small absolute numbers also affect the meaningful calculation of relative rates, particularly when considering the impact of female deaths[18] where absolute death rates are far lower than males for both accidental[42] and suicide deaths[21]. This has resulted in some farmer suicide research excluding female fatalities from consideration[21]. A related impact of small absolute death numbers has resulted in accidental death rates in some rural areas being suppressed to maintain confidentiality[67]. The utilization of contemporary remoteness classifications further complicates the challenges of small sample sizes. While developments have been made in remoteness classifications to increase the detail of regional descriptions, this detail is often lost in mortality research. The amalgamation of remoteness categories has been justified by the need to obtain more meaningful analysis of small absolute numbers of suicide deaths but results in a greatly simplified rural–urban division[73]. Given that farming may be conducted in very remote areas (in the case of large beef properties), as well as on the fringes of urban areas (in the case of market gardening), much of the detail of the heterogeneity of rural or remote areas is thus lost in the context of this methodology.

The reporting of a definitive cause of death is not always clear-cut[74]. The International Classification of Diseases – Version 10 (ICD-10) underpins the coding of cause of death in Australia and enables deaths to be coded by both mechanism and intent[75]. Some deaths, including single-vehicle accidents, drug overdoses and drowning, may be

suspected as suicide but may, as a result of limited information, be classified as accidental due to the absence of any surety of intent[74]. Particularly relevant to farming communities, less indicative methods used by females compared with males (eg overdose as opposed to firearms) may conceal female suicides and erroneously increase accidental death rates. Farming communities may also report fewer suicides due to concerns about stigma and confidentiality[74]. De Leo et al[74] caution that these hypotheses require confirmation. Within farming communities, where survival of a family farm following a death may rely on successfully claiming an insurance policy, suicide has been reportedly concealed:

> *… inaccurate recording of the cause of death can occur through the intention to avoid financial hardship for a family – especially in smaller communities where families know each other and socialise together*[76].

Australian mortality data is unlikely ever to be completely accurate as it relies on the collection of human-interpreted data from inconsistently resourced states and territories with varying death registration and coronial legislation. These concerns have been particularly noted for suicide[24] but are also relevant for accidental death. The data reviewed by the coroner relies on an accurate investigative process by police and medical examiners. However, no standardized process for investigating a possible suicide death currently exists across Australia[74]. Consequently, numerous human elements may directly or indirectly influence the reporting of suicide including human error, stigma and family pressures[24]. This raises the need for a more integrated approach to understanding death in farming communities to gain a more accurate picture of preventable death, along with the broader health and wellbeing of these communities. Farm-fatality research expressly excludes any consideration of suicide within the data collected[17,44,45]. The exclusion of suicide from farming-related deaths research has been justified 'due to the difficulty of deciding if they were work-related'[45]. However, these deaths continued to be excluded 'even if there appeared to be some direct connection with work'[45]. This exclusion is confusing given the link research has identified between suicide and farming both within Australia[21,57] and internationally[58,77,78]. The exclusion of suicide as a farming-related death compounds the already pronounced stigma around suicide within rural areas[76].

Discussion

The literature reviewed offers a significant foundation from which to understand the contextual influences and patterns of morbidity and mortality among farming communities. It is important, however, to recognize the limitations of the current research and the significant gaps in existing knowledge. This section provides recommendations for a more integrated and contextualized understanding of fatalities within farming communities as an outcome of accidents or suicide. Further extending this discussion will be recommendations for considering not only the patterns of mortality, but also the subsequent impact of death by accident or suicide on farming communities.

Research investigating death by preventable causes, including suicide and accidents, currently lacks clarity, inclusiveness and contextual specificity. Complexity in the systems identifying and recording data, along with human error, exacerbate these shortcomings. Extending data collection points, such as including family members in postmortem investigations, may increase clarity. Further, fatality data needs also to include all members of the population who live or work within the unique context of farming. This includes those classified by occupation as farmers as well as those who self-identify as members of farming families – regardless of whether they earn an income from farm work – who are equally exposed to the vagaries of the rural economy, and the stresses and strains of farm life. Until such an inclusive focus is developed, the ability to draw encompassing conclusions relative to the occurrence of suicide and accidental death in the unique context of farming communities is limited.

Absent from the literature is any investigation of the level of impact suicide and accidental death have on members of Australian farming communities. Despite the recognition that

farmers and farming families live and work in a unique social, geographical and psychological context, there is no knowledge of whether this influences the effect of externally caused death on this cohort, either positively or negatively. Given the elevated mortality risk following death by external causes – particularly suicide – it is critical that bereavement following such modes of death is explored.

Conclusion

Suicide and accidental death haves an enormous impact on the families and communities in which they occur, an impact arguably exacerbated when in smaller communities. The unique context of farming communities – where social connections are limited and anonymity is low; where masculinist ideals are preserved despite their hindrance to health and wellbeing; and where fatalistic attitudes persist in the face of elevated mortality rates – presents additional challenges to understanding and responding to these deaths. Until research is able to explore and understand death by external causes in a way that recognizes the specific experience of farming communities, there is little hope of being able to prevent further deaths and adequately support those bereaved by such tragic loss.

References

1. Australian Bureau of Statistics. *Regional population growth, Australia, 2009–2010*. (Online) 2011. Available: http://www.abs.gov.au/ausstats/abs@.nsf/Products/3218.0~2009-10~Main+Features~Main+Features?OpenDocument (Accessed 3 July 2012).

2. Ward N. *The culture of traffic safety in rural America. Improving traffic safety culture in the United States.* Washington DC: AAA Foundation for Traffic Safety, 2007.

3. Australian Bureau of Statistics. *Australian social trends March, 2011: health outside major cities.* (Online) 2011. Available: http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/LookupAttach/4102.0Publication25.03.114/$File/41020_HealthOMC_Mar2011.pdf (Accessed 16 June 2012).

4. Alston M. Rural male suicide in Australia. *Social Science and Medicine* 2012; **74(4)**: 515-522.

5. Fuller J, Edwards J, Procter N, Moss J. How definition of mental health problems can influence help seeking in rural and remote communities. *Australian Journal of Rural Health* 2000; **8(3):** 148-153.

6. Weerasinghe DP, Yusuf F, Parr NJ. Life lost due to premature deaths in New South Wales, Australia. *International Journal of Environmental Research and Public Health* 2009; **6(1):** 108-120.

7. Bourke L. Rural communities. In: Bourke L, Lockie S (Eds). *Rurality bites: the social and environmental transformation of rural Australia.* Annandale: Pluto Press; 2001; 118-128.

8. Tonna A, Kelly B, Crockett J, Greig J, Buss R, Roberts R, et al. Improving the mental health of drought-affected communities: an Australian model. *Rural Society* 2009; **19(4)**: 296-305.

9. Stayner R. Families and the farm adjustment process. In: Lees J (Ed). A *Legacy under threat? Family farming in Australia*. Armidale: University of New England, 1997; 121-145.

10. Alston M, Kent J. *Social impacts of drought: a report to NSW Agriculture.* Wagga Wagga: Centre for Rural Social Research, Charles Sturt University, 2004.

11. Muenstermann I. Where the crows fly backward and women explore their choices. *Rural Society* 2010; **20(Suppl):** 25-41.

12. Fragar L, Henderson A, Morton C, Pollock K. *The mental health of people on Australian farms – the facts.* Barton, ACT: National Farm Injury Data Centre, 2007.

13. Smith KB, Humphreys JS, Wilson MGA. Addressing the health disadvantage of rural populations: how does epidemiological evidence inform rural health policies and research? *Australian Journal of Rural Health* 2008; **16(2):** 56-66.

14. Australian Bureau of Statistics. *Australian social trends – living arrangements: Farming families*. (Online) 2003. Available: http://www.abs.gov.au/Ausstats/ABS@.nsf/7d12b0f6763c78caca257061001cc588/cdcd7dca1f3ddb21ca2570eb00835393!OpenDocument (Accessed 21 August 2012).

15. National Farmers Federation. *NFF farm facts: 2012*. Barton, ACT: NFF, 2012.

16. Judd F, Jackson H, Fraser C, Murray G, Robins G, Komiti A. Understanding suicide in Australian farmers. *Social Psychiatry and Psychiatric Epidemiology* 2006; **41(1):** 1-10.

17. Franklin R. *Epidemiology of farm injuries in New South Wales*. PhD thesis. Sydney, NSW: University of Sydney, 2007.

18. Kolves K, Milner A, McKay K, De Leo D (Eds). *Suicide in rural and remote areas of Australia*. Brisbane: Australian Institute for Suicide Research and Prevention, 2012.

19. Bureau of Rural Sciences. *2008 country matters: social atlas of rural and regional Australia*. Canberra: Department of Agriculture, Fisheries and Forestry, 2008.

20. Frank AL, McKnight R, Kirkhorn SR, Gunderson P. Issues of agricultural safety and health. *Annual Review of Public Health*. 2004; **25:** 225-245.

21. Page AN, Fragar LJ. Suicide in Australian farming, 1988-1997. *Australian and New Zealand Journal of Psychiatry* 2002; **36(1):** 81-85.

22. Franklin R, Fragar L, Page A. *The health and safety of SA farmers, farm families and farm workers.* Moree: Australian Agricultural Health Unit, 1999.

23. Voaklander D, Hartling L, Pickett W, Dimich-Ward H, Brison RJ. Work related mortality among older farmers in Canada. *Canadian Family Physician* 1999; **45(December):** 2903-2910.

24. The Australian Senate. *The hidden toll: suicide in Australia*. Canberra: Senate Community Affairs Secretariat; 2010.

25. Hard DL, Myers JR. Adoption of rollover protective structures (ROPS) on U.S. farm tractors by state: 1993–1995, 2001, and 2004. *Journal of Agricultural Safety and Health* 2011; **17(2):** 157-172.

26. Sturgeon R, Morrissette PJ. A qualitative analysis of suicide ideation among Manitoban farmers. *Canadian Journal of Counselling* 2010; **44(2):** 191-207.

27. Gallagher AG, Sheehy NP. Suicide in rural communities. *Journal of Community &Applied Social Psychology* 1994; **4(3):** 145-155.

28. Milner A, McClure R, Sun J, De Leo D. Globalisation and suicide: an empirical investigation in 35 countries over the period 1980-2006. *Health and Place* 2011; **17(4)**: 996-1003.

29. Perceval M, Fuller J, Holley AM. Farm-link: improving the mental health and well-being of people who live and work on NSW farms. *International Journal of Mental Health* 2011; **40(2):** 88-110.

30. Brumby S, Chandrasekara A, McCoombe S, Kremer P, Lewandowski P. Farming fit? Dispelling the Australian agrarian myth. *BMC Research Notes* **4**:89. (Online) 2011. Available: http://www.biomedcentral.com/1756-0500/4/89 (Accessed 13 March 2012).

31. Nicholson LA. Rural mental health. *Advances in Psychiatric Treatment* 2008; **14(4)**: 302-311.

32. Czech S, Shakeshaft AP, Byrnes JM, Doran CM. Comparing the cost of alcohol-related traffic crashes in rural and urban environments. *Accident Analysis and Prevention* 2010; **42(4):** 1195-1198.

33. Henley G, Harrison JE. *Injury deaths, Australia 2004–2005*. Adelaide: Australian Institute of Health and Welfare, 2009.

34. Ballestas T, Xiao J, McEvoy S, Somerford P. *The epidemiology of injury in Western Australia, 2000–2008*. Perth: Department of Health Western Australia, 2011.

35. Tziotis M, Roper P, Edmonston C, Sheehan M. Road safety in rural and remote areas of Australia. In: *22nd ARRB Conference – Research into Practice*. 22nd ARRB Conference, Canberra, Australia. Melbourne: ARRB Group Ltd, 2006.

36. Brumby S, Kennedy A, Chandrasekara A. Alcohol consumption, psychological distress and physical health in farming communities – an Australian study. *Journal of Rural Health* **00:** 1-9 (prepublication online release). (Online) 2013. Available: http://onlinelibrary.wiley.com/doi/10.1111/jrh.12001/abstract;jsessionid=C2C939E9312867906A3594E5C4506250.d03t03 (Accessed 28 January 2013).

37. Courtenay WH. Constructions of masculinity and their influence on men's well-being: a theory of gender and health. *Social Science and Medicine* 2000; **50:** 1385-1401.

38. Robertson SM, Murphy DJ, Davis LA. Social and emotional impacts of farmwork injuries: an exploratory study. *Journal of Rural Health* 2006; **22(1):** 26-35.

39. Murphy DJ. *Looking beneath the surface of agricultural and safety and health*. St Joseph, Michigan: American Society of Agricultural Engineers, 2003.

40. Bourke L. Toward understanding youth suicide in an Australian rural community. *Social Science and Medicine* 2003; **57(12):** 2355-2365.

41. Herde E, Lower T. *Farm injury related deaths Australia 2003-06*. Moree: Australian Centre for Agricultural Health and Safety, 2011.

42. Lower T, Herde E. Non-intentional farm injury fatalities in Australia, 2003-2006. *New South Wales Public Health Bulletin* 2012; **23(1-2):** 21-26.

43. Fragar L, Pollock K, Morton C. The changing profile of Australian farm injury deaths. *Journal of Occupational Health and Safety – Australia and New Zealand* 2008; **24(5)**: 425-433.

44. Erlich SM, Driscoll TR, Harrison JE, Frommer MS, Leigh J. Work-related agricultural fatalities in Australia, 1982–1984. *Scandinavian Journal of Work, Environment & Health* 1993; **19(3)**: 162-167.

45. Franklin R, Mitchell R, Driscoll T, Fragar L. *Farm-related fatalities in Australia, 1989-1992*. Moree: Australian Centre for Agricultural Health and Safety, National Occupation Health and Safety Commision, and Rural Industries Research and Development Corporation, 2000.

46. Lower T, Fragar L, Temperley J. *Health and safety on Australian farms*. (Online) 2011. Available: http://www.rirdc.gov.au (Accessed 10 February 2012).

47. Day LM. Farm work related fatalities among adults in Victoria, Australia: the human cost of agriculture. *Accident Analysis and Prevention* 1999; **31(1-2):** 153-159.

48. Miller J, Fragar L. *Farm machinery injury: injury involving tractor run-over*. Barton, ACT: Rural Industries Research and Development Corporation, and Australian Centre for Agricultural Health and Safety, 2006.

49. Mitchell RJ, Franklin RC, Driscoll TR, Fragar LJ. Farm-related fatalities involving children in Australia, 1989–92. *Australian and New Zealand Journal of Public Health* 2001; **25(4):** 307-314.

50. Fragar L, Pollock K, Morton C. *ATV injury on Australian farms – the facts*. Barton, ACT: Australian Centre for Agricultural Health and Safety, 2007.

51. Brumby S. The flow on effect of poor health on farmers, families, farms and communities. In: Policy launch presentation: rural directions for a better state of health. Echuca, VIC. (unpublished), 2005.

52. Villa M. Born to be farmers? Changing expectations in Norwegian farmers' life courses. *Sociologia Ruralis* 1999; **39(3):** 328-342.

53. Alston M. Socio-cultural factors and family farming. In: J Lees (Ed). *A legacy under threat? Family farming in Australia*. Armidale: University of New England, 1997; 99-120.

54. McKay K, Milner A, Kolves K, De Leo D. Suicide behaviours in rural and remote areas in Australia: a review. In: K Kolves, K McKay, A Milner, D De Leo (Eds). *Suicide in rural and remote areas of Australia*. Brisbane: Australian Institute for Suicide Research and Prevention, 2012; 7-18.

55. Gun RT, Lang, ley LJ, Dundas SJ, McCaul K. *The human cost of work: a review of the occurrence and causes of occupational injury and disease in South Australia*. Adelaide, SA: South Australian Health Commission, 1996.

56. Guiney R. Farming suicides during the Victorian drought: 2001–2007. *Australian Journal of Rural Health* 2012; **20(1):** 11-15.

57. Miller K, Burns C. Suicides on farms in South Australia, 1997–2001. *Australian Journal of Rural Health* 2008; **16(6):** 327-331.

58. Booth N, Briscoe M, Powell R. Suicide in the farming community: methods used and contact with health services. *Occupational and Environmental Medicine*. 2000; **57(9)**: 642-644.

, **59**. Jones-Fairnie H, Perroni P, Silburn S, Lawrence D. Suicide in Australian veterinarians. *Australian Veterinary Journal* 2008; **86(4):** 114-116.

60. Bartram DJD, Baldwin DSD. Veterinary surgeons and suicide: a structured review of possible influences on increased risk. *The Veterinary Record* 2010; **166(13):** 388-397.

61. Hawton K, Clements A, Simkin S, Malmberg A. Doctors who kill themselves: a study of the methods used for suicide. *QJM: An International Journal of Medicine* 2000; **93(6):** 351-357.

62. Gunn K, Kettler L, Skaczkowski G, Turnbull D. Farmers' stress and coping in a time of drought. *Rural and Remote Health* **12**:2071. (Online) 2012. Available: http://www.rrh.org.au (Accessed 12 February 2012).

63. Lester D. Preventing suicide by restricting means to methods for suicide. *Archives of Suicide Research* 1998; **4:** 7-24.

64. De Leo D, Dwyer J, Firman D, Neulinger K. Trends in hanging and firearm suicide rates in Australia: substitution of method? *Suicide and Life-Threatening Behavior* 2003; **33(2):** 151-164.

65. Harrison JE, Pointer S, Elnour AA. *A review of suicide statistics in Australia*. Adelaide: Australian Institute of Health & Welfare, 2009.

66. De Leo D. Suicide mortality data need revision. *Medical Journal of Australia* 2007; **186(3):** 157-158.

67. Henley G, Kreisfeld R, Harrison J. *Injury deaths, ?Australia 2003–04*. Adelaide: Australian Institute of Health and Welfare, 2007.

68. Australian Institute of Health and Welfare. *Health in Rural and Remote Australia*. Canberra: AIHW, 1998.

69. Australian Institute of Health and Welfare. *Rural, regional and remote health: a study on mortality*. Canberra: AIHW, 2003.

70. Australian Institute of Health and Welfare. *Rural, regional and remote health: a study on mortality*, 2nd edn. Canberra: AIHW, 2007.

71. Day L, Boulter J, McGrath A. Hazard exposure among farmers in Victoria, Australia. *Journal of Occupational Health and Safety – Australia and New Zealand*. 1999; **15(1):** 53-60.

72. Australian Safety and Compensation Council. *Compendium of Workers' Compensation Statistics Australia, 2006–07*. Barton, ACT: Commonwealth of Australia, 2009.

73. Pearce J, Barnett R, Jones I. Have urban/rural inequalities in suicide in New Zealand grown during the period 1980–2001? *Social Science & Medicine* 2007; **65(8):** 1807-1819.

74. De Leo D, Dudley MJ, Aebersold CJ, Mendoza JA, Barnes MA, Harrison JE, et al. Achieving standardised reporting of suicide in Australia: rationale and program for change. *Medical Journal of Australia* 2010; **192(8):** 452-456.

75. Australian Bureau of Statistics. *Suicides, Australia, 2010*. (Online) 2012 (updated 24/07/2012). Available: http://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/3309.0Main Features12010?opendocument&tabname=Summary&prodno=3309.0&issue=2010&num=&view= (Accessed 29 July 2012).

76. Lifeline Australia. *Submission to The hidden toll: suicide in Australia*. Canberra, ACT: Lifeline Australia, 2010.

77. Sarma K, Kola S. The socio-demographic profile of hanging suicides in Ireland from 1980 to 2005. *Journal of Forensic and Legal Medicine* 2010; **17(7):** 374-377.

78. Stark C, Gibbs D, Hopkins P, Belbin A, Hay A, Selvaraj S. Suicide in farmers in Scotland. *Rural and Remote Health* **6(1):** 509 (Online) 2006. Available: http://www.rrh.org.au (Accessed 12 February 2012).