DOCTORATE IN CLINICAL PSYCHOLOGY

An Exploration of Suicidality in Farmers

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Introductory Chapter: Thesis Overview

The following thesis presents two papers investigating suicidality in farmers. The first paper, a systematic review, identifies and consolidates the existing literature relating to farming suicide. The second, an empirical paper, explores the relationship between adverse events on the farm, such as extreme weather and disease, and suicidal ideation in farmers.

Suicide represents an incredibly tragic, yet often preventable, public health problem (Knox, Conwell, & Caine, 2004; World Health Organization, 2012). Consequently, existing research has sought to identify those most at risk (Arnautovska, McPhedran, & De Leo 2014). Farmers, for instance, have been found to be at an elevated risk of suicide in many countries across the world (Andersen, Hawgood, Klieve, Kõlves, & De Leo, 2010; Booth, Briscoe, & Powell, 2000; Gallagher, Kliem, Beautrais, & Stallones, 2008; Kelly, Charlton, & Jenkins, 1995; Milner, Spittal, Pirkis, & LaMontagne, 2013). Likewise, in the United Kingdom (UK), farmers are considered one of the occupational groups at greatest risk of suicide (Malmberg, Simkin, & Hawton, 1999). Moreover, in recent years the popular media has drawn significant attention to this crisis. However, despite being widely acknowledged, the reasons for the high suicide rates in farmers still remain unclear (Andersen et al., 2010; Malmberg et al., 1999; Walsh, 2000).

The need to address the high risk of suicide within the farming community is nevertheless undeniable (Hossain, Eley, Coutts, & Gorman, 2008). However, the lack of existing knowledge has impeded the development of appropriately tailored interventions and suicide prevention strategies (Arnautovska et al., 2014; Arnautovska, McPhedran, Kelly, Reddy, & De Leo, 2016; Malmberg, Hawton, & Simkin, 1997). A better understanding of the risk factors that lie behind the elevated suicide rates in farmers is therefore required (Bossard, Santin, & Guseva Canu, 2016; Skegg, Firth, Gray, Cox, & psychiatry, 2010; Stallones, 1990).

Existing research has attempted to identify factors that may account for the high rate of suicide in farmers (Booth, Briscoe, Powell, 2000). The impact and interaction of many of these factors, however, still remains ambiguous (Bossard et al., 2016). The systematic review, therefore, aimed to identify, evaluate and consolidate existing international research in order to develop a more conclusive understanding about the risk factors for suicide in farmers (Rodgers, 2011). The review identified seven overarching themes that encompass a number of risk factors. These were demographics, suicidality, coping strategies, health, life events, relationships and support, and farm information. Accordingly, the review concluded that multiple risk factors may contribute to suicide in farmers and, subsequently, it is suggested that they are considered collectively in future research and suicide prevention strategies.

The majority of existing research is retrospective, which can certainly be helpful in determining the events that precede suicide and identifying the people most at risk (Platt, Hawton, Simkin, & Mellanby, 2012). However, it can also be difficult to pinpoint from retrospective research the specific antecedents that cause people to consider suicide and, subsequently, establish appropriate points for intervention. For example, a widely acknowledged trigger for suicidality in the general population is the experience of adverse life events (Bennett & McMichael, 2010; Farmer et al., 2000). Accordingly, as farming is often associated with a unique set of stressors, including unpredictable and uncontrollable circumstances, frequent exposure to adverse events has been suggested as a possible explanation for the elevated suicide rates in farmers (Arnautovska et al., 2016; Gregoire, 2002; Guiney, 2012). Yet, the impact of these events on farmer suicidality has not been explicitly explored.

Accordingly, the empirical paper aimed to investigate the relationship between adverse events on the farm and suicidal ideation in farmers. Of the farmers who completed

the study, 88.8% reported that they had experienced an adverse farming event and 32.9% said that they had experienced suicidal thoughts over the past 12 months, with subsequent analysis revealing a relationship between the variables. Accordingly, it was concluded that the high rates of suicidal ideation revealed a critical need, and opportunity, for effective intervention. Whilst the prevalence, and potential impact, of adverse events demonstrated the requirement for interventions to be appropriately tailored.

It is consequently hoped that through the consolidation of the existing literature, and with the contribution of the empirical research into the risk factors for suicidality in farmers, the present thesis will offer important information to help develop more effective and timely intervention programmes in order to address the high suicide rates in farmers.

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Chapter One: Literature review

Risk Factors for Farming Suicide: A Mixed-Method Systematic Review

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Article intended for submission to the Journal of Clinical Psychology Review for peer review. Please see 'Appendix A' for a copy of the journal guidelines for authors.

Highlights

- The systematic review identified 39 papers that investigated suicidal behaviour in farmers.

- Seven between-study themes were identified; demographics, suicidality, coping strategies, health, life events, relationships and support, and farm information. Each of these overarching themes then contained more itemised sub-themes. These sub-themes, identified by the review, depicted a number of risk factors for farming suicide.

- The review identified risk factors for farming suicide on multiple levels. These included personal factors, community level factors and peripheral level factors.

- It was clear from the majority of papers that seldom one risk factor caused farmers to take their own life, rather it was often a complex interaction of many.

Abstract

Internationally, the rates of suicide amongst farmers are elevated. Yet, little is known about the contribution of risk factors. The systematic review therefore aimed to identify, and consolidate, existing research to enhance the understanding of suicide risk factors in farmers.

An electronic search was conducted in October 2018 of MEDLINE, AMED, CINAHL, PsycINFO and Web of Science. The terms 'farmer', 'farm labourer', 'farmhand', 'farm worker' and 'agricultural worker' were all combined with 'well being' OR 'wellbeing' OR 'well-being', 'emotion', 'anxiet*', 'psycholog*, 'mortalit*', 'menta*', 'stress*', 'depress*', 'self harm' OR self-harm' and 'suicid*' in a free text search. Screening occurred at title, abstract and full-text level against a pre-defined inclusion criteria. Reference lists of included studies were also searched for references. There were no methodological restrictions and studies were rated for quality and discussed accordingly throughout.

There were 39 included papers; 31 were quantitative, two were qualitative and six had both quantitative and qualitative components. Through data extraction, seven themes were identified. These were demographics, suicidality, coping strategies, health, life events, relationships and support, and farm information.

The review demonstrated multiple risk factors that may contribute to suicide in farmers and, subsequently, they should be considered collectively in suicide prevention strategies.

Keywords

Suicide; Farmers; Agriculture; Systematic review; Mixed-method

Introduction

Rationale

The internationally elevated suicide rate among farmers is alarming (McLaren & Challis, 2009; Sturgeon & Morrissette, 2010). Research from Organisation for Economic Co-operation and Development (OECD) countries has found farmers at an increased risk of death by suicide compared to people in other occupations (Andersen, Hawgood, Klieve, Kolves, & De Leo, 2010; Booth, Briscoe, & Powell, 2000; Browning, Westneat, & McKnight, 2008; Bryant & Garnham, 2014; Gallagher, Kliem, Beautrais, & Stallones, 2008; Kelly, Charlton, & Jenkins, 1995; Koskinen et al., 2002; Milner, Spittal, Pirkis, & LaMontagne, 2013). In England and Wales, for example, it is reported that the risk for males working in agricultural roles is almost twice the national average (Office for National Statistics, 2018). Whilst this may in part be described by the high proportion of males in the industry, reasons for the heightened occupational rate remain unclear (Andersen et al., 2010). Accordingly, it is important to understand the factors that lie behind occupational risk, so that effective prevention programmes can be established for this vulnerable group (Hossain, Eley, Coutts, & Gorman, 2008; Skegg, Firth, Gray, & Cox, 2010; Stallones, 1990).

Suicide among farmers has received research attention on a national and a localised level, most notably in Australia and the United Kingdom (Kavalidou, McPhedran, & De Leo, 2015). A body of research was also completed in North America following the 1980's farming crisis (Gunderson, Donner, Nashold, & Salkowicz, 1993). Existing research has highlighted the prevalence of farming suicide and attempted to explain its incidence (Arnautovska, McPhedran, & De Leo, 2014; Arnautovska, McPhedran, & De Leo, 2015; Perceval, Kolves, Reddy, & De Leo, 2017; Stark et al., 2006). Yet international patterns of

farming suicide have rarely been explored and these findings have not been consolidated (Browning et al., 2008; Gallagher et al., 2008).

Despite sometimes being viewed as an idyllic way of life, research into farming has identified a range of potentially hazardous circumstances for suicide (Andersen et al., 2010; Gregoire, 2002). These include isolation, financial uncertainty, vulnerability to environmental factors and access to means (Andersen et al., 2010; Booth et al., 2000; Bossard, Santin, & Canu, 2016; Guiney, 2012; Hossain et al., 2008; McLaren & Challis, 2009; Perceval et al., 2017; Pickett, Davidson, & Brison, 1993). The contribution of many of these factors, however, still remains controversial (Bossard et al., 2016). Consequently, it is important to explore the existing research in order to gain a more conclusive understanding about the antecedents of suicide in the farming community (Gallagher et al., 2008; Page & Fragar, 2002; Skegg et al., 2010). It is also important to consider the relationship between personal factors, such as demographics, and farming suicide (Arnautovska, McPhedran, Kelly, Reddy, & De Leo, 2016; Malmberg, Hawton, & Simkin, 1997); this is fundamental in order to identify those most at risk and ensure that appropriate prevention recommendations are made (Malmberg et al., 1997).

Objectives

This review aimed to identify, and evaluate, existing international research into farming suicide. The review also aimed to consolidate findings from the existing research in order to develop a more conclusive understanding about the risk factors for suicide in farmers (Rodgers, 2011). The present review focused on research from OECD countries, in order to ensure that they were based in relatable ecological and political contexts.

The aim of the literature search was to retrieve all articles relevant to the research question. Therefore, no date or methodological restrictions were applied to the search.

Methods

Protocol

The review protocol can be found in Appendix B. The review write-up followed PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) guidelines and the relevant checklist can be found in Appendix C.

Search strategy

The systematic review procedure is illustrated in Figure 1. An electronic search was conducted in October 2018 of the databases MEDLINE (1948-present), AMED (1985-present), CINAHL (1937-present), PsycINFO (1887-present) and Web of Science (1898-present). The terms ‘farmer’, ‘farm labourer’, ‘farmhand’, ‘farm worker’ and ‘agricultural worker’ were all combined with ‘well being’ OR ‘wellbeing’ OR ‘well-being’, ‘emotion’, ‘anxiet*’, ‘psycholog*, ‘mortalit*’, ‘menta*’, ‘stress*’, ‘depress*’, ‘self harm’ OR self-harm’ and ‘suicid*’ in a free text search.

All identified article titles were independently screened for relevance against the inclusion criteria documented in Table 1 by the primary reviewer. For the purpose of the inclusion criteria, the definition of farmer was taken from (Thomas et al., 2003): “an individual occupationally concerned with the tending of live animals or plants”. As this definition was purposefully broad, the screening process also relied on an element of reviewer autonomy to confirm that the paper was referring to farmers and not another professional groups. A second reviewer screened ten percent of the excluded articles, confirming agreement with the initial screen. The abstracts of the remaining articles where then screened again according to the inclusion criteria detailed in Table 1. Articles were also excluded if they investigated the impact of pesticide exposure. Again, a second reviewer

screened ten percent of the excluded articles to confirm agreement for exclusion. Duplicates were also searched for and removed at every stage as Endnote did not identify all duplicates in the original search.

Full text screening involved reviewing the articles against the full inclusion criteria detailed in Table 1. Articles were excluded if they did not report on suicidal behaviour. This criterion was only applied at this stage as it was felt some articles may have been missed if they discussed suicidal behaviour alongside other issues of mental health. Articles were also excluded if they did not include primary evidence or if they were not written in English, as resources were not available to the reviewer for translation. Again, ten percent of the excluded papers were screened by a second reviewer. Additional search methods included hand-searching of the reference list of included articles to identify any further references. All included articles were also reviewed by a second reviewer.

Table 1. Article title, abstract and full text screening criteria

Title screening criteria	
1	Included information on suicide, mental illness, stress and other related issues
2	Distinguishably reported on the above issues in relation to farmers or retired farmers
3	Reported on the above in a country that is a member of the Organisation for Economic Co-operation and Development (OECD)
4	Published in a journal or book, was in press or was an unpublished dissertation
Abstract screening criteria (Including all of the above)	
5	Met the above criteria and was not in relation to pesticide exposure
Full text screening criteria (Including all of the above)	
6	Included information about suicidal behaviour of farmers
7	Included primary data
8	Written in English

Quality appraisal

Due to the diversity of the included studies, quality was assessed using the QATSDD critical appraisal tool (Sirriyeh, Lawton, Gardner, & Armitage, 2012). The QATSDD has shown good reliability and validity for the use of quality assessment of diverse studies

(Sirriyeh et al., 2012). Each article was awarded a quality score, for each of the QATSDD criteria, from a 4-point Likert scale (0=criterion is totally undescribed, 1= described to some extent, 2= moderately described and 3= described) (Sirriyeh et al., 2012). Quality appraisal was completed by both reviewers, a Cohen's kappa analysis was then completed to compare the reviewers scores for each study (see Appendix D). Where the 'strength of agreement' was less than moderate, the opinion of a third reviewer was sought (Landis & Koch, 1977). If the reviewers disagreed, the papers were discussed until a consensus was agreed. Quality scores are reported in Table 2 as the percentage of the maximum possible score, which was 42 for quantitative and qualitative studies, and 48 for mixed-method designs. Methodological quality of the individual studies are also described within the results section of the thesis, and their awarded quality ranking, as presented within Table 2, is provided throughout the results section.

Data extraction and synthesis

After the studies were identified, data relevant to the research question was extracted by reviewer one and checked by reviewer two. The data was then grouped into relevant themes and sub-themes (see Appendix E for an example). An integrated methodology was then utilised to assimilate quantitative and qualitative outcomes into a single mixed-methods synthesis under the relevant thematic subject headings (Dixon-Woods, Agarwal, Young, Jones, & Sutton, 2004; Sandelowski, Voils, Barroso, & Alabama, 2006). Where possible quantitative data was converted into qualitative summaries and percentages to assist with between study comparison. Identified themes that had limited applicability across papers, such as salary, location and ethnicity, were excluded from the review. The heterogeneous nature of the extracted data meant that it was not appropriate to synthesise the literature using statistical techniques.

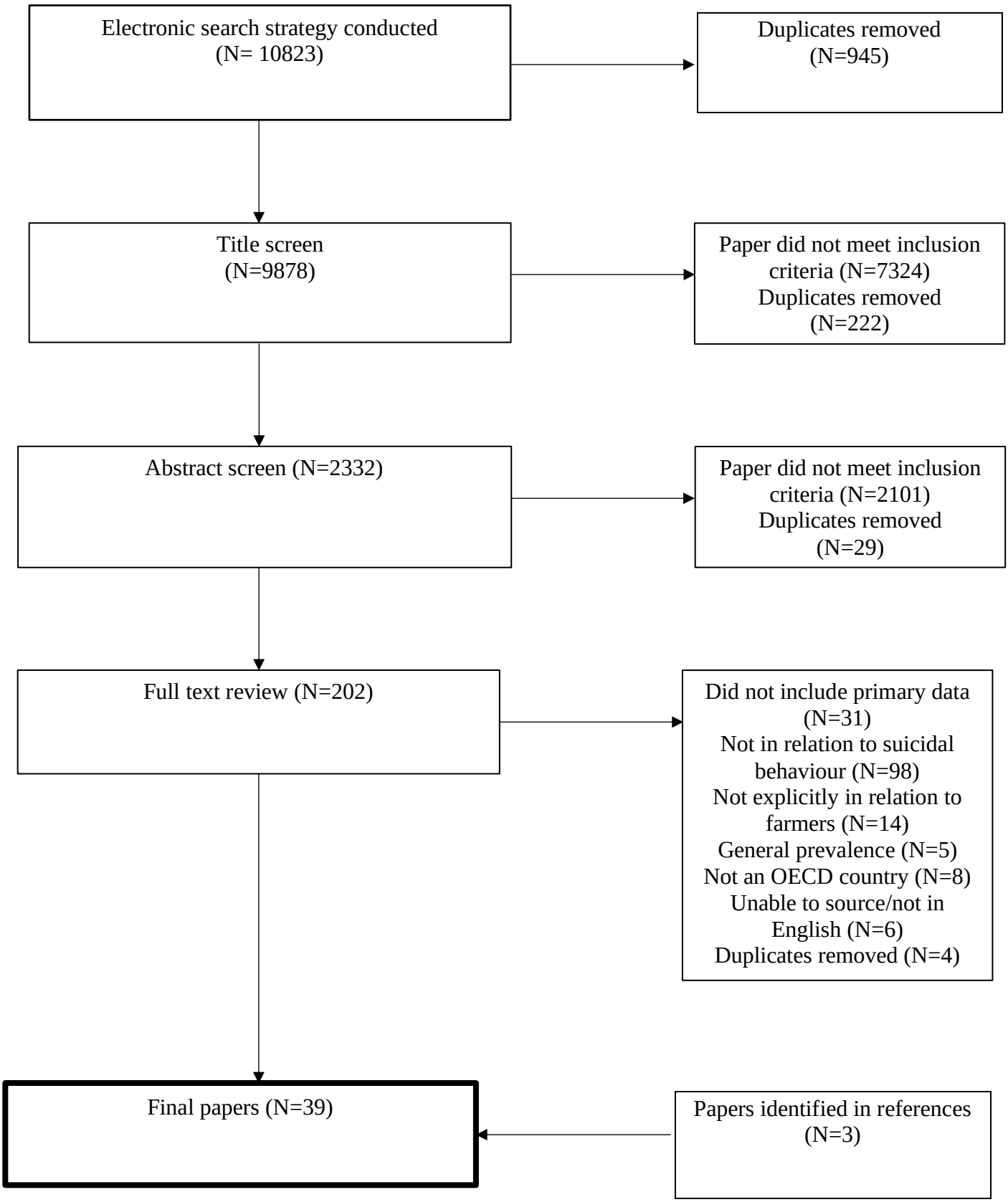

Figure 1. Flow chart of the review process

Results

As detailed in Figure 1., the systematic search returned 10,823 results from the combined databases. After reviewing the titles and abstracts, 10,621 did not satisfy the inclusion criteria. The remaining references were retrieved, where possible, for full-text screening. Thirty-six papers were found to meet the inclusion criteria along with three further papers identified in their references. All 39 papers included in the review are detailed in Table 2. There were three pairs and one triplet of studies which were found, in part, to describe the same data set. These studies were therefore presented together to ensure that information was not duplicated and unduly weighted.

Of the 39 included studies, 31 were quantitative, two were qualitative and six had both quantitative and qualitative components. Moreover, 27 were retrospective case-control or descriptive studies, four used psychological autopsy methods, two described focus groups, one included a content analysis, three used cross-sectional self-report questionnaires and two used prospective longitudinal designs. One of the longitudinal studies, however, only presented first round data and will therefore be considered in this review as a fourth cross-sectional study. The farmer response rates for the three cross-sectional studies were 30.3%, 49.5% and 91%. The fourth study did not present the response rate.

The studies were largely completed in Australia (N=13), the United Kingdom (N=11) and the United States of America (N=6). There were also four studies completed in New Zealand, two in Canada, two in Finland and one in France. Data for the studies was collected between 1900 and 2015. A further three studies did not detail their data collection period. Due to the size of the review, studies are numbered by their quality rating, or partner study. The corresponding number, methodology and location of each study is detailed in Table 2. The themes and subthemes, outlined in Figure 2., were identified through data extraction.

Methodological quality

Overall, there was a large variation in methodological quality between the included studies. Out of 39, for example, 23 provided an explicit statement of aims and objectives where five did not mention them at all. Likewise, 24 provided a specific description of the research problem and target population, but three studies did not describe them at all. In terms of considering the sample size, 26 made an explicit statement of data being gathered until information redundancy/saturation was reached or to fit exact calculations, three studies however provided no evidence of considering the sample size. Furthermore, it was felt that only 23 included a sample of individuals that represented a cross section of the target population. Ten studies provided a detailed description of each stage of the data collection procedure; however, 28 did state each stage of data collection but only with limited detail. It was felt that for 11 studies the method of analysis was the most suitable approach to attempt to answer the question; for the majority of the remaining studies, it was felt that the method of analysis addressed the research question but that more suitable alternatives could have been used or additional detail offered, for three studies there was unfortunately no mention at all. It was felt that the majority of studies did not offer a complete discussion of strengths and weaknesses with 33 providing no or very limited mention of the strengths and weaknesses of the study with omissions of many key issues. Some key limitations that were identified by the review however included reliance of coroner's records and challenges with the definition of farming.

Table 2. Quality rating and corresponding number, methodology and location of each study

Paper number/ Authors (Year)	**Location/ Study period**	**Study design**	**Sample**	**Themes**	**Quality rating (Highest to lowest)**
1.Sturgeon and Morrissette (2010)	Canada 2003-2008	Quantitative and qualitative Content analysis	29 callers to a crisis line	Relationships and support; Life events; Health; Coping strategies; Suicidality	81.3%
2.McLaren and Challis (2009)	Australia	Quantitative Cross-sectional	99 farmers	Suicidality; Relationships and support	76.2%
3. Kunde, Kolves, Kelly, Reddy, and De Leo (2017)	Australia 2014	Quantitative and qualitative Psychological autopsy	Next of kin (NOK) of 18 farmers	Demographics; Suicidality; Coping strategies; Health; Life events; Relationships and support; Farm information.	72.9%
4. Arnautovska et al. (2015) 5. Arnautovska et al. (2014) 6. Arnautovska et al. (2016)	Australia 2000-2009	Quantitative Retrospective case-control Quantitative Retrospective descriptive Quantitative Retrospective case-control	147 farmers + 92 farmers	Demographics; Suicidality; Coping strategies; Health; Life events; Relationships and support; Farm information.	69% 66.7% 64.3%
7. Browning et al. (2008)	America 1990-1998	Quantitative Retrospective descriptive	590 farmers + control group	Demographics; Suicidality; Relationships and support; Health	64.3%

Table 2. Quality rating and corresponding number, methodology and location of each study

8.Skegg et al. (2010)	New Zealand 1973-2004 (Excluding 1996 and 1997)	Quantitative Retrospective case-control	731 farmers	Demographics; Suicidality	64.3%
9. Hawton et al. (1999) 10. Hawton, Fagg, Simkin, Harriss, and Malmberg (1998)	England and Wales 1981-1993	Quantitative Retrospective case-control Quantitative Retrospective descriptive design	719 farmers + control group	Demographics; Relationships and support; Farm information; Suicidality	64.3% 52.4%
11. Kavalidou et al. (2015)	Australia 1990 onwards	Quantitative Retrospective case-control	212 farmers + control group	Demographics; Health; Relationships and support	64.3%
12. Andersen et al. (2010)	Australia 1990-2006	Quantitative Retrospective case-control	206 farmers + control group	Demographics; Relationship and support	64.3%
13. Pickett et al. (1993)	Canada 1980-1989	Quantitative Retrospective descriptive	126 farmers	Demographics; Suicidality	64.3%

14. Bossard et al. (2016)	France 2007-2009	Quantitative Retrospective case-control	485 farmers	Demographics; Suicidality; Farm information	61.9%
15. Page and Fragar (2002)	Australia 1988-1997	Quantitative Retrospective case-control	921 farmers	Demographics; Suicidality; Life events	61.9%
16. Beautrais (2018)	New Zealand 2007-2015	Quantitative Retrospective descriptive	185 farmers	Demographics; Suicidality; Coping strategies; Health; Life events; Relationships and support; Farm information	59.5%
17. Turvey, Stromquist, Kelly, Zwerling, and Merchant (2002)	America 1990	Quantitative First round data presented	572 farmers + control group	Suicidality	57.1%
18. Ragland and Berman (1990)	America 1980-1985	Quantitative Retrospective case-control	Farmers + control group	Demographics; Life events	57.1%
19. Kunde, Kolves, Kelly, Reddy, and de Leo (2018)	Australia 2014	Qualitative and quantitative Psychological autopsy	NOK of 12 farmers	Demographics; Suicidality; Coping strategies; Health; Life events; Relationships and support; Farm information	56.3%

Table 2. Quality rating and corresponding number, methodology and location of each study

20. Booth et al. (2000)	England and Wales 1979-1994	Quantitative Retrospective case-control	63 farmers + control group	Demographics; Suicidality; Health; Life events; Relationships and support; Farm information	54.8%
21. Stark et al. (2006)	Scotland 1981-1999	Quantitative Retrospective case-control	307 farmers + control group	Demographics; Suicidality	54.8%
22. Simkin, Hawton, Yip, and Yam (2003)	England and Wales 1982-1999	Quantitative Retrospective case-control	966 farmers	Suicidality; Life events	52.4%
23. Penttinen (2001)	Finland November 1979-January 1980 with a follow up in February 1980-December 1992	Quantitative Prospective longitudinal	44 farmers + control group	Suicidality; Health;	52.4%
24. Koskinen et al. (2002)	Finland 1988-1999	Quantitative Retrospective case-control	57 farmers + control group	Demographics; Suicidality; Life events	52.4%

Table 2. Quality rating and corresponding number, methodology and location of each study

25. Perceval, Kolves, Ross, Reddy, and De Leo (2018) 26. Perceval et al. (2017)	Australia	Qualitative Focus groups	63 farmers	Demographics; Suicidality; Health; Life events; Relationships and support; Farm information	52.4% 47.6%
27. Thomas et al. (2003)	United Kingdom March-July 1999	Quantitative Cross-sectional	425 farmers	Suicidality	50%
28. Pylka and Gunderson (1992)	America 1986-1988	Quantitative Retrospective descriptive	499 farmers	Demographics; Suicidality; Relationships and support	50%
29. Gunderson et al. (1993)	America 1980-1988	Quantitative Retrospective case-control	1352 farmers	Demographics; Suicidality; Relationships and support; Life events	50%
30. Kelly et al. (1995)	England and Wales 1982-1992	Quantitative Retrospective case-control	487 farmers 102 farmers wives	Demographics; Suicidality;	47.6%
31. Guiney (2012)	Australia 2001-2007	Quantitative Retrospective case-control	110 farmers	Demographics; Suicidality; Life events	45.2%
32. Stallones (1990)	America 1970-1985	Quantitative Retrospective case-control	302 farmers + control group	Demographics; Suicidality	45.2%

Table 2. Quality rating and corresponding number, methodology and location of each study

33. Miller and Burns (2008)	Australia 1997-2001	Quantitative Retrospective case-control	50 farmers + control group	Gender	45.2%
34. Gallagher et al. (2008)	New Zealand 2001-2005	Quantitative Retrospective descriptive	2261 cases of suicide. Number of farmers is unknown	Demographics	45.2%
35. Booth and Lloyd (2000)	England 1995	Quantitative Cross-sectional	303 farmers	Suicidality	42.9%
36. Malmberg et al. (1997) 37. Malmberg, Simkin, and Hawton (1999)	England and Wales 1991-1994	Quantitative and qualitative Psychological autopsy	84 farmers	Demographics; Suicidality; Relationships and support; Health; Life events; Coping strategies; Farm information	14.3% 40.5%
38. Capstick (1960)	Wales 1951-1955	Quantitative Retrospective descriptive	46 farmers	Demographics; Health; Relationships and support; Life events; Farm information	28.6%
39. Weaver and Munro (2009)	New Zealand 1900-1950	Quantitative and qualitative Retrospective descriptive	894 farmers	Demographics; Health; Coping strategies; Relationships and support; Life events;	22.9%

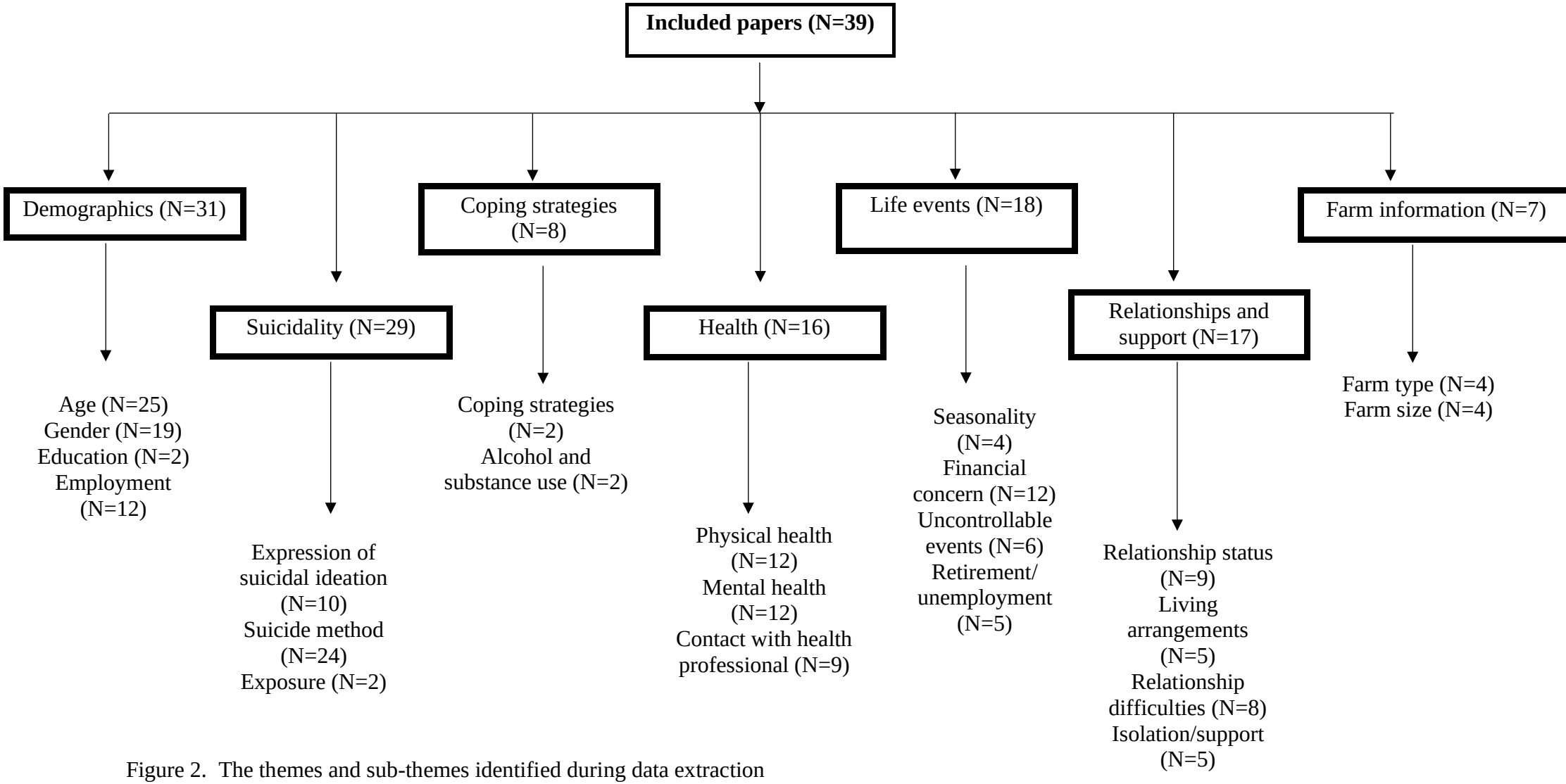

Figure 2. The themes and sub-themes identified during data extraction

Demographics

The demographics of farmers (Thomas et al., 2003) who died by suicide was presented by 30 retrospective studies. Of, 17 were case-control studies, nine were descriptive studies and four were psychological autopsy studies. One further qualitative study summarised the reflections of focus groups on the impact of gender. The quality of the studies ranged from 22.9% to 72.9% of the maximum available quality score. Accordingly, in the context of the review, they varied from the second lowest scoring to the third highest scoring study.

The average of farmers when they died was reported by seven studies and ranged from 43 to 56 years old (Arnautovska et al., 2014; Booth et al., 2000; Gunderson et al., 1993; Hawton et al., 1998; Kavalidou et al., 2015; Koskinen et al., 2002; Malmberg et al., 1997). Studies within the review were awarded a percentage of the maximum possible quality score and ranked accordingly. The rankings of the studies that reviewed age were 5, 10, 11, 20, 24, 29, 36. This means that the findings included one relatively high-quality study with a rating of 66.7% of the total possible score, five moderate quality studies with ratings ranging from 52.4% to 50% and one low quality study with a quality rating of 22.9%. The study with the highest quality rating found the average age of farmers who died to be 45 years old (Arnautovska et al., 2014).

Furthermore, six studies found the highest proportion of deaths to be in older farmers (Arnautovska et al., 2016; Browning et al., 2008; Pickett et al., 1993; Pylka & Gunderson, 1992; Ragland & Berman, 1990; Weaver and Munro, 2009). The studys' quality ratings within the review were 6, 7, 13, 18, 28, 39. Again, the quality of these studies ranged from two relatively high-quality studies, with 64.3% of the total possible quality score, to a low-quality study with a quality rating of 22.9%. Similarly, three studies found a higher rate of suicide in older farmers than in their control groups; however, these were all low-quality

studies (Gallagher et al. 2008; Kelly et al., 1995; Stallones, 1990). The studies were rated within the review as 30, 32 and 34. The findings may also be representative of the aging population of farmers.

One study found the largest number of deaths in younger farmers and two reported that over half of people who worked on farms (farm labourers) were under the age of 40 when they died (Anderson et al., 2010; Page & Fragar, 2002; Weaver and Munro, 2009). The studies were rated within the review as 12, 15 and 39; this meant that two papers were of relative high quality, scoring 64.3% and 61.9% of the total possible quality score, and one was of low quality with a rating of 22.9%.

Males accounted for between 86% and 99.7% of the deaths reported (Anderson et al., 2010; Arnautovska et al., 2014; Arnautovska et al., 2015; Arnautovska et al., 2016; Beautrais, 2018; Booth et al., 2000; Bossard et al., 2016; Browning et al., 2008; Hawton et al, 1998; Hawton et al, 1999; Guiney, 2012; Gunderson et al, 1993; Miller & Burns, 2008; Page & Fragar, 2002; Pickett et al., 1993; Pylka & Gunderson, 1992; Skegg et al., 2010). The studies were rated within the review as 4, 5, 6, 7, 8, 9, 10, 12, 13, 14.15, 16, 20, 28, 29, 31, 33. Therefore, the findings included 11 relatively high-quality studies with a range of 61.9% to 69% of the total possible score. The rest were moderate quality studies ranging from 45.2% to 59.5% of the total possible score. One mixed method and one qualitative study described the enmeshment between notions of masculinity and the identity of male farmers (Kunde at al., 2018; Perceval et al., 2017). The quality of these studies was rated within the review as ‘moderate quality’ within the review with rankings of 19 and 26. One study reported that most men had a propensity to hide or supress their emotions, and in order to socialise they would wear a mask as a coping strategy (Kunde at al., 2018). The same paper also said that this was strongly embedded within the sociocultural norms of the occupation (Kunde at al., 2018). Likewise, a study of focus groups denoted notions of masculinity, where male

farmers would not ask for help as they felt it would threaten their identity and make them appear weak or feel like a failure (Perceval et al., 2017). The same study also associated this with male farmers finding it difficult to communicate, not communicating and having little opportunity to talk, and raised it as a risk factor for suicide (Perceval et al., 2017). The high proportion of male deaths may also be part explained by the large proportion of males in the farming industry, and the significantly larger proportion of males who die by suicide in the general population (Office for National Statistics, 2018).

People with 11 years or fewer of formal education were reported to account for 50% and 66.7% of suicide deaths by two studies (Browning et al. 2008; Kunde et al., 2017;). These were both high quality studies within the review with ratings of 3 and 7, meaning that they respectively scored 72.9% and 64.3% of the total possible score. The average proportion of farm owners or managers who died by suicide ranged between 31.9% and 91%, and the average proportion of farm labourers ranged between 9% and 56.2% (Arnautovska, 2015; Beautrais, 2018; Booth et al, 2000; Browning et al, 2008; Gunderson et al., 1993; Kunde et al., 2017; Page & Fragar, 2002; Pickett et al., 1993; Pylka & Gunderson, 1992; Weaver & Munro, 2009). The quality of the studies were rated within the review from 3 to 39 meaning that the findings included both high quality and low-quality studies. The findings were, however, consistent with one further study which concluded that the risk for farm labourers was lower than that for farm owners/managers but still higher than expected when compared to the general population (Kelly et al., 1995). These findings are however different to the wider population where it is suggested that lower skilled occupations are at greater risk of suicide than higher skilled occupations (Milner et al., 2013).

The average proportion of those who were retired when they died by suicide ranged between 3.4% and 31% (Arnautovska et al., 2015; Beautrais, 2018; Malmberg, Simkin & Hawton, 1999; Weaver & Munro, 2009). The quality of the studies were rated within the

review as ranging from 4 to 39. This means that the findings included high-quality studies with the highest achieved percentage being 69% of the total possible quality score and low-quality studies with the lowest percentage being 22.9%. It therefore very important to note that the lowest and highest value were reported by low-quality studies and should be considered with caution (Malmberg, Simkin & Hawton, 1999; Weaver & Munro, 2009). There are also some difficulties in defining retired farmers, as some may continue to input into the farm well into older age. That said, the highest quality study reported that 10.2% of farmers were retired when they died (Arnautovska et al., 2015). The average proportion of people who were unemployed, or facing unemployment, ranged between 0.5% and 16.7% (Arnautovska et al., 2015; Beautrais, 2018; Malmberg, Simkin & Hawton, 1999; Weaver & Munro, 2009). Again, the quality of the studies ranged significantly from the 4th ranked study to the 39th ranked study. Similarly, the average proportion of farm homemakers ranged between 3.2% and 17.3%, but all of these studies were of moderate quality with their rating ranging from 13 to 30 (Gunderson et al., 1993; Kelly et al, 1995; Pickett et al. 1993; Pylka & Gunderson, 1992).

Suicidality

The suicidality of farmers was described by 29 studies. Of these, 22 were retrospective, four were cross-sectional, one was a prospective longitudinal study, and two used qualitative methods. The quality of the studies ranged from 40.5% to 81.3% of the maximum available score. Accordingly, in the context of the review, they varied from moderate to high quality studies.

The prevalence of suicidal ideation was reported by three cross-sectional studies and ranged between 3.1% and 6.7% (Booth & Lloyd, 2000; Thomas et al, 2003; Turvey et al, 2002). The quality of the studies within the review were rated as 17, 27 and 35, meaning that

they were all of moderate quality within the context of the review. A fourth, high quality, cross-sectional study found that farmers had higher suicidal ideation than a sample of randomly selected men (McLaren & Challis, 2009). Moreover, in an analysis of 29 calls to a crisis line, 16 callers reported experiencing suicidal ideation and eight had experienced past ideation (Sturgeon & Morrissette, 2010). These findings were, however, not followed up and it was therefore not possible to conclude a relationship with completed suicide. Nevertheless, four retrospective studies did consider the number of farmers who had expressed suicidal ideation before their death, with a range between 38.9% and 46.3% (Arnautovska et al., 2015; Beautrais, 2018; Kunde et al. 2017; Malmberg, Simkin & Hawton, 1999). Of these, two studies were rated as high quality and the findings of all four were fairly consistent.

The number of farmers who had made previous suicide attempts before they died was reported by four studies with a range between 13% and 22% (Arnautovska et al., 2015; Beautrais, 2018; Booth et al, 2000; Malmberg, Simkin & Hawton, 1999). The quality of the studies, however, ranged from 40.5% of the total possible quality score to 69% of the total possible score, meaning that they ranged from moderate to high-quality within the context of the review. Furthermore, it was suggested by one study that there was a lower rate of previous suicide attempts than in other studies, which may reflect the wish of farmers to take decisive action and the availability of lethal means (Malmberg, Simkin & Hawton (1999). Correspondingly, it was concluded that suicide threats should be taken particularly seriously in farmers (Malmberg, Simkin & Hawton (1999).

The means by which farmers took their lives was explored by 24 studies. Studies reported either hanging/suffocation or firearms to be the most commonly used method (Arnautovska et al., 2015; Arnautovska et al., 2016; Beautrais, 2018; Booth et al., 2000; Bossard et al., 2016; Browning et al, 2008; Guiney, 2012; Gunderson et al., 1993; Kelly et al., 1995; Kunde et al, 2017; Kunde et al, 2018; Malmberg et al., 1997; Malmberg, Simkin &

Hawton, 1999; Page & Frager, 2002; Penttinen, 2001; Pickett et al., 1993; Pylka & Gunderson, 1992; Skegg et al., 2010; Simkin et al., 2003; Stallones, 1990; Stark et al, 2006). The quality of the studies ranged from high quality with a total of 69% of the total possible quality score to a particularly low quality study with a total of 14.3% of the possible score. The use of firearms ranged from 10% to 86% and the use of hanging/suffocation ranged from 8.3% to 49.3%. Furthermore, one study reported that those who died by hanging did not have access to firearms (Kunde et al., 2017). The unique relationship between farmers and firearms was highlighted by a qualitative study that aimed to examine the life and death circumstances of Australian male farmers (Kunde et al., 2018). The paper reported that there was an assumption that a firearm was the most likely suicide method because most farmers possessed a firearm and knew how to kill things (Kunde et al., 2018). There were also suggestions from another qualitative paper that access, familiarity, and repetitive use of firearms put farmers at an increased risk of suicide (Perceval et al., 2018). The lethality of firearms was also mentioned (Perceval et al., 2018). Other methods that were identified included gas poisoning with a range of 5% to 17.4%, submersion/drowning which ranged from 0.4% to 30.2%, chemical and pharmaceutical poisoning which ranged from 1.6% to 26%, jumping from a high place which ranged from 0.4% to 8%, and cutting/piercing which ranged from 0.7% to 4,6%. These findings are somewhat different from the general population where hanging is the predominant method of suicide in most countries, including the UK (Office for National Statistics, 2018; Gross et al, 2008). There are however also differences between population sub-groups, such as gender, and the method of suicide they select (Arnautovska et al., 2015; Hawton et al., 1999).

Two studies considered how many farmers left a suicide note and found that 21% and 32% of farmers did (Arnautovska et al., 2015; Booth et al., 2000). Two studies also reported on suicide exposure; one study found that 38.9% of people had been exposed to suicide and

another reported that one farmer had experienced the death of a child due to suicide (Kunde et al, 2017; Kunde et al, 2018).

Coping strategies

The coping strategies of farmers was described by eight studies. One was a retrospective case control study, two were retrospective descriptive studies, three were psychological autopsy studies, one was a prospective longitudinal study and one was an analysis of calls to a crisis line. The quality of the studies ranged from 22.9% to 81.3% of the maximum available quality score. Accordingly, in the context of the review, they varied from a low-quality study to the highest quality study.

The highest quality study reported that callers appeared to have a limited repertoire of coping abilities with many citing none, reported that they did not know what to do or were engaging in negative behaviours, such as continually not sleeping or eating, while others reported using alcohol, drugs or both (Sturgeon & Morrissette, 2010). Likewise, a second, moderate quality study using a psychological autopsy study reported that stress was managed by employing unconscious avoidance strategies such as increasing time working, engaging in aggressive behaviours, and increasing consumption of alcohol or cannabis (Kunde et al., 2018). The study also reported that farmers largely coped with stress alone, did not seek help, engaged in impulsive behaviours and increased consumption of alcohol and cannabis. Accordingly, six studies reported on how many farmers had difficulties with alcohol and substance abuse at the time of death (Arnautovska et al., 2015; Beautrais, 2018; Kunde et al., 2017; Malmberg, Simkin & Hawton, 1999; Perceval et al., 2018; Weaver & Munro, 2009). The range was between 6% and 38.8%. The quality of the included studies ranged significantly however from relatively high-quality to low quality. Furthermore, two studies reported that farm labourers had more problematic alcohol use than farm managers

(Arnautovska et al., 2015; Weaver & Munro, 2009). These findings, however, need viewing with caution as one was a low-quality study. In a content analysis of calls to a crisis line, a few farmers reported various self-care activities including reading, talking with someone, writing, napping, walking the dog or attending a self-help meeting, and 21% reported using psychotropic medication to cope (Sturgeon & Morrissette, 2010).

Health

The health of farmers was described by 16 studies. Of these, seven were retrospective case control or descriptive studies, four were psychological autopsy studies, one was a cross-sectional study, one was a prospective longitudinal study, one was an analysis of crisis calls and two reported on data from focus groups. The quality of the studies ranged from 22.9% to 81.3% of the maximum available quality score. Accordingly, in the context of the review, they varied from a low-quality study to the highest quality study.

Analysis of the calls to a crisis line revealed that 28% of callers were concerned about their physical health; this study was given the highest quality rating (Sturgeon & Morrissette, 2010). Findings from the retrospective studies ranged from 10.9% to 72.2% of farmers having had physical health concerns prior to their suicide (Arnautovska et al., 2015; Beautrais, 2018; Booth et al., 2000; Capstick, 1960; Kavalidou et al., 2015; Kunde et al., 2017; Malmberg, Simkin & Hawton, 1999; Weaver & Munro, 2009). The studys' quality ratings within the review were 3, 4, 11, 16, 20, 37, 38 and 39. This meant that the findings included three relatively high-quality studies, three moderate quality studies and two low quality studies. One moderate quality study reported that physical illness was a significant problem for farmers because taking time off to rest and get treatment was difficult and had financial implications (Malmberg, Simkin & Hawton, 1999). Another, moderate quality,

qualitative study reported that physical illness or injury affected a person's sense of identity because they were not able to work and their circumstances changed (Perceval et al., 2017).

The analysis of calls to the crisis line also revealed that 34% of callers made reference to mental health issues (Sturgeon & Morrissette, 2010). The range of mental health difficulties, particularly depression, reported by the retrospective studies was however notably large (17.1%-94%) and the studies varied from high quality to low quality with within study ratings ranging from 3 to 39 (Arnautovska et al., 2015; Beautrais, 2018; Booth et al., 2000; Capstick, 1960; Kavalidou et al., 2015; Kunde et al., 2017; Malmberg, Simkin & Hawton, 1999; Penttinen, 2001; Weaver and Munro, 2009). Accordingly, two studies also reported on probable but undiagnosed mental health difficulties [21%/23%] (Kavalidou et al., 2015; Malmberg, Simkin & Hawton, 1999). Interestingly, one moderate quality study reported that externalising, somatic symptoms were more commonly reported than internalising symptoms, and stated that only a small number of farmers had experienced long term mental health disorders (Kunde et al., 2018).

A moderate quality study reported that 22% of farmers had been prescribed antidepressants before their death (Booth et al., 2000). A further study reported that 36.5% of farmers who were depressed were being treated with anti-depressants and seven had been prescribed an inadequate dose (Malmberg, Simkin & Hawton, 1999). It was also reported by the same authors that there was evidence of under-treatment and poor follow up (Malmberg et al., 1997); however, this was a low-quality study. A cross-sectional study reported that farmers with high scores on the Hospital Anxiety and Depression Scale (HADs) (Zigmond & Snaith, 1983) and the General Health Questionnaire (GHQ) (Goldberg & Hillier, 1979) were no more likely to have been in contact with their general practitioner (GP) than those with low scores (Booth & Lloyd, 2000). Nevertheless, another study reported that farmers were just as likely to have consulted their GP as people in other studies of suicide (Malmberg et

al., 1997). Within the content of the review, these studies were however both low quality. Four studies reported how many farmers had been in contact with a doctor before their death, this ranged from 26.5% to 67% (Booth et al., 2000; Kavalidou et al., 2015; Malmberg et al., 1997; Penttinen, 2001). The total possible quality score of these papers however ranged from 64.3% to 14.3%; there was therefore great variation in the quality of the studies. A moderate quality study reported that 31% of these consultations were for exclusively physical reasons and only 27% made reference to psychiatric difficulties (Kavalidou et al., 2015). Likewise, another high-quality study reported that 23.1% of the farmers who died had been in contact with their doctor for a physical condition (Arnautovska et al., 2015). It was concluded by one study that these consultations represented missed opportunities for the detection and treatment of depression (Malmberg, Simkin & Hawton, 1999. For example, reports of tiredness were often taken at face value and treated symptomatically (Malmberg, Simkin & Hawton, 1999). It was reported that this seemed to arise from a reluctance to consider emotional difficulties by both the farmer and doctor (Malmberg, Simkin & Hawton, 1999. Three studies reported a range between 26.5% and 42.7% of people were in contact with a mental health provider before their death (Arnautovska et al., 2015; Beautrais, 2018; Kavalidou et al., 2015). These studies were of relatively high quality. One qualitative study also reported on concerns about access to doctors for geographically isolated rural communities (Perceval et al., 2017).

Adverse events

The experience of adverse events for farmers was described by 18 studies. Of these, 12 were retrospective descriptive or case-control studies, four were psychological autopsy studies, one was a content analysis of crisis calls and one was a qualitative description of focus groups. The quality of the studies ranged from 22.9% to 81.3% of the maximum

available quality score. Accordingly, in the context of the review, they varied from a low-quality study to the highest quality study.

The analysis of calls to a crisis line revealed that over 55% of callers cited finances as directly related to their call, 59% reported bad weather conditions, 28% spoke of problems with livestock and others described things like machinery breakdown, crop failure, loss of a loved one and frustration with government programs (Sturgeon & Morrissette, 2010). A further 12 studies reported that farmers were experiencing financial concerns prior to their death, four studies talked about seasonal issues, five studies reported that farmers were facing unemployment/retirement, four studies referenced legal and policy issues, and six studies described uncontrollable events such as prolonged drought (Beautrais, 2018; Booth et al., 2000; Browning et al., 2008; Capstick, 1960; Guiney, 2012; Gunderson et al., 1993; Koskinen et al., 2002; Kunde et al., 2018; Page & Fragar, 2002; Perceval et al., 2018; Malmberg et al., 1997; Malmberg, Simkin & Hawton,1999; Ragland & Berman,1990; Simkin et al., 2003; Weaver and Munro, 2009). The quality of the studies within the review were rated from 7 to 39, meaning that their total quality score ranged from 64.3% to 14.3% of the total possible score.

Relationships and support

The relationships and support of farmers was discussed by 17 studies. Of which, ten were retrospective descriptive or case-control studies, three were psychological autopsy studies, one was a cross-sectional study, one was a content analysis and two were descriptions of focus groups. The quality of the studies ranged from 22.9% to 81.3% of the maximum available quality score. Accordingly, in the context of the review, they varied from a low-quality study to the highest quality study.

The relationship status of those who died by suicide was described by nine studies. The largest proportion of farmers appeared to be married or in a de facto relationship when they died, with a range between 33.3% and 54.1% (Andersen et al., 2010; Arnautovska et al., 2015; Arnautovska et al., 2016; Beautrais, 2018; Booth et al., 2000; Browning et al., 2008; Kavalidou et al., 2015; Kunde et al., 2017; Pylka & Gunderson, 1992). The quality of the studies within the review were rated from 3 to 28; this means that they were all of high or moderate quality. The proportion of single farmers ranged between 16.7% and 27%, divorced farmers ranged between 8.4% and 50%, and widowed farmers ranged between 3.4% and 15.9% (Andersen et al., 2010; Arnautovska et al., 2015; Arnautovska et al., 2016; Booth et al., 2000; Beautrais, 2018; Browning et al., 2008; Kavalidou et al., 2015; Kunde et al., 2017; Pylka & Gunderson, 1992). Furthermore, five studies described the living arrangements of the farmers who died by suicide. The proportion of farmers who were living with a partner, and in some cases children, when they died was between 38.9% and 58.3%, the proportion living alone ranged between 21.1% and 44.4%, living with parents ranged between 9.5% and 17.8%, living with flatmates/friends ranged between 4.9% and 16.3% and temporarily living away from home ranged between 0.5% and 5.4% (Arnautovska et al., 2015; Beautrais, 2018; Kavalidou et al., 2015; Kunde et al., 2017; Kunde et al., 2018).

The analysis of calls to the crisis line also revealed that 41% of callers cited marital and/or other relationship strains including communication and isolation problems (Sturgeon & Morrissette, 2010). Likewise, six retrospective studies considered relationship factors that were present before the farmers died. The of range of people who experienced a bereavement before they died was between 1.1% and 17.9%, likewise the range of people experiencing relationship problems was between 12.7% and 50%, and those experiencing conflicts/problems with other persons was between 10.2% and 33.3% (Arnautovska et al., 2015; Beautrais, 2018; Booth et al., 2000; Kunde et al., 2017; Malmberg, Simkin & Hawton,

1999; Weaver & Munro, 2009). A qualitative study of individual semi-structured interview conducted with relatives of male farmers who died by suicide reported that farmers felt that they were failing in their relationship and that this was an important proximal factor contributing to their suicide (Kunde et al., 2018). This was interrelated with cultural norms of masculinity and with the family, land and the commodity. Likewise, norms associated with subsequent feelings of failure included: family expectation for the farm to stay in the family name, children inheriting the family farm, pressure to keep up with other farms, land autonomy, and attitudes to regulatory procedures (Kunde et al., 2018).

Isolation and support were subthemes identified in five studies. The highest quality study, which analysed crisis calls, reported that three callers expressed concerns about feelings of physical and/or social isolation and one commented they had no support. Four callers said that 'outside people' would not understand (Sturgeon & Morrissette, 2010). Likewise, a psychological autopsy study reported isolation problems to be present in 5% of deaths and a qualitative study of focus groups described geographical isolation as a concern (Booth & Lloyd, 2000; Perceval et al., 2018). The focus groups described the isolating nature of farming itself and the many hours spent working alone as problematic. Furthermore, group participants spoke about the combination of geographical and emotional isolation as a potential risk factor for suicide (Perceval et al., 2018).

In contrast, eleven callers (38%) to the crisis line named family support as something to live for. Of these, six claimed to have great support from at least one family member, while the other five directly cited a certain family member regardless of their support as a reason for living. Of the 11 callers, only two (18%) cited their spouses or significant others as forms of support. Instead family support was perceived primarily from a variety of extended family members (Sturgeon & Morrissette, 2010). Another, high quality, cross-sectional study

concluded that farmers had a high sense of belonging and often felt that they had friends and family to call upon (McLaren & Challis, 2009).

Farm information

Information about the farm was noted by seven studies. Four were retrospective, descriptive or case control studies, two were psychological autopsy studies and one study reported on qualitative data from focus groups. The quality of the studies ranged from 52.4% to 72.9% of the maximum available quality score. Accordingly, in the content of the review these were moderate to high quality studies.

Four, high to moderate quality, studies reported that beef cattle/livestock farmers accounted for the largest proportion of deaths (Beautrais, 2018; Bossard et al., 2016; Kunde et al., 2017; Kunde et al., 2018). Dairy farming was found to have the second highest proportion (Bossard et al., 2016; Beautrais, 2018). However, another moderate quality study reported that that was no relationship between the mean annual county farming suicide rates and the distribution of types of farm holding (Hawton et al., 1998).

Work problems were reported in three studies. The percentages however varied significantly as did the quality of the studies. The highest quality study reported that 16.6% of participants had long work hours and 38.9% had work problems (Kunde et al., 2017). The other two moderate quality studies, however, reported varying findings with one noting that 29% had work problems and another reported that only 1.1% did (Beautrais, 2018; Booth et al., 2000). In the qualitative study, farmers described the increasing need for technology in an already overburdened work environment as stressful as they perceived that they did not have the time or skills to keep up (Perceval et al., 2018). This was particularly relevant for older farmers. This theme was not, however, spoken of in terms of suicide risk but it did feature as a stressor in the environment that farmers work in (Perceval et al., 2018).

Discussion

Summary of evidence

The systematic review identified 39 papers that investigated suicidal behaviour in farmers. Through data extraction, seven between-study themes were identified; demographics, suicidality, coping strategies, health, life events, relationships and support, and farm information. Each of these overarching themes then contained more itemised sub-themes. These sub-themes, identified by the review, depicted a number of risk factors for farming suicide (Rodgers, 2011). Risk factors are circumstances that make it more likely that a person will die by suicide (Rodgers, 2011). They, therefore, provide critical information to help assess and manage suicide risk and, subsequently, are vital in suicide prevention strategies (Rodgers, 2011).

The review identified risk factors for farming suicide on multiple levels. Personal risk factors, for example, included age, gender, lack of appropriate coping abilities, health conditions and suicidal ideation. Likewise, at a community level, risk factors included education level, employment status, access to means, suicide exposure, difficult relationships and isolation, inappropriate health provision and types of farm work. Furthermore, antecedents on a peripheral level included seasonality, financial concerns and uncontrollable events.

It was difficult, however, to directly compare the findings of the review with the general population because the study considered research from multiple time points and from several counties. That said, the review demonstrated a number of risk factors that are widely acknowledged in the general population; for example, isolation, existing mental and physical health concerns and being male (World Health Organisation, 2018). There were also findings that were felt to be more farming specific including the high use of firearms and the presence

of adverse events on the farm, as well as factors that might even be considered protective factors in the general population, such as family ties.

Nevertheless, it was clear from the majority of papers, that seldom one risk factor caused farmers to take their own life, rather it was often a complex interaction of many. This is consistent with the nature of farming where many lifestyle factors are often inter-connected, such as work, home and family life. The interactions between risk factors may, therefore, be more prominent in farming than many other occupations and may, in part, account for the elevated suicide rates in farmers.

Strengths and limitations

Despite the elevated suicide risk in farmers, the review effectively demonstrated the paucity of research in this area. Moreover, a large proportion of the studies were retrospective, with only one reporting on prospective longitudinal outcomes. Retrospective studies enable researchers to understand preceding events but accordingly they examine factors related to pre-established outcomes and therefore have more sources of bias than prospective studies (Platt, Hawton, Simkin, & Mellanby, 2012). Furthermore, information provided may be exposed to recall bias particularly in the case of psychological autopsy studies (Capstick, 1960). Conversely, four of the studies were cross-sectional, and whilst they helped establish the prevalence of suicidality, it was not possible to assume causality from their findings.

The mixed-method design of the review was considered a strength. Most notably because the methodologically inclusive design produced findings that are arguably more meaningful to a wider group of people (Sandelowski et al, 2006). Likewise, the inclusion of the qualitative papers helped to create an important narrative for the quantitative findings.

That said, a limitation of the study was the relatively small proportion of 'high quality' studies in the review with just three scoring above 70% of the maximum available quality score (Sirriyeh et al., 2012). Notably, however, two of the studies with the lowest quality ratings were the two oldest studies. This may in part be explained by changes in research reporting and the resources available to the researchers. It may also reflect a methodological error in the present review as no cut-off date was utilised. The reviewer attempted to address this by ranking the studies using their QATSDD scores and then providing each study's numerical rating throughout the paper (Sirriyeh et al., 2012). Accordingly, all of the identified themes included at least one of the highest quality studies, and when findings were only presented in low quality studies a note was made to ensure that they were considered with appropriate caution. The QATSDD scores were also checked for inter-rater reliability using Kappa analysis (Sirriyeh et al., 2012).

It is acknowledged that studies in a systematic review must be assimilated in a valid and reliable way. Accordingly, it is felt that the review established a balance between a valid and reliable methodology and a search strategy was as inclusive as possible with multiple search terms and no methodological restrictions. The opinion of a second reviewer was also sought at every level to ensure that inter-reviewer reliability was not compromised by the broad inclusion criteria.

A further difficulty with assimilating the research was the possible variation in the definition of 'farmer' across the included studies. For example, some studies regarded farmers as people who owned farms whereas other studies considered farmers to be people who worked on farms. The review attempted to account for this by providing a broad definition within the inclusion criteria to ensure all relevant studies were included. The review however then relied on reviewer autonomy to confirm that the paper was relating to people in a farming role which in turn is a limitation of the present review. Likewise, it is

possible that some of the independent studies may not have had a definition as broad and may therefore not have included the same people (Arnautovska et al., 2016). Furthermore, papers on rural suicide may apply to farmers, but without explicitly stating details of any farmers in their sample it was not possible to include those papers in the review. Additional difficulties with definition are also apparent when defining suicide, some studies for example included open verdicts that appeared to be suicide whereas others did not. This is important to note as there is some evidence to suggest that suicide is often misclassified and unreported, sometimes in order to obtain life insurance benefits or to reduce stigma (Browning et al., 2008; Mohler & Earls, 2001). Some of the studies were also based on coroner of GP records which may have had missing data or the data may not have been recorded in a consistent way (Beautrais, 2018; Booth et al., 2000).

Future research

The present review did not complete between group comparisons. There are, however, indications that risk factors may vary across different sub-groups of farmers (Arnautovska et al., 2015). Nevertheless, it was felt that there was not enough research in the area to complete a more segregated systematic review at this time. Furthermore, some studies also limited their analysis to white male farmers due to the small number of minority groups or female farmers in their samples (Browning et al, 2008). It is therefore recommended that further research is completed with sub-groups of farmers. Further comparisons with the general population should also be completed to help identify farming specific risk factors.

Future research should also consider alternative research designs. For example, longitudinal studies may help to establish the direction in which various risk factors work. Evaluation studies of interventions to improve the wellbeing of the farming profession may also help establish protective factors to support suicide prevention programmes, whilst

further consideration of the engagement of farmers with primary and secondary care services may help to develop future interventions. It is noted, for example, that some papers talked about the prescription of anti-depressant medication as a treatment for depression but there was no mention in the included papers of psychological therapies or other interventions as treatment options.

Fundamentally though, there is an obvious need for better and more consistent data collection regarding the suicide of farmers, in order to build the knowledge base and address the unacceptable level of suicidality. (Arnautovska et al, 2016). Likewise, better data collection is needed to thoroughly understand suicide risk factors such as the relationship between suicidal ideation, suicide attempts and death by suicide in farmers.

Conclusions

This review identified a number of risk factors that may contribute to suicidal behaviour in farmers. Consequently, suicide prevention strategies should take a holistic approach, ensuring that they account for the presence of multiple risk factors on various levels. For example, it is unlikely that simply restricting access to firearms will be effective in preventing farming suicide. Future approaches should, therefore, account for individual, social, occupational and environmental factors and their complex interactions within farming suicide.

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Chapter Two: Empirical paper

An exploration of the relationship between adverse events on the farm and suicidal ideation in farmers; the mediating role of psychological factors

Word Count: 5487

(exc. References)

Article intended for submission to the Journal of Public Health for peer review.

Please see ‘Appendix F’ for a copy of the journal guidelines for authors.

Abstract

Background: The risk of suicide for agricultural workers in parts of the United Kingdom is almost twice the national average. Existing research has suggested that this may be explained by the unique nature of farming, where success or failure is recurrently determined by uncontrollable and unpredictable forces. Yet, the impact of such events on farmer suicidality has not been explicitly explored. The study therefore aimed to investigate the relationship between adverse farming events and suicidal ideation in farmers, with consideration of optimism, resilience and trait-impulsivity as mediating, psychological variables.

Methods: A cross-sectional questionnaire battery was disseminated between July 2018 and February 2019, and completed by 170 adult farmers.

Results: During the preceding 12 months, 88.8% reported that they had experienced an adverse farming event and 32.9% said that they had experienced suicidal thoughts. Correlational analysis revealed a relationship between these variables, and further analysis demonstrated a significant indirect effect of the experience of adverse events on suicidal ideation through the mediator, optimism.

Conclusions: The high rates of suicidal ideation reveal a critical need for effective intervention. Whilst the prevalence of adverse farming events suggests that interventions need to be appropriately tailored, with greater understanding about the relationship between adverse events and reduced optimism.

Keywords

Farmers; Agriculture; Suicidal ideation; Suicide; Adverse events

Introduction

Suicide presents a major public health issue as a leading cause of global mortality [1, 2]. Accordingly, extant research has sought to identify those most at risk, with farmers frequently figuring in the findings [3-7]. A systematic review of suicide by occupation, for example, identified agricultural workers at elevated risk when compared to most other occupations [7]. Likewise, in parts of the United Kingdom (UK), the suicide risk for agricultural workers is almost twice the national average [8]. However, while existing research has focussed on suicide in this occupational group, few studies have investigated its relationship with predisposing factors [9]. This has obvious implications for intervention in a vulnerable group that typically utilises lethal means [10-13]. The present study therefore aimed to improve understanding about the factors that lead farmers to experience suicidal ideation.

Farming represents a unique amalgamation, often over many generations, of work, home and family life [2, 14, 15]. It is usually characterised by long hours, lone working and strenuous labour, [15-17]. Yet, success or failure is recurrently determined by uncontrollable and unpredictable forces with the industry being particularly vulnerable to social, economic, political, environmental and cultural fluctuations [15-18]. Accordingly, previous research has long acknowledged farming's reputation as a decidedly stressful industry [19, 20].

Early studies that investigated stress inducing factors in farmers highlighted price uncertainties, finances, uncontrollable weather, hazardous working conditions, government bureaucracy, media criticisms, time pressures and machinery breakdowns [9, 16, 19, 21-23]. A more recent study with farmers from North Carolina deduced similar findings, most notably that large proportions of farmers found concerns about the weather (60.2%), market prices for crops and livestock (45.3%), worries about the future of the farm (29.7%),

problems with farm machinery (23.4%) and outsiders not understanding the nature of farming (25.2%) very stressful [24]. Studies have also found livestock disease epidemics to have considerable impacts on the mental health of farmers. For instance, a study in the Netherlands reported that about half of those whose animals were culled due to foot and mouth disease suffered from severe post-traumatic distress [25]. Likewise, a UK study reported that 25% of farmers affected by the Schmallenberg virus, during the 2011-2012 lambing season, experienced a detrimental effect on their emotional wellbeing [26]. That said, the psychological impact of adverse events on farmers still needs further exploration and public health attention [20, 27].

Adverse events have been linked to increased suicidality in the wider population [28, 29]. Accordingly, Gregoire [15] suggested that adverse events on the farm may, in part, explain the high rates of suicide in farmers. In Australia, a qualitative study of focus groups with people who lived or worked on farms suggested that adverse climatic events may increase suicide risk [10]. Group members described such events leading to feelings of hopelessness and despair and noted that they depicted “no win” situations where, despite their best efforts, hardship was experienced [10]. Furthermore, a qualitative analysis of suicidal ideation in Manitoban farmers reported that 59% of callers cited an uncontrollable event as the reason for their call to a crisis line [2]. Of these callers, 28% reported bad weather conditions, such as rain and drought, 28% spoke of problems with livestock and a small number spoke of machinery breakdown, crop failure and frustration with government programmes [2]. However, due to the qualitative design of these studies, it was not possible to conclude a generalisable relationship between suicidal ideation and adverse events. It is also important to note that suicidal ideation does not always lead to completed suicide but it is an important risk factor in longitudinal studies [30-33]. Accordingly, existing research has

proposed explanations for the transition from suicidal thoughts to suicidal behaviour including impulsivity [34, 35].

Suicidal ideation can vary from transient thoughts, to attempts, to kill oneself [30, 31]. Existing research has sought to identify the occurrence of suicidal ideation in farmers, with the prevalence varying from 3.1% to 6.7% [19, 31, 32]. It was noted, however, that these results may be an underestimate of the proportion of people who actually experience suicidal ideation [32]. That said, it is also highly likely that not every farmer who experiences a predisposing factor will experience suicidal ideation. It is therefore also important to consider psychological factors that may make people more or less likely to experience suicidal ideation in the presence of a predisposing factor. A study investigating the relationship between depression and suicidal ideation, for example, found that the relationship weakened with the presence of protective factors such as resilience [36]. Accordingly, studies with other population groups have found that high levels of optimism are associated with decreased thoughts of suicide [37]. Furthermore, one study concluded that an optimistic explanatory style mitigates the influence of negative and potentially traumatic life events on thoughts of suicide [38].

Objectives

The study, therefore, aimed to investigate whether there was a relationship between adverse events on the farm and suicidal ideation in farmers. Examples of adverse events include weather related problems, animal and/or crop disease, and problems with farm machinery. Furthermore, the study aimed to investigate the relationship between suicidal ideation and psychological factors such as higher levels of optimism, resilience and traits of impulsivity. The study also aimed to investigate if psychological factors mediate the relationship between adverse events on the farm and suicidal ideation in farmers.

Hypotheses

1. It was predicted that adverse events on the farm would be associated with increased suicidal ideation in farmers

2. It was hypothesised that psychological factors, namely reduced optimism, reduced resilience, and traits of impulsivity, would be correlated with suicidal ideation in farmers.

3. It was predicted that low levels of optimism and resilience, and higher levels of impulsivity traits, would mediate the relationship between adverse events on the farm and suicidal ideation in farmers.

Methods

The research write-up followed STROBE (The Strengthening the Reporting of Observational Studies in Epidemiology) guidelines and the relevant checklist can be found in Appendix G.

Consultation

The design, methods and procedure of the study were discussed with a focus group (N=7) of farmers to ensure that they were as sensitive and representative as possible. The researcher also actively liaised with a number of farming organisations and, appropriately experienced, individuals throughout the research process. A detailed list of these contacts can be found in Appendix H.

Participants

In order to be eligible for the study, participants needed to be farmers who were aged 18 years or older and fluent in English. The definition of farmers was the same as that adopted by Thomas et al.'s study on the mental health of British farmers [32]. That is, a farmer is "an individual occupationally concerned with the tending of live animals or plants". *Apriori* power analysis based on a multiple regression model, using G*Power 3, (Faul, Erdfelder, Buchner & Lang, 2009) indicated a sample of at least 118 participants would be required to reach .80 power, based on five predictors, with a medium effect size (f^2=.15) in line with Cohen's (1977) guidelines for behavioural sciences.

Measures

The questionnaire battery took approximately 15 to 20 minutes to complete and consisted of seven parts. Part One referred to the study's inclusion criteria, and Part Two involved questions about age, gender, location, occupation and farm type.

Part Three included questions about the farmers' experiences, and the impact, of adverse events on the farm over the preceding 12 months. Participants were given examples of adverse events on the farm including weather related problems, disease and/or difficulties with animals and/or farm machinery. This was the independent variable (IV). Participants were asked to describe the adverse event with the most impact on them, and report on the frequency of all adverse events on the farm. Participants were also asked to describe the impact of the event on them and their business, ranging from very positive to very negative.

Part Four asked participants to complete an adapted version of The Social Readjustment Rating Scale (SRRS) [39]. This acted as a background variable. The scale provided a measure of the impact of a wide range of common stressors experienced by participants. A score of 150 or less suggested a low level of stress. When testing the scale's validity, a positive correlation (+0.118) was found between life change scores and illness scores [39]. Likewise, when testing the reliability, it was found that rank ordering remained extremely consistent for healthy adults ($r = 0.96 – 0.89$) [40]. Furthermore, a systematic evaluation conducted in 2000 concluded that the scale remained a useful tool for measuring stress [41]. In the current study, the scale was adapted to reflect the time period and to ensure that participants were not having to repeat themselves throughout the questionnaire battery.

Questions in Part Five asked the farmers whether they had ever suffered from feelings of depression or anxiety and if they were receiving, or had ever received, support for their

mental health. Again, this acted as a background variable. This was not a diagnostic measure, but rather a self-report question relating to the farmers' experiences.

Part Six involved questions about the presence, frequency and intensity of suicidal thoughts; this was the dependent variable (DV). First, participants were asked if they had experienced suicidal thoughts over the preceding 12 months. They were then asked to indicate how often and how intense the thoughts were.

Part Seven included measures of psychological factors; these were the mediator variables. Optimism was assessed using the Life Orientation Test- Revised (LOT-R) [42]. The LOT-R is a measure of optimism versus pessimism [42]. Participants rate each item on a five-point scale, and the higher they score the more optimistic they are deemed to be. A number of studies have documented the validity and reliability of the scale, reporting satisfactory measures of internal consistency and test-retest reliability [43]. Accordingly, the Cronbach's alpha for the scale in the present study was 0.830 which indicates a high level of internal consistency. Resilience was assessed using the Coping Competence Questionnaire (CCQ) [44]. The CCQ is a 12-item measure, where participants rate each item on a six-point scale [44]. The higher participants score the more resilient they are deemed to be. Evidence from previous studies have indicated that the CCQ is highly reliable and internally valid [44]. The Cronbach's alpha for the scale in the present study was 0.915 which indicates a high level of internal consistency. A score for impulsive personality traits was provided by the Barratt Impulsiveness Scale (BIS-11) which consists of motor, attentional and non-planning impulsivity [45]. The BIS-11 is a 30-item measure, where participants rate each item on a four-point scale [45]. The higher participants score the more impulsive they are believed to be. The BIS-11 is widely used and has been consistently found to be a valid and reliable

measure of impulsivity [46]. Likewise, the Cronbach's alpha for the scale in the present study was 0.744 which indicates a high level of internal consistency

At the end of the questionnaire battery, participants were given the option of making a donation to two selected farming charities, as compensation for their time.

Data collection

The cross-sectional questionnaire battery was disseminated between July 2018 and February 2019 (see Appendix I). The study was circulated through social media, farming organisations, farming press, and at relevant local and national events (Appendix J, K & L). The questionnaire battery was available in both an online and a paper format to ensure that people were not excluded from participating due to reasons such as poor internet accessibility or limited information technology (IT) skills. If participants selected the paper version, they were able to return it in a pre-paid postage envelope.

Data Analysis Procedure

The questionnaire data was analysed using SPSS version 25. Descriptive statistics described respondent's demographics.

A content analysis was performed to determine the frequency of adverse events described by respondents. This method was selected because it is a flexible approach that facilitates the processing of large amounts of data into clear themes [47]. The content analysis was based on Krippendorff's recommendations [48]. Accordingly, the reported adverse events were grouped into themes and a total frequency was then calculated for each theme. The themes were checked by a second reviewer to ensure that they agreed with the grouping of each individual response (Appendix M).

Shapiro-Wilko tests were used to determine if the data assumed a normal distribution. As the data was not normally distributed a Spearman's Rank Order Correlation was used to test hypothesis one and two, and Non-Parametric Partial Correlation was performed to control for the background variables. Mediation analyses were completed to test hypothesis three. Mediation analyses followed the Hayes (2013) method, with bias corrected and accelerated bootstrap percentile confidence intervals (5000 resamples) for total and indirect effects and 95% confidence intervals that did not contain zero, between upper and lower bounds, indicated significant mediation.

Sixteen respondents did not answer all the required questions regarding adverse events and suicidal ideation, and were subsequently excluded from the analysis as it was not possible to impute the missing data due to the nature of the questions asked. A further person did not answer all the questions regarding their mental health, again it was not possible to impute this data. One person did not complete all items on the LOTr [42]. However, as this accounted for less that 5% of the completed sample, list-wise deletion was completed and they were excluded from the analysis. Likewise, six people did not complete all items on the CCQ [44]. Little's Missing Completely at Random (MCAR) test confirmed that the data was missing at random. This also accounted for less that 5% of the completed sample. List-wise deletion was, therefore, completed and they were excluded from the analysis.

However, forty-six (29.9%) people did not complete all items on the BIS-II [45]. The percentage of missing values across the 30 variables varied between 0% and 16.5%. Where participants did not complete a variable, it was largely because they had selected the "don't know/prefer not to say option" or the question was missed. Little's MCAR test revealed that the data was missing at random. Multiple imputation (regression method) was therefore completed for the BIS-II [45], using the default and automatic settings of SPSS. Multiple

imputation was selected because it is believed to improve accuracy and statistical power relative to other missing data techniques.

Correlation tests were, therefore, completed for each data set and then pooled by SPSS. For comparison, the analysis was also performed on the subset of complete cases (N=108). It was not possible, however, to use multiple imputation when completing the mediator analysis as it could not be used with Hayes' process macro in SPSS. The mediator analysis therefore used completed cases.

Research ethics

The study protocol '2566' was approved by the Research Ethics Committee at the University of Liverpool (see Appendix N). Participants were provided with information about the study and informed that participation was voluntary. Participants were also informed that participation was anonymous and about the process of data collection and storage (Appendix I). Participants were able to stop completing the study at any time without explanation or disadvantage, and any information they had already provided was withdrawn and not used in the study. As the study addressed sensitive issues, signposting information regarding farming support organisations, Farming Community Network (FCN) and Royal Scottish Agricultural Benevolent Institution (RSABI), was available throughout. Participants were also advised to contact their General Practitioner (GP) if they were distressed by the subject. No adverse events related to taking part in the study were reported to the research team.

Results

One hundred and seventy farmers completed the questionnaire battery between July 2018 and February 2019. Their demographic information is presented in Table I. Data from a further 117 respondents who started, but did not complete, the questionnaire battery was excluded from the analysis. Out of the 170 respondents, 162 people submitted the survey online and eight returned it in paper format.

IV: Adverse events (AE)

One hundred and fifty-one (88.8%) farmers reported that they had experienced one, or more, adverse event/s on the farm within the past 12 months. Their demographic information is presented in Table I. Of this group, 142 (94%) reported that the adverse event/s had a negative impact on themselves or their farming business. Fifty-six (32.9%) farmers reported that adverse events occurred on the farm more than once a year, 17 (10%) said that they occurred more than once a month, and two (1.2%) said that they occurred more than once a week.

A content analysis of the adverse events reported by 109 farmers was completed. The original data is presented in Appendix M. The data was grouped into ten themes which are presented, along with the frequency that they were reported, in Figure 1.

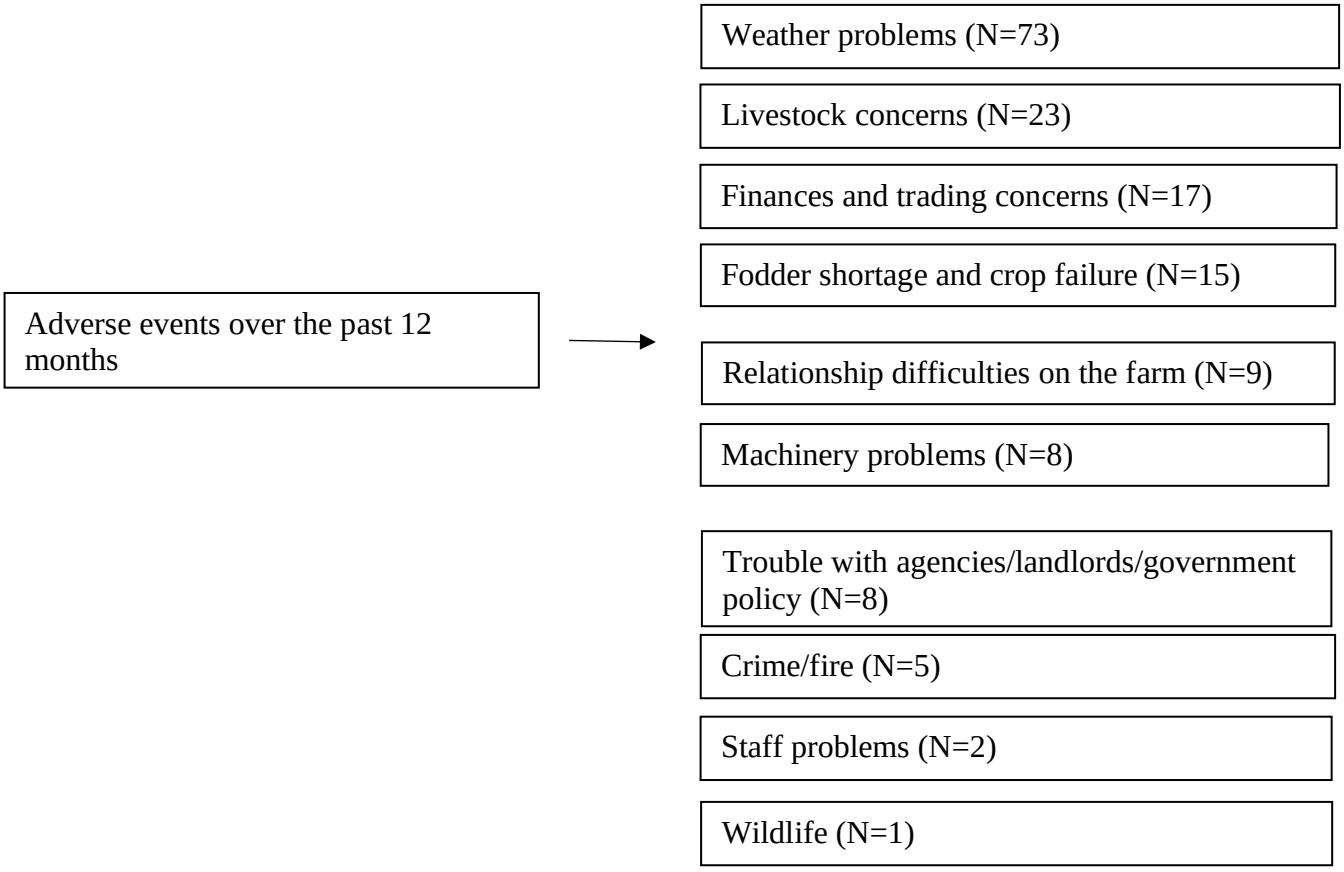

Figure 1. Frequency of adverse events over the past 12 months reported by farmers (N=109)

DV: Suicidal ideation (SI)

Fifty-six (32.9%) farmers reported that they had experienced suicidal thoughts over the preceding 12 months. Their demographic information is presented in Table I. A further eight people selected not to answer the question. Of those who experienced suicidal thoughts, 14 (25%) experienced them rarely, 29 (51.8%) described them as a brief passing thought, nine people (16.1%) said that they happened often and four (7.1%) said that they happened very often.

Background variable: Mental health

One hundred and fifty-seven (92.4%) farmers reported that they experienced feelings of depression or anxiety. Of these, 45 (28.7%) experienced them infrequently, 65 (41.4%) experienced them sometimes, 30 (19.1%) experienced them frequently and 17 (10.8%) experienced them often. Forty-three people (25.3%) reported that they had taken medication or used services to support their mental health in the past. Of these, 21 (48.8%) were currently taking medication or using services to support their mental health.

Background variable: Life events

According to the scoring guidelines of the adapted Social Readjustment Scale [39], 31 (18.2%) people reported high levels of stress associated with life events.

Table I. Demographic information of farmers, including those who experienced adverse events (AE) and reported thoughts of suicide (SI). (N=170)

Age											
	Under 28	29-38	39-48	49-58	59-68	68 and over	Prefer not say				Total
Number/Percentage	16 (9.4%)	30 (17.4%)	41 (24.1%)	55 (32.4%)	21 (12.4%)	7 (4.1%)	0				170
Experienced AE	15 (93.8%)	28 (93.3%)	35 (85.4%)	49 (89.1%)	17 (81%)	7 (100%)	0				151
Experienced SI	6 (40%)	9 (30%)	16 (39%)	17 (30.9%)	6 (28.6%)	2 (28.6)	0				56
Gender											
	Female		Male								Total
Number/Percentage	45 (26.5%)		125 (73.5%)								170
Experienced AE	41 (91.1%)		110 (88%)								151
Experienced SI	13 (28.9%)		43 (34.3%)								56
Job role											
	Business owner (land owner)	Spouse of business owner	Salaried farm manager	Business owner (tenant)	Regular farm employee	Casual farm worker	Other	Prefer not to say			Total
Number/Percentage	95 (55.9%)	7 (4.1%)	5 (2.9%)	43 (25.3%)	9 (5.3%)	3 (1.8%)	8 (4.7%)	0			170
Experienced AE	83 (87.4%)	7 (100%)	5 (100%)	37 (86.1%)	8 (88.9%)	3 (100%)	8 (100%)	0			151
Experienced SI	32 (33.7%)	2 (28.6%)	1 (20%)	13 (30.2%)	4 (44.4%)	2 (66.7%)	2 (25%)	0			56
Hours worked											
	Full time		Part time		Prefer not to say						Total
Number/Percentage	130 (76.5%)		39 (22.9%		1 (0.6%)						170
Experienced AE	117 (90.7%)		33 (84.6%)		1 (100%)						151
Experienced SI	40 (31%)		15 (38.5%)		1(100%)						56
Farm Type											
	Cereals	Horticulture	Grazing Livestock (Lowland)	Specialist Pigs	Beef production	General cropping	Dairy	Grazing Livestock (LFA)	Specialist poultry	Other (including non-classifiable)	Total
Number/Percentage	75 (44.1%)	7 (4.1%)	60 (35.3%)	12 (7.1%)	54 (31.8%)	32 (18.8%)	38 (22.4%)	37 (21.8%)	8 (4.7%)	25 (14.7%)	170
Experienced AE	66 (88%)	7 (100%)	53 (88.3%)	10 (90.9%)	48 (88.9%)	27 (84.4%)	34 (89.5%)	35 (94.6%)	6 (75%)	19 (76%)	
Experienced SI	16 (21.3%)	3 (42.9%)	23 (38.3%)	5 (45.5%)	18 (33.3%)	8 (25%)	14 (36.8%)	12 (32.4%)	3 (37.5%)	4 (16%)	
Country											
	England	Scotland	Wales	Northern Ireland	Other						Total
Number/Percentage	125 (73.5%)	18 (10.6%)	11 (6.5%)	6 (3.5%)	10 (5.9%)						170
Experienced AE	112 (89.6%)	16 (88.9%)	8 (72.7%)	5 (83.3%)	10 (100%)						151
Experienced SI	42 (33.6%)	6 (33.3%)	3 (27.3%)	1 (16.7%)	4 (40%)						56
Holding size											
	Under 20 hectares		20 to 50 hectares		50 to 100 hectares		100 hectares and over		Prefer not to say		Total
Number/Percentage	13 (7.6%)		24 (14.1%)		33 (19.4%)		99 (58.2%)		1 (0.6%)		170
Experienced AE	12 (92.3%)		23 (95.8%)		31 (93.9%)		85 (85.9%)		1 (100%)		
Experienced SI	6 (46.2%)		7 (29.2%)		13 (39.3%)		29 (29.3%)		1 (100%)		151
											56
Less Favoured Area (LFA)											
	Yes				No				Prefer not to say		Total
Number/Percentage	47 (30.3%)				108 (69.7%)				0		155
Experienced AE	44 (93.8%)				94 (87%)				0		
Experienced SI	17 (36.2%)				31 (28.7%)				0		138
											48

Hypothesis one

There was a statistically significant positive correlation between adverse events on the farm and suicidal ideation ($r_s(154)=.251$, $p= 0.02$), which was still seen after accounting for non-farm related stressful life events through partial correlation ($r_s(154)=.240$, $p=<0.00$). Both effect sizes would however be considered weak. This significant correlation was also no longer seen after accounting for respondent's mental health through partial correlation ($r_s(153)=.087$, $p=.285$). That said, there was a statistically significant positive correlation between the impact of adverse events and feelings of depression and anxiety ($r_s(153)=.349$, $p=< 0.00$), although the effect size was weak, and a statistically significant positive correlation between suicidal ideation and feelings of depression and anxiety ($r_s(153)=.523$, $p=< 0.00$). This effect size was moderate.

Hypothesis two

Optimism

There was a negative correlation between suicidal ideation and scores on the LOTr, which was statistically significant (r_s (153) =-.406, p=<0.00). The effect size was moderate.

Resilience

There was a negative correlation between suicidal ideation and scores on the CCQ, which was statistically significant (r_s (148) =-.373, p=<0.00). The effect size was however weak.

Trait impulsivity

The pooled Spearman's Rank-Order correlation between suicidal ideation and BIS-II scores revealed a positive correlation ($r_{s(}$(154)=.195, p=.016). The effect size was however very weak. The completed case analysis also demonstrated a statistically significant correlation between BIS-II scores and suicidal ideation ($r_{s(}$(108)=.210, p=.029), but again the effect size was weak.

Hypothesis three

The results of hypothesis three are presented in Figure 2., and Table II. There was a statistically significant indirect effect of experience of adverse events on suicidal ideation through the mediator, optimism. By contrast, there was no statistically significant indirect effect of the experience of adverse events on suicidal ideation through resilience or trait-impulsivity.

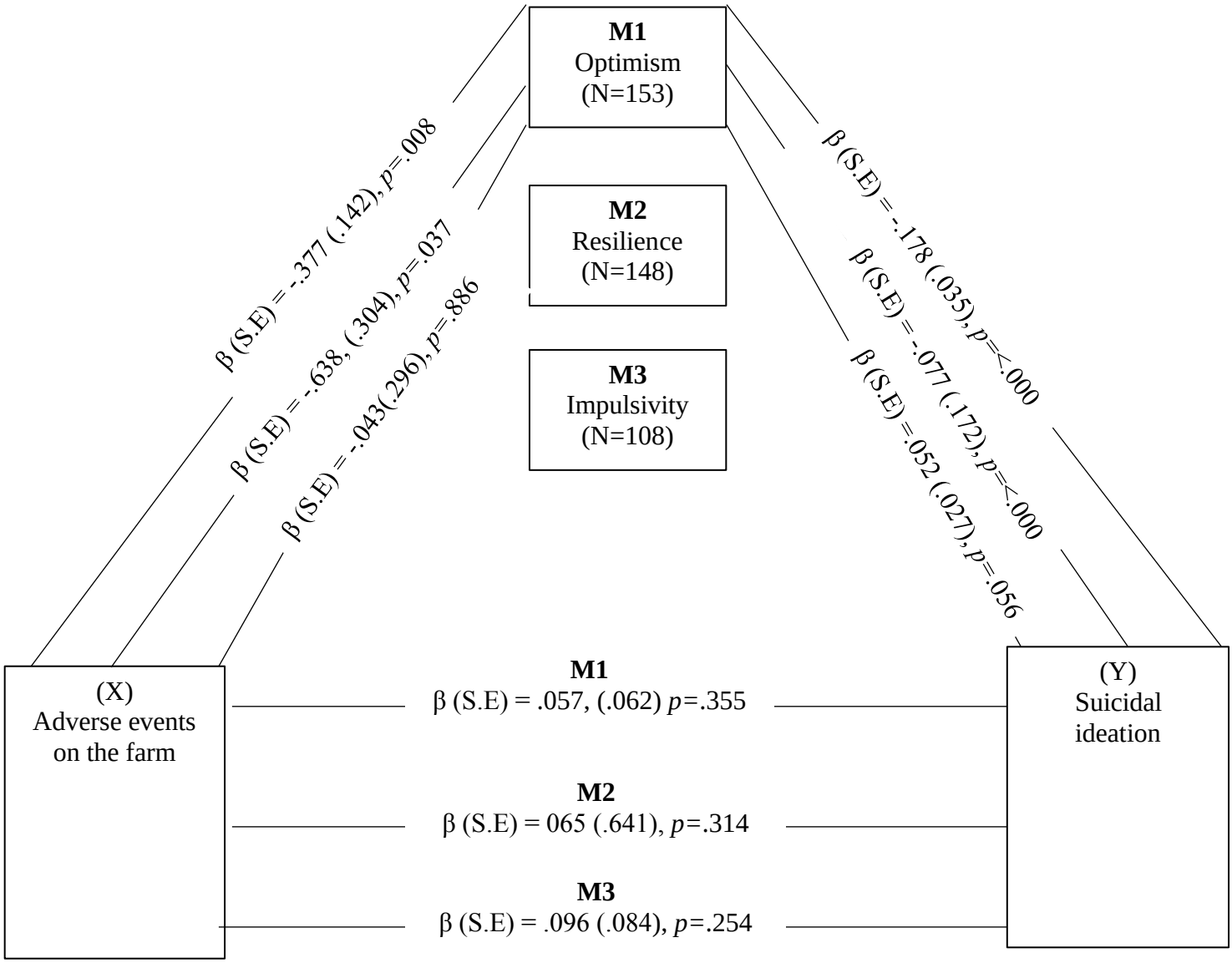

Figure 2. A diagram to show the relationships between adverse events on the farm, suicidal ideation and the mediators, optimism, resilience and impulsivity.

Table II. A table to show the relationships between adverse events on the farm, suicidal ideation and the mediators, optimism, resilience and impulsivity.

	Path a (X→M)	Path b (M→Y)	Path C (X→Y)	Indirect effect	Bootstrap confidence intervals
Model 1: X (Adverse events) →Y (Suicidal ideation) mediated by M (Optimism)					
β (S.E)	-.377 (.142)	-.178 (.035)	.057 (.062)	.067 (.031)	.0122-.1337
p-values	.008	<.000	.355		
Model 2: X (Adverse events) →Y (Suicidal ideation) mediated by M (Resilience)					
β (S.E)	-.638 (.304)	-.077 (.172)	.065 (.641)	.492 (.311)	-.0041-.1168
p-values	.037	<.000	.314		
Model 3: X (Adverse events) →Y (Suicidal ideation) mediated by M (Trait impulsivity)					
β (S.E)	-.043(.296)	.052 (.027)	.096 (.084)	-.002 (.022)	-.0512-.0413
p-values	.886	.056	.254[1]		

[1] It is important to note that there was a significant correlation between suicidal ideation and resilience, and suicidal ideation and impulsivity.

Discussion

Main findings of this study

The study aimed to explore the relationship between adverse events on the farm and suicidal ideation in farmers. The correlational analysis revealed a relationship between the two variables; however, the effect sizes were small and it was not possible to conclude that adverse events directly predicted suicidal ideation. That said, there was a significant indirect effect of the experience of adverse events on suicidal ideation through, the mediator, optimism. This may suggest that the more optimistic people are the less likely they are to experience suicidal ideation when also experiencing adverse events on the farm. However, due to methodological limitations of the present paper, this would need further investigation. The same could also not be concluded for the mediators, resilience and trait-impulsivity. There was, however, a significant correlation between suicidal ideation and resilience, and suicidal ideation and impulsivity when multiple imputation was utilised, but again the effect sizes were relatively small.

What is already known on this topic? What does this study add?

A substantial number of the farmers, who took part in the study, reported experiencing an adverse event on the farm within the past 12 months. These findings were consistent with previous research which also identified similar farming stressors [9, 16, 19, 21-26, 29]. That said, the findings were also felt to be somewhat representative of the preceding farming year which had undergone several extreme weather conditions. Consequently, it is suggested that, whilst adverse events may appear to occur frequently on the farm, the impact of specific events may vary. The challenge is therefore for interventions and future research to reflect the dynamic nature of farming whilst also being sufficiently

sensitive to the experience of recurring adverse events for farmers which is likely to impact their levels of optimism and resilience.

The number of farmers in this study who reported experiencing suicidal ideation was substantially higher than that identified by previous research [19, 31, 32]. Likewise, the findings were also substantially higher than the 2.3% annual incidence identified in the general population [49]. Moreover, similar to conclusions drawn by other studies, the findings may also be an underrepresentation of the actual number as some participants selected not to answer the question. Accordingly, there are several possible explanations for a higher prevalence of suicidal ideation being recorded by the present study. For example, the study is one of the first to explicitly explore suicidal ideation in farmers; therefore, being asked directly may have helped the farmers to be more open [50]. Another viable explanation is the possible impact of recent media campaigns, particularly with younger farmers, that have sought to tackle stigma and encourage them to speak more openly about their mental health. This corresponds with a large proportion of participants also reporting experiencing feelings of depression and anxiety. A third possibility is the study's self-selected recruitment method which may have meant that people were more likely to complete the study if they felt able to talk about their suicidal ideation and mental health. That said, only a quarter of those who experienced feelings of depression or anxiety had used services to support their mental health.

It was also important to consider personal factors to identify those farmers at heightened risk of experiencing suicidal ideation, something which the review chapter has attempted. Accordingly, similar to existing research with other population groups, the present study has potentially identified a protective factor, in the form of increased optimism. Within the context of this research, we consider optimism to be the expectation that one's own outcome will generally be positive. Indeed, it incorporates the belief that a stressful present

can change to become a better future. This is therefore felt to be important as it may reflect how farmers appraise the adverse farming event and may present an important consideration for future suicide preventions strategies and risk assessments. However, again due to methodological limitations of the present paper, this would need further investigation. It is also important to view these conclusions within the context of mental health, as pessimistic thinking is often associated with depression.

Previous research has also reported difficulties with getting representative samples of farmers to take part [51]. Consequently, the number and wide range of farmers involved in the present study was considered to be a particular strength where considered alongside agricultural data for the UK [52]. This is believed to be due to the utilisation of a broad range of recruitment methods, which were informed by a farming focus group and a number of experienced individuals, and subsequently ensured that the project was as inclusive as possible. Likewise, the study also gave participants the option of completing either a paper or an online questionnaire.

Limitations of the study

The majority of previous research into farming suicide has been retrospective and, subsequently, relied heavily on obtainable records and observer or relatives' accounts. Therefore, the cross-sectional design of the present study, exploring predisposing risk factors for suicide with the farmers themselves, is felt to be a strength. However, it is acknowledged that there are some arguments against using mediation analysis with cross-sectional data. Notably, that it does not consider time-sequence and therefore it is felt to be potentially biased and misleading [53]. Maxwell, Cole and Mitchell [54] argue, for example, that a variable that is found to be a mediator in a cross-sectional analysis may not be a mediator at all in a longitudinal analysis. However, Hayes and Rockwood [55] argue that the

mathematics aren't the inference, rather the inference comes from making sense of the results of the mathematical procedure. They acknowledge that correlation does not imply causation, but state that sometimes two variables are correlated because they are causally related [55]. They, therefore, argue that instead of restricting conditional process analysis to certain categories of research designs, it should be applied more broadly [55]. It is also acknowledged that some researchers may select to use reverse mediation to address these concerns. However, this was felt to be inappropriate here because the notion of a feasible reversed relationship was at odds with the established theoretical basis and the clinical knowledge that underpinned the study.

A clear methodological limitation of the present study was that adverse events on the farm, suicidal ideation and anxiety and depression were not assessed using validated measures. It is acknowledged that this may impact upon the reliability and the generalisability of the findings. The decision was however taken not to use a validated measure of suicidal ideation because the farming focus group and experienced individuals felt that, with the limited body of existing research and recruitment concerns expressed in other studies, the questionnaire should be as sensitive to and representative of the farming community as possible. Therefore following a review of the existing measures it was felt that they did not satisfy these important criteria. Accordingly, whilst we acknowledge this as a significant limitation of the present study we also argue that the study has taken an effective forward step in researching farming suicidality and subsequently demonstrated a route for more useful further research and possible measures. In terms of not using validated measures of depression and anxiety, the researchers did consider this when designing the study; however, as the paper was interested in the past year the majority of validated measures were not appropriate as they looked at a much smaller time frame. The present study was also not interested with diagnosable clinical depression and therefore it was felt that participants self-

reporting feelings of depression or anxiety over the preceding year was appropriate to the research question.

The decision to provide participants with a "I don't know/would prefer not to say" option throughout the study could be regarded as a methodological limitation that hampered best practice analysis of the data. The option was included because it was felt that this would help farmers complete the study rather than disengaging from it. Unfortunately, it resulted in a lot of data having to be treated as missing. This was particularly the case for the BIS-II [45].

Future research and intervention

It is felt that prospective and longitudinal research is needed to contribute further information to help understand the high levels of suicidality in farmers, and to ascertain the relationship between suicidal ideation and suicide in the farming community, something that is beyond the scope of the present study. It would also help to gain greater clarity about the possible causal relationships between suicidal ideation and adverse events. However, there are significant ethical concerns to consider when conducting prospective research into suicidal behaviour.

It may also be particularly beneficial to collect data over a period of significant adversity, such as the foot and mouth disease outbreak, to gain more understanding about the impact of these challenging and distressing events on farmers.

More research that considers protective factors against farming suicide is needed to help shape more effective intervention programmes that reflect the unique nature of farming. If, as suggested by the research, heightened optimism reduces suicidal ideation then future interventions may need to consider how to improve optimism in the farming community.

Suggestions may include reducing rumination, re-telling stories with different narratives and future planning.

Most importantly, however, research needs to continue with the farming community who, despite elevated rates of suicide, are often neglected from research which has tended in recent years to focus on urban settings.

Conclusions

Suicidal ideation does not always lead to completed suicide; however, it is recognised as an important risk factor [30-33]. It is also often troubling and distressing in its own right. It therefore represents an important focus for intervention. Accordingly, steps need to be taken to establish ways that suicidal ideation can be identified, and addressed, within the farming community. Approaches and interventions also need to be sensitive to the vulnerability of farmers to elements beyond their control. Improved awareness of these stressors may help to reduce farmers' frustration with outsiders' lack of understanding and thereby reduce stigma and encourage them to seek help if needed [14]. It is, therefore, suggested that interventions are dynamic and in the presence of significant adversity, such as high-profile disease outbreaks, health professionals are able to ensure the quick and flexible provision of appropriate mental health support.

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Appendices

Appendix A: Guidelines for publication

Clinical Psychology Review

Relevant information taken from:
https://www.elsevier.com/wps/find/journaldescription.cws_home/652?generatepdf=true

Description:

Clinical Psychology Review publishes substantive reviews of topics germane to **clinical psychology**. Papers cover diverse issues including: psychopathology, psychotherapy, behavior therapy, cognition and cognitive therapies, behavioral medicine, community mental health, assessment, and child development.

Article structure:

- Manuscripts should be prepared according to the guidelines set forth in the Publication Manual of the American Psychological Association (6th ed., 2009).
- Manuscripts should ordinarily not exceed 50 pages, *including* references and tabular material.
- Authors are referred to the PRISMA Guidelines (http://www.prisma-statement.org/statement.htm) for guidance in conducting reviews and preparing manuscripts. Adherence to the Guidelines is not required, but is recommended to enhance quality of submissions and impact of published papers on the field.

Highlights:

Highlights are mandatory for this journal. They consist of a short collection of bullet points that convey the core findings of the article. Please include 3 to 5 bullet points (maximum 85 characters)

Abstract:

A concise and factual abstract is required (not exceeding 200 words). This should be typed on a separate page following the title page. The abstract should state briefly the purpose of the research, the principal results and major conclusions.

Keywords:

Immediately after the abstract, provide a maximum of 6 keywords, using American spelling and avoiding general and plural terms and multiple concepts.

References

Citations in the text should follow the referencing style used by the American Psychological Association. Please ensure that every reference cited in the text is also present in the reference list (and vice versa). References should be arranged first alphabetically and then

further sorted chronologically if necessary. References should be formatted with a hanging indent.

Appendix B: Review protocol

Title of the review	Risk Factors for Farming Suicide; A Mixed-Method Systematic Review
Background to review	
Rationale	The high levels of suicide in the farming industry is concerning (Roy, Tremblay, Oliffe, Jbilou, & Robertson, 2013). In England, the Office for National Statistics (2016) reported that the risk of suicide was almost twice the national average for individuals working in agricultural roles. Likewise, a systematic review of occupation and suicide found agricultural workers to be an occupation with an elevated suicide risk (Milner, Spittal, Pirkis, & LaMontagne, 2013). Accordingly, existing research has attempted to explain this phenomenon, but to date these findings have not been consolidated.
Research question	What are the risk factors for suicidal behaviour in farmers?
Objectives	• To identify existing international research into farming suicide • To evaluate existing international research into farming suicide • To consolidate findings from existing research to develop an understanding about risk factors for suicide in farmers.
Criteria for including studies in the review	
Population of interest	Farmers and retired farmers. The definition of farmer being "an individual occupationally concerned with the tending of live animals or plants" (Thomas et al., 2003).
Interventions or exposures	Not applicable
Comparisons or control groups	Not applicable
Outcomes of interest	Suicidal behaviour
Setting	'Organisation for Economic Co-operation and Development (OECD)' countries
Study designs	No methodological restrictions will be applied to the search.
Criteria for excluding studies not covered in inclusion criteria	
• Papers that are not published in a journal or book, in press or in an unpublished dissertation. • Papers that are not wrote in English • Papers that do not include primary data • Papers that are reporting on the impact of pesticide exposure • There will be no date restrictions applied to the search	
Search methods	
Electronic databases	MEDLINE; AMED; CINAHL; PsycINFO; Web of Science.

Other methods used for identifying relevant research	Reference checking of included articles
Search terms	The terms 'farmer', 'farm labourer', 'farmhand', 'farm worker' and 'agricultural worker' will all be combined with 'well being' OR 'wellbeing' OR 'well-being', 'emotion', 'anxiet*', 'psycholog*, 'mortalit*', 'menta*', 'stress*', 'depress*', 'self harm' OR self-harm' and 'suicid*.
Methods of review	
Details of methods	One main reviewer; then one second reviewer to check 10% of every screen, all included papers, quality appraisal and data extraction. A third reviewer can be called on to resolve any disagreements.
Quality assessment	The method of the papers retrieved will define the quality measure that is used.
Data extraction	Endnote to be used to keep track of references Data extraction form in Word document
Synthesis	The method of the papers retrieved will define the synthesis that is used.
Journal	
The systematic review will be targeted to the journal of Clinical Psychology Review	

References

Office of National Statistics (2016) Suicide by occupation England: 2011 to 2015. Retrived from: https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/articles/suicidebyoccupation/england2011to2015.

Milner, A., Spittal, M. J., Pirkis, J., & LaMontagne, A. (2013). Suicide by occupation: systematic review and meta-analysis. *203*(6), 409-416.

Roy, P., Tremblay, G., Oliffe, J. L., Jbilou, J., & Robertson, S.(2013). Male farmers with mental health disorders: A scoping review. *21*(1), 3-7.

Thomas, H. V., Lewis, G., Thomas, D. R., Salmon, R. L., Chalmers, R. M., Coleman, T. J., Softley, P. (2003). Mental health of British farmers. *Occupational and Environmental Medicine, 60*(3), 181-185. doi:10.1136/oem.60.3.181

Appendix C: PRISMA table

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a literature review.	7
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings;	9
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known about your topic.	10
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	11
METHODS			
Eligibility criteria	5	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	13
Information sources	6	Describe all information sources (e.g., databases with dates of coverage) in the search and date last searched.	12
Search	7	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	12
Study selection	8	State the process for selecting studies (i.e., screening, eligibility).	13
Risk of bias in individual studies	9	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level).	N/A

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	10	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	N/A
RESULTS			
Study selection	11	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	16
Study characteristics	12	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	17-32
Synthesis of results of individual studies	13	For all outcomes considered (benefits or harms), present, for each study: (a) summary of results and (b) relationship to other studies under review (e.g. agreements or disagreements in methods, sampling, data collection or findings).	17-32
DISCUSSION			
Summary of evidence	14	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	33
Limitations	15	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	34
CONCLUSION			
Conclusions	16	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	36

Appendix D: Kappa analysis

Paper Number	Kappa statistic	Strength of agreement	Third reviewer opinion sought
1	.593	Moderate	
2	.569	Moderate	
3	.724	Substantial	
4	.113	Slight	Yes
5	.892	Almost perfect	
6	.457	Moderate	
7	.585	Moderate	
8	.641	Substantial	
9	.457	Moderate	
10	.903	Almost perfect	
11	.449	Moderate	
12	.300	Fair	Yes
13	.799	Substantial	
14	.504	Moderate	
15	.687	Substantial	
16	.466	Moderate	
17	.616	Substantial	
18	.909	Almost perfect	
19	.474	Moderate	
20	.510	Moderate	
21	.507	Moderate	
22	.582	Moderate	
23	.504	Moderate	
24	.248	Fair	Yes
25	.470	Moderate	
26	.539	Moderate	
27	.611	Substantial	
28	.563	Moderate	
29	.770	Substantial	
30	1.0	Almost perfect	
31	.338	Fair	Yes
32	.442	Moderate	
33	.738	Substantial	
34	.735	Substantial	
35	.435	Moderate	
36	.444	Moderate	
37	.818	Almost perfect	
38	1.00	Almost perfect	
39	.562	Moderate	

**Strength of agreement as reported in Landis & Koch (1977

Appendix E: An example of data extraction

Suicidality			
Paper	Expression	Suicide Method	Exposure to suicide
Malmberg (1999)	There was also a lower rate of previous suicide attempts (11 farmers; 14%) than in other studies, which may reflect farmers' wishes to take decisive action and the availability of means of committing suicide. Suicide threats should be taken particularly seriously in farmers: where interview information was available. 46% had made a clear suicidal communication within three months of death. Four of the interview subjects had threatened death, or cause their family to be concerned for their safety and to take unsuccessful steps, including involving the police, to prevent access to the gun.	Hanging= 43% Shooting=27% Car gas=17% Drowning=11% Car exhaust poisoning=10%	
Malmberg (1997)		Hanging= 28% Shotgun=19% Other firearms=19% Car gas=17% Poisoning by chemicals and pharmaceuticals= 5 Drowning=4 Other=7	

Appendix F: Guidelines for publication

Journal of Public Health

Relevant information taken from:
https://academic.oup.com/jpubhealth/pages/instructions_for_authors

Description:

The *Journal of Public Health* invites submission of papers on any aspect of public health research and practice. Papers reporting findings from any region of the world are welcome. Papers are welcome that report on the theory and practice of the whole spectrum of public health across the domains of health improvement, health protection and service improvement, with a particular focus on the translation of science into action.

Article structure:

The Journal of Public Health expects papers to meet Observational studies in epidemiology STROBE guidelines.

Abstract- The abstract should be structured under the following headings: Background; Methods; Results; Conclusions. Reference citations should be avoided. The abstract should be no longer than 200 words.

Discussion- We ask all authors to structure the Discussion section with sub-headings as follows: Main finding of this study What is already known on this topic What this study adds Limitations of this study

References- In the text references should be numbered consecutively in Arabic numerals. All references cited should be listed according to the form of reference adopted by Index Medicus. Up to six authors can be listed; if the number exceeds six, quote the first three followed by et al. The sequence for a standard article is: author(s); title; journal; year; volume; first and last page numbers. The sequence for a book or other publication is: author(s), editor(s) or compiler(s); title; edition number; place of publication; publisher's name; year; first and last pages of reference (if relevant).

Tables- should be in table format, not inserted as graphics, on separate sheets and numbered consecutively with Roman numerals. They should be self-explanatory, with a brief descriptive title. Footnotes to tables indicated by lower case letters are acceptable, but they should not include extensive experimental detail.

Illustrations

All illustrations (line drawings and photographs) should be referred to in the text as Figure 1, etc., which should be abbreviated to 'Fig. 1.' only in the figure legend. Illustrations should be submitted in Adobe Photoshop compatible formats, preferably .tif, or alternatively .eps or .jpg, and saved as separate files, not embedded in the text file. If submitting line drawings

which require reduction, please check that the lettering will be clearly legible after the drawing has been reduced to the size at which it will be printed. After reduction, letters should not be smaller than 1.5 mm in height.

Appendix G: Strobe checklist

Checklist of items that should be included in reports of cross-sectional studies:

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	46
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	46
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	47-
Objectives	3	State specific objectives, including any pre-specified hypotheses	49/50
Methods			
Study design	4	Present key elements of study design early in the paper	51-
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	51-
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	51-
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	51-
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	51-
Bias	9	Describe any efforts to address potential sources of bias	54
Study size	10	Explain how the study size was arrived at	51
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	54
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	54
		(*b*) Describe any methods used to examine subgroups and interactions	54
		(*c*) Explain how missing data were addressed	55
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	51-
		(*e*) Describe any sensitivity analyses	N/A
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	54
		(b) Give reasons for non-participation at each stage	54
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg	51-

		demographic, clinical, social) and information on exposures and potential confounders	
		(b) Indicate number of participants with missing data for each variable of interest	54
Outcome data	15*	Report numbers of outcome events or summary measures	57-
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	N/A
		(*b*) Report category boundaries when continuous variables were categorized	N/A
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—e.g. analyses of subgroups and interactions, and sensitivity analyses	57-
Discussion			
Key results	18	Summarise key results with reference to study objectives	65
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	67
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	65-
Generalisability	21	Discuss the generalisability (external validity) of the study results	65-
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	N/A

Appendix H: Contact organisations

The Farming Community Network (FCN) is a voluntary organisation and charity that supports farmers and families within the farming community through difficult times. The charity runs a confidential national helpline and e-helpline which is open every day of the year from 7am-11pm. FCN has over 400 volunteers throughout England and Wales. They provide free pastoral and practical support to anyone who seeks help, whether the issue is personal or business-related. Most volunteers are involved in farming, or have close links with agriculture so have a great understanding of the issues farmers and farming families face. FCN works with a variety of stakeholders critical to the successful outcome of cases including government bodies, agricultural organisations and healthcare services. FCN volunteers can facilitate direct links to sympathetic professionals. FCN Volunteers provide support for as long as it is needed, 'walking with' people and helping them find a positive way through their problems.

Initial ideas for the project were discussed with Glyn Evans, Regional Director from FCN. Glyn also invited the researcher to join him at a University Farm-Animal Vet Society talk about FCN's work and the issues facing farmers. FCN and Glyn also regularly shared links to the project on social media. FCN's helpline number was used throughout the project

RSABI provides emotional, practical and financial support to individuals and their families across the agricultural sector including farming. RSABI is confidential and non-judgemental. RSABI encourage anyone who is finding things difficult or feeling under pressure to call their helpline. The helpline is available every day of the year from 7am to 11pm

Initial ideas for the project were discussed with Mags Granger, Welfare Manager from RSABI. Mags also reviewed the first draft of the questionnaire and provided comments. RSABI's helpline number was used throughout the project.

YANA (You Are Not Alone) offers specific help for those involved in any way with farming or agriculture in Norfolk, Suffolk and Worcestershire.

The project was discussed with Melinda Raker from YANA. Melinda sign-posted the researcher to a YANA document detailing a number of farming organisations which was particularly helpful for recruitment purposes. YANA also regularly shared links to the project on social media.

The National Farmers Union (NFU) is a representation body for agriculture and horticulture in England and Wales.

Initial ideas for the project were discussed with a number of staff members from the National Farmers Union (NFU). An article about the project (Appendix K) was put in the North-West Edition of the Farmer and Grower. The Farmer and Grower is a magazine for NFU members. Information about the project, and how to take part, was also circulated in NFU newsletters.

A number of other farming organisations shared the study online and with their members.

FCN Helpline- **03000 111 999** RSABI Helpline - **0300 111 4166**

Appendix I: Participant information sheet, consent form and questionnaire battery

An investigation into the relationship between adverse events on the farm and thoughts of suicide

Full project title*: An exploration of the relationship between adverse events on the farm and suicidal ideation in farmers; the mediating role of psychological factors*

Information Sheet

Introduction

You are being invited to participate in a research study. Before you decide whether to participate, it is important for you to understand why the research is being done and what it will involve.

Please take time to read the following information carefully. If you would like more information, or if there is anything that you do not understand, please contact the researcher.

You do not have to accept this invitation and you should only agree to take part if you want to.

Thank you for reading this.

General information: Why have I been chosen to take part?

The research study is interested in the views of adult farmers. This refers to individuals who are aged 18 years or older and who work as farmers, tending to live animals or plants. Participants will need to be fluent in English in order to successfully complete the questionnaire.

Do I have to take part?

Participation in the research study is voluntary. You do not have to accept this invitation and you should only agree to take part if you want to.

If you decide to participate, you are able to stop completing the questionnaire at any time without explanation and without incurring any disadvantage. If you stop completing the questionnaire, the information you will have already provided will be withdrawn and not be used in the study.

However, because all information will be anonymous, once the questionnaire has been submitted/posted you will not be able to withdraw your information from the study.

What will happen if I take part?

Once you have read about the study, you will be asked to confirm that you have understood the information provided. You will also be asked if you agree to taking part in the study.

If you agree to taking part in the study, you will be asked to confirm that you are an adult farmer and that you are fluent in English. If so, you will then be asked to complete some questions about yourself and the farm; this includes your age, gender, occupation and farm type.

You will be asked some questions about your recent experience of adverse events on the farm. Examples of adverse events include weather related problems, animal and/or crop disease, troubles with animals and problems with farm machinery. You will also be asked questions about your mental health, recent life experiences and thoughts of suicide. You will then be asked to complete a selection of short self-report measures focussing on optimism/pessimism, resilience and impulsivity.

The questionnaire should take you about 15-20 minutes to complete.

Will my participation be kept confidential?

Yes. The present study will not ask you for any information that would jeopardise your anonymity.

You have the option of completing either a paper or an online questionnaire. If you have selected to use a paper questionnaire, you will have been provided with a pre-paid postage envelope to enable you to return the questionnaire anonymously. If you have decided to complete an online questionnaire, you will be able to submit this anonymously.

Donations

At the end of the questionnaire the work of two organisations, who provide support to the farming community, will be described. You will then be asked if you would like a monetary donation to be made to these organisations as compensation for your time. If you tick yes, the researcher will make a donation on your behalf equalling around £2.50.

Are there any risks in taking part?

The content of the questionnaire has the potential to be distressing for some readers as you are being asked to think about negative life events. For support, you can contact your GP or you can call one of the helplines detailed, at the top of the page, throughout the study.

FCN Helpline- **03000 111 999** RSABI Helpline - **0300 111 4166**

The Farming Community Network (FCN) is a voluntary organisation and charity that supports farmers and families within the farming community through difficult times. The charity runs a confidential national helpline and e-helpline which is open every day of the year from 7am-11pm. FCN has over 400 volunteers throughout England and Wales. They provide free pastoral and practical support to anyone who seeks help, whether the issue is personal or business-related. Most volunteers are involved in farming, or have close links with agriculture so have a great understanding of the issues farmers and farming families face. FCN works with a variety of stakeholders critical to the successful outcome of cases including government bodies, agricultural organisations and healthcare services. FCN volunteers can facilitate direct links to sympathetic professionals. FCN Volunteers provide support for as long as it is needed, 'walking with' people and helping them find a positive way through their problems.

RSABI provides emotional, practical and financial support to individuals and their families across the agricultural sector including farming. RSABI is confidential and non-judgemental. RSABI would encourage anyone who is finding things difficult or feeling under pressure to call. The helpline is available every day of the year from 7am to 11pm.

The questionnaires are completed anonymously in order to ensure confidentiality. This means that you will not be able to receive individual feedback about the results of the study. However, you can contact the researcher if you have any questions. If you would like to receive a copy of the final report of the study when it is completed, please contact the researcher by email.

The questionnaire will take about 20 minutes of your time to complete.

Are there any benefits in taking part?

Along with the opportunity to make a monetary donation to two farming support organisations, you will be providing valuable information. It is hoped that this information will help to address suicide in farming. You will also be helping to raise awareness of the difficulties experienced by farmers.

What if I am unhappy or if there is a problem?

If you are unhappy, or if there is a problem, please feel free to let us know by contacting Professor Rhiannon Corcoran (Rhiannon.Corcoran@liverpool.ac.uk) and we will try to help.

If you remain unhappy or have a complaint which you feel you cannot come to us with then you should contact the Research Governance Officer (ethics@liv.ac.uk). When contacting the Research Governance Officer, please provide details of the name or description of the study (so that it can be identified), the researcher involved, and the details of the complaint you wish to make.

How will my data be used?

The University processes personal data as part of its research and teaching activities in accordance with the lawful basis of 'public task', and in accordance with the University's purpose of "advancing education, learning and research for the public benefit.

Under UK data protection legislation, the University acts as the Data Controller for personal data collected as part of the University's research. The Principal Investigator, Professor Rhiannon Corcoran, acts as the Data Processor for this study, and any queries relating to the handling of your personal data can be sent to Professor Rhiannon Corcoran.

Further information on how your data will be used can be found in the table below

How will my data be collected?	You have the option of completing either a paper or an online questionnaire. If you have selected to use a paper questionnaire, you will have been provided with a pre-paid postage envelope to enable you to return the questionnaire anonymously. If you have decided to complete an online questionnaire, you will be able to submit this anonymously.
How will my data be stored?	Data will be stored in accordance with the University's Research Data Management policy. It will remain the responsibility of the trainee until completion of the doctoral program. Following this, the data custodian (Professor Rhiannon Corcoran) will be responsible for the data until it is destroyed in accordance with the University's Research Data Management.
How long will my data be stored for?	The data custodian (Professor Rhiannon Corcoran) will be responsible for the data until it is destroyed after a minimum of 10 years in accordance with the University's Research Data Management policy.
What measures are in place to protect the security and confidentiality of my data?	The questionnaires are completed anonymously in order to ensure confidentiality and the data collected will be stored in accordance with the

	University's Research Data Management policy.
Will my data be anonymised?	The present study will not ask you for any information that would jeopardise your anonymity.
How will my data be used?	The results of the study will be written up as part of a clinical psychology doctoral thesis and may be published in professional journals and/or shared at relevant conferences. The results may also be shared through relevant organisations and networks. You will not be identified by name in any dissemination of the results.
Who will have access to my data?	Laura Phalp- Trainee Clinical Psychologist Professor Rhiannon Corcoran- Primary Supervisor Dr Catrin Eames- Secondary Supervisor
Will my data be archived for use in other research projects in the future?	In line with the University of Liverpool's Data Management Policy, anonymised research data will be made available for sharing and use by other authorised researchers to support other research in the future.
How will my data be destroyed?	The data will be destroyed in accordance with the University's Research Data Management.

Who can I contact if I have further questions?

If you have any further questions you can ask the researcher/primary investigator.

Email:
Laura Phalp- Trainee Clinical Psychologist (laura.phalp@liverpool.ac.uk) Professor Rhiannon Corcoran- (Rhiannon.Corcoran@liverpool.ac.uk)

Postal address:
Rhiannon Corcoran
Psychological Sciences
University of Liverpool
Liverpool
L69 3BX

FCN Helpline- **03000 111 999** RSABI Helpline - **0300 111 4166**

Telephone number:
+44 (0)151 794 3094 / +44 (0)151 795 5365

An investigation into the relationship between adverse events on the farm and thoughts of suicide

Full project title*: An exploration of the relationship between adverse events on the farm and suicidal ideation in farmers; the mediating role of psychological factors*

Consent Form

Researcher: Laura Phalp; Trainee Clinical Psychologist

Please read the following statements and tick if you agree with them:

1. I confirm that I have been provided with and read information about the, above detailed, study. ☐
2. I confirm that I have understood the information provided ☐
3. I confirm that I have been provided with the researcher's contact details should I wish to ask any questions about the above study ☐
4. I understand that taking part in the study involves completing a questionnaire. ☐
5. I understand that my participation is voluntary and I am able to stop completing the questionnaire at any time and, subsequently, withdraw from the study without giving any reason and without my rights being affected. ☐
6. I understand that once I have completed the questionnaire and submitted it/posted it I will not be able to withdraw the information I have provided. ☐
7. I understand that the information I provide will be held securely and in line with data protection requirements at the University of Liverpool. And that the anonymised data will be made available for sharing and use by other authorised researchers in order to support other research in the future. ☐
8. I agree to take part in the above study. ☐

FCN Helpline- **03000 111 999** RSABI Helpline - **0300 111 4166**

Part one

This research study is interested in the views of adult farmers. This refers to individuals who are aged 18 years or older and who work as farmers, tending to live animals or plants. Participants will need to be fluent in English in order to successfully complete the questionnaire.

Q1. Are you aged 18 years or over?

☐ Yes ☐ No

Q2. Are you a farmer (someone who tends to live animals or plants)?

☐ Yes ☐ No

Q3. Are you fluent in English?

☐ Yes ☐ No

Part two

Q4. Which of the following best describes your age?

☐ Under 28 years ☐ 29-38 years ☐ 39-48 years ☐ 49-58 years

FCN Helpline- **03000 111 999** RSABI Helpline - **0300 111 4166**

☐ 59-68 years ☐ 69 years and over ☐ Prefer not to say

Q5. Are you:

☐ Male ☐ Female ☐ Prefer not to say

Q6. Which of the following best describes your job role:

☐ Business owner (Land Owner) ☐ Business owner (Tenant)

☐ Spouse of business owner ☐ Regular Farm Employee

☐ Salaried Farm Manager Casual ☐ Farm Worker

☐ Other ☐ Prefer not to say

Q7. Do you work on a farm:

☐ Part time (less than 30 hours a week) ☐ Full time (more than 30 hours a week)

☐ Prefer not to say

Q8. Please tick the type of farm you work on (you can select more than one**):**

☐ Cereals ☐ General Cropping

☐ Horticulture ☐ Dairy

☐ Grazing Livestock (lowland) Grazing ☐ Livestock (LFA)

☐

☐ Specialist Pigs Specialist Poultry

☐ Beef Production ☐ Other (including non-classifiable)

☐ Prefer not to say

Q9. Where are you based?

☐ England ☐ Wales ☐ Scotland ☐ Northern Ireland

☐ Other ☐ Prefer not to say

Q10. Which of the following best describes the holding you work on/own:

☐ Under 20 hectares ☐ 20 to 50 hectares ☐ 50 to under 100 hectares

☐ 100 hectares and over ☐ Prefer not to say

Q11. Does the farm include land classified as 'Less Favoured Area' (LFA)?

☐ Yes ☐ No ☐ Don't know/Prefer not to say

Part three

Q12. Within the past 12 months, have you experienced one or more adverse events on the farm? Examples of such events include weather related problems, disease and/or difficulties with animals and/or farm machinery.

☐ Yes No ☐ Don't ☐ know/Prefer not to say

If your answer to the above question (Q12) is 'No' or 'Don't know/Prefer not to say', please skip to Q16.

Q13. If so, please briefly detail the adverse event on the farm which you feel to have been the most prominent within the past 12 months?

Q14. Which of the following best describes the impact of the, above detailed, event on you?

- ○ Very negative
- ○ Negative
- ○ Neutral
- ○ Positive
- ○ Very positive
- ○ Don't know/Prefer not to say

Q15. Which of the following best describes the impact of the, above, event on the farm business?

- ○ Very negative
- ○ Negative
- ○ Neutral
- ○ Positive
- ○ Very positive
- ○ Don't know/Prefer not to say

Q16. Which of the following best describes how often you experience adverse events on the farm?

- ○ Less than once every ten years
- ○ More than once every ten years
- ○ More than once every five years
- ○ More than once every year
- ○ More than once a month
- ○ More than once a week
- ○ Don't know/Prefer not to say

Part four Q17. Please tick the life events that have occurred to you within the past 12 months. If a particular life event has happened to you more than once within the past 12 months, please document how many times in the space provided.

- ☐ Death of a spouse *How many times?* _____
- ☐ Divorce *How many times?* _____
- ☐ Marital separation *How many times?* _____
- ☐ Jail term *How many times?* _____
- ☐ Death of a close family member *How many times?* _____
- ☐ Personal injury or illness *How many times?* _____
- ☐ Marriage *How many times?* _____
- ☐ Fired at work *How many times?* _____
- ☐ Marital reconciliation *How many times?* _____
- ☐ Retirement *How many times?* _____
- ☐ Change in health of family member *How many times?* _____
- ☐ Pregnancy *How many times?* _____
- ☐ Sex difficulties *How many times?* _____
- ☐ Gain of a new family member *How many times?* _____
- ☐ Death of a close friend *How many times?* _____
- ☐ Change in number of arguments with spouse *How many times?* _____
- ☐ Mortgage or loan over £100000 *How many times?* _____
- ☐ Foreclosure of mortgage or loan *How many times?* _____
- ☐ Son or daughter leaving home *How many times?* _____
- ☐ Trouble with in-laws *How many times?* _____

- ☐ Change in living conditions *How many times?* _____

- ☐ Revision of personal habits *How many times?* _____
- ☐ Trouble with boss *How many times?* _____
- ☐ Change in residence *How many times?* _____
- ☐ Change in recreation *How many times?* _____
- ☐ Change in church activities *How many times?* _____
- ☐ Change in social activities *How many times?* _____
- ☐ Mortgage or loan under £100000 *How many times?* _____
- ☐ Change in the number of family get-togethers *How many times?* _____
- ☐ Single person living alone *How many times?* _____

Part five

Q18. Would you say that you tend to suffer with feelings of depression or anxiety?

- ○ Never
- ○ Infrequently
- ○ Sometimes
- ○ Frequently
- ○ Often
- ○ Don't know/Prefer not to say

Q19. Have you ever taken medication or used services to support your mental health?

☐

Yes No ☐ Don't ☐ know/Prefer not to say

If your answer to the above question (Q19) is 'No' or 'Prefer not to say', please skip to Q21.

Q20. If yes, are you currently taking medication or using services to support your mental health?

☐ Yes No ☐ Don't ☐ know/Prefer not to say

Part six

Q21. Suicidal thoughts are a lot more common than most people think– in fact, most people have thought about suicide at some point or another.

In the past 12 months, have you had any thoughts that you would be better off dead or of hurting yourself in some way?

☐ Yes No ☐ Don't ☐ know/Prefer not to say

If your answer to the above question (Q21) is 'No' or 'Prefer not to say', please skip to Q24.

Q22. If yes, how often have you had such thoughts in the past 12 months?

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Very often
- ○ Don't know/Would prefer not to say

Q23. If yes, which best describes the thoughts?

- ○ It was just a brief passing thought
- ○ I have had a plan at least once to hurt myself but did not try to do it
- ○ I have had a plan at least once to hurt myself but did not want to die
- ○ I have had a plan at least once to hurt myself and really wanted to die
- ○ I have attempted to hurt myself but did not want to die
- ○ I have attempted to hurt myself and really hoped to die
- ○ Would prefer not to say

FCN Helpline- **03000 111 999** RSABI Helpline - **0300 111 4166**

Part seven

Q.24 Please read each of the following statements and tick the response that best applies to you.

Please be as honest and accurate as you can throughout. Try not to let your response to one statement influence your responses to other statements. There are no "correct" or "incorrect" answers. Answer according to your own feelings, rather than how you think "most people" would answer.

	I agree a lot	I agree a little	I neither agree nor disagree	I disagree a little	I disagree a lot	Don' t know/I would prefer not to say
In uncertain times, I usually expect the best						
It's easy for me to relax						
If something can go wrong for me, it will						
I'm always optimistic about my future						
I enjoy my friends a lot.						
It's important for me to keep busy.						
I hardly ever expect things to go my way						
I don't get upset too easily						
I rarely count on good things happening to me.						
Overall, I expect more good things to happen to me than bad.						

Q25. How do you usually deal with stressful situations? Please read each of the following statements and select the one answer that most closely reflects your own reactions. There are no "right" or "wrong" answers.

	1= VERY UNcharacteristic of me	2 = RATHER UNcharacteristic of me	3 = SOMEWHAT UNcharacteristic of me	4 = SOMEWHAT characteristic of me	5 = RATHER characteristic of me	6 = VERY characteristic of me
I become easily discouraged by failures.	☐	☐	☐	☐	☐	☐
When my performance does not satisfy I start to question my abilities	☐	☐	☐	☐	☐	☐
I often feel unable to deal with problems.	☐	☐	☐	☐	☐	☐
Failures can shake my self-confidence for a long time.	☐	☐	☐	☐	☐	☐
When I am confronted with unusual demands, I feel helpless	☐	☐	☐	☐	☐	☐
When I do not immediately succeed in a project, I quickly lose hope for a good	☐	☐	☐	☐	☐	☐

outcome.

	1= VERY UNcharacteristic of me	2 = RATHER UNcharacteristic of me	3 = SOMEWHAT UNcharacteristic of me	4 = SOMEWHAT characteristic of me	5 = RATHER characteristic of me	6 = VERY characteristic of me
When I can't solve a task, I blame my lack of abilities.	☐	☐	☐	☐	☐	☐
When I fail at something, I tend to give up	☐	☐	☐	☐	☐	☐
When my work is criticised, I feel depressed	☐	☐	☐	☐	☐	☐
I often feel overpowered by obstacles or troubles	☐	☐	☐	☐	☐	☐
I lose faith in myself when I make mistakes.	☐	☐	☐	☐	☐	☐
If I do not instantly succeed in a matter, I am at a loss	☐	☐	☐	☐	☐	☐

FCN Helpline- **03000 111 999** RSABI Helpline - **0300 111 4166**

Q26. People differ in the ways they act and think in different situations. This is a test to measure some of the ways in which you act and think. Read each statement and tick the appropriate rating. Do not spend too much time on any statement. Answer quickly and honestly.

	1- Rarely/never	2-Occasionally	3-Often	4-Almost always/always
I plan tasks carefully.	☐	☐	☐	☐
I do things without thinking	☐	☐	☐	☐
I make-up my mind quickly.	☐	☐	☐	☐
I am happy-go-lucky.	☐	☐	☐	☐
I don't "pay attention."	☐	☐	☐	☐
I have "racing' thoughts	☐	☐	☐	☐
I plan trips well ahead of time	☐	☐	☐	☐
I am self controlled.	☐	☐	☐	☐
I concentrate easily	☐	☐	☐	☐
I save regularly	☐	☐	☐	☐
I "squirm" at plays or lectures	☐	☐	☐	☐
	☐	☐	☐	☐

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I plan for job security				
I am a careful thinker	☐	☐	☐	☐
I say things without thinking	☐	☐	☐	☐
I like to think about complex problems	☐	☐	☐	☐
I change jobs	☐	☐	☐	☐
I act "on impulse"	☐	☐	☐	☐
I get easily bored when solving thought problems	☐	☐	☐	☐
I act on the spur of the moment	☐	☐	☐	☐
I am a steady thinker	☐	☐	☐	☐
I change residences	☐	☐	☐	☐
I buy things on impulse	☐	☐	☐	☐
I can only think about one thing at a time	☐	☐	☐	☐
I change hobbies	☐	☐	☐	☐
I spend or charge more than I earn	☐	☐	☐	☐

I am more interested in the present than the future	☐	☐	☐	☐
I often have extraneous thoughts when thinking	☐	☐	☐	☐
I am restless at the theatre or lectures	☐	☐	☐	☐
I like puzzles	☐	☐	☐	☐
I am future oriented	☐	☐	☐	☐

FCN Helpline- **03000 111 999** RSABI Helpline - **0300 111 4166**

Thank you very much for completing the questionnaire.

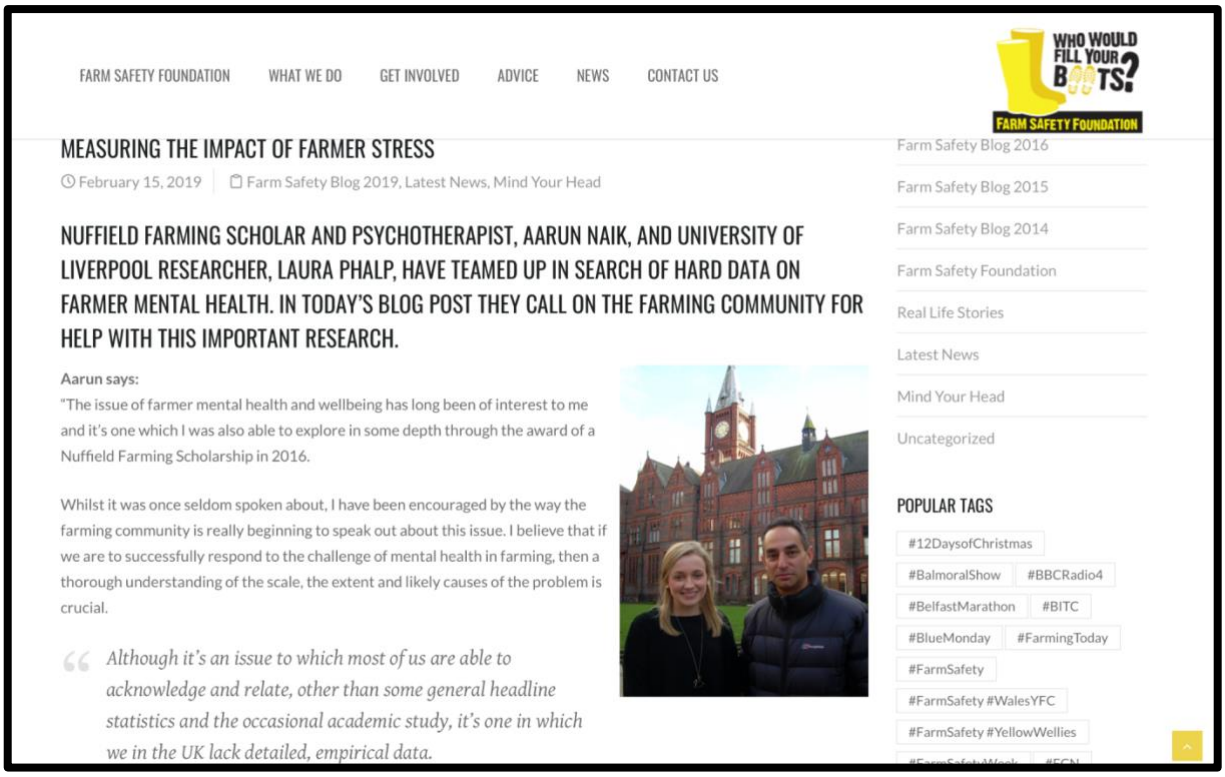
The Farming Community Network (FCN) is a voluntary organisation and charity that supports farmers and families within the farming community through difficult times. The charity runs a confidential national helpline and e-helpline which is open every day of the year from 7am-11pm. FCN has over 400 volunteers throughout England and Wales. They provide free pastoral and practical support to anyone who seeks help, whether the issue is personal or business-related. Most volunteers are involved in farming, or have close links with agriculture so have a great understanding of the issues farmers and farming families face. FCN works with a variety of stakeholders critical to the successful outcome of cases including government bodies, agricultural organisations and healthcare services. FCN volunteers can facilitate direct links to sympathetic professionals. FCN Volunteers provide support for as long as it is needed, 'walking with' people and helping them find a positive way through their problems.

RSABI provides emotional, practical and financial support to individuals and their families across the agricultural sector including farming. RSABI is confidential and non-judgemental. RSABI would encourage anyone who is finding things difficult or feeling under pressure to call. The helpline is available every day of the year from 7am to 11pm.

Would you like a monetary donation to be made to these organisations as compensation for your time? If you tick yes, the researcher will make a donation on your behalf equalling around £2.50.

No ☐ Yes ☐

Appendix J: Yellow Wellies- Farm Safety Blog 2019



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WHO WOULD FILL YOUR BOOTS? FARM SAFETY FOUNDATION

MEASURING THE IMPACT OF FARMER STRESS

February 15, 2019 | Farm Safety Blog 2019, Latest News, Mind Your Head

NUFFIELD FARMING SCHOLAR AND PSYCHOTHERAPIST, AARUN NAIK, AND UNIVERSITY OF LIVERPOOL RESEARCHER, LAURA PHALP, HAVE TEAMED UP IN SEARCH OF HARD DATA ON FARMER MENTAL HEALTH. IN TODAY'S BLOG POST THEY CALL ON THE FARMING COMMUNITY FOR HELP WITH THIS IMPORTANT RESEARCH.

Aarun says:

"The issue of farmer mental health and wellbeing has long been of interest to me and it's one which I was also able to explore in some depth through the award of a Nuffield Farming Scholarship in 2016.

Whilst it was once seldom spoken about, I have been encouraged by the way the farming community is really beginning to speak out about this issue. I believe that if we are to successfully respond to the challenge of mental health in farming, then a thorough understanding of the scale, the extent and likely causes of the problem is crucial.

> *Although it's an issue to which most of us are able to acknowledge and relate, other than some general headline statistics and the occasional academic study, it's one in which we in the UK lack detailed, empirical data.*

Farm Safety Blog 2016
Farm Safety Blog 2015
Farm Safety Blog 2014
Farm Safety Foundation
Real Life Stories
Latest News
Mind Your Head
Uncategorized

POPULAR TAGS

#12DaysofChristmas
#BalmoralShow #BBCRadio4
#BelfastMarathon #BITC
#BlueMonday #FarmingToday
#FarmSafety
#FarmSafety #WalesYFC
#FarmSafety #YellowWellies

Appendix K: Farmer and Grower North-West Edition

NORTH WEST

Researching the relationship between adverse events on farms and thoughts of suicide

Researcher and trainee Clinical Psychologist **Laura Phalp** is investigating the relationship between adverse events on farms and thoughts of suicide.

The 27 year old's study will form a big part of her doctorate in clinical psychology at the University of Liverpool. Her thesis will be submitted in June 2019 and Laura hopes her investigation will be published and that the findings are interesting and informative enough to publish in medical journals.

The daughter of a North Yorkshire tenant farmer, the study is close to Laura's heart having witnessed the heartbreak and frustration farming can bring to a family. Laura said: "I was quite young when Foot and Mouth Disease took place

but the little I can remember will stay with me for life. Seeing families who had spent lifetimes raising herds just losing it all overnight was gut wrenching.

"That's just one example. There are still countless unpredictable forces at play in farming which can make or break a business and worse still the farmer has absolutely no control over any of them. You just have to look at floods and droughts as examples. This is where my project has come from. I want to know if there is a link. And once this piece of work is completed I don't want it to be

shelved. I want the results to be used by the agricultural industry to further our understanding of mental health in farming."

The full project title is: An exploration of the relationship between adverse events on the farm and suicidal ideation in farmers; the mediating role of psychological factors.

Farmers taking part will be asked some questions about their recent experience of adverse events on the farm. Examples include weather related problems, animal or crop disease, troubles with animals and problems with farm machinery. They will also be asked questions about their mental health, recent life experiences and thoughts of suicide. Participants will then be asked to complete a selection of short self-report measures focusing on optimism, pessimism, resilience and impulsivity.

The questionnaire takes about 20 minutes to complete and will not ask participants for any information that would jeopardise anonymity.

Laura said: "The content of the questionnaire does have the potential to be distressing for some readers as they are asked to think about negative life events. So there is a small risk to taking part but support is available from two organisations assisting me. These are Farming Community Network and the Royal Scottish Agricultural Benevolent Institution (RSABI).

"However there are major benefits for taking part. Along with the opportunity to make a monetary donation to two farming support organisations

participants will also be providing valuable information. It is hoped that this information will help to address suicide in farming. They will also be helping to raise awareness of the difficulties experienced by farmers."

So far, 53 people have clicked through to take part in Laura's study. She needs another 118 in order to apply the relevant statistical test and she'll be recruiting nationwide up until 30 December 2018.

To take part in the study visit: https://tinyurl.com/farmingresearchstudy

Participants have the option of completing either a paper or the online questionnaire. Paper questionnaires will be available at the NFU Regional Office in Skelmersdale and will come with a pre-paid postage envelope to enable people to return the questionnaire anonymously.

Data will be stored in accordance with the University of Liverpool's Research Data Management policy.

Laura studied psychology at Sterling University for four years before getting a support worker job in Hartlepool before progressing to be an assistant psychologist in Tyneside and Gateshead.

Now completing her doctorate, she works as a trainee clinical psychologist and is employed by Mersey Care NHS. She now helps older adults at the Arrowe Park Hospital on the Wirral.

Laura enlisted the assistance of the NFU via her parents' group secretary Greg Pyrah who has been the group secretary for Stokesley since 1994. Greg put her in touch with the NFU North East Regional Director who then in turn put her in contact with former NFU Cheshire County Adviser Aarun Naik who has become her mentor.

Aarun Naik is a former NFU adviser now psychotherapist. Having worked in the wider industry for many years he became concerned about the issue of mental health in farming and was awarded a Nuffield Farming Scholarship to look in depth into the problem.

Appendix L: Advertisement cards

Appendix M: Content analysis: example of themes

Weather problems	The beast from the East. Snow/Beast from the East snow followed by drought/ The 'Beast from the East' last February
	Bad weather/Weather/Significant weather/Weather last winter/Poor weather in spring
	Weather affecting quality/quantity of crops.
	Drought and lack of grass for feed/Drought/Worry over drought conditions May –July/ Drought leading shortage of grass/silage/ Severe drought meaning less crop yield
	Flooding/Floods
	We had awful wet weather over winter, and now the boiling summer means we are now short of forage for winter.
	Weather related wet spring followed by drought through summer/Weather, wet spring, drought for 9 weeks/ Weather, both spring and a dry summer/Very wet spring, followed by drought in the summer
	Adverse weather, snow & freezing, drought
	Adverse weather and poor-quality forage/ Adverse weather conditions have made it difficult
	The weather, from the cold wet winter to the hot dry summer impacted on the amount of grazing land we had and meant more supplementary feeding
	The dry weather
	Hail
	The "Beast from the East took the roof off the barn which was not insured.
	Un-favourable weather for extended periods of time (2 months)
	Extreme wet seven month winter followed by extreme dry summer.
	Poor weather and rising input costs.
	Poor harvest due to weather
	We grow crops under cover in greenhouses and polytunnels. This summer temperatures were very hot which put myself and my staff under extreme pressure to deliver class one produce to the supermarkets.
	Drought, frost damage, low yields
	Sending sheep away for wintering last winter due to the extreme wet conditions and lack of forage at home.
	Snow trapping ewes
	Hot summer, dry spring has resulted in failed rape crops.

	Dry summer- having to use winter feed during the dry months when there was no grass, therefore impacting on amount/ price of feed for winter.
	Hot weather causing drop of yields
	Weather has been a challenge, but in reality there is always a challenge and an issue with something that causes worry and stress. Started wet then went very dry.
	Snow in March/ Snow during calving
	Extremely wet weather /late spring
	2018 drought leading to crop/yield losses/ Drought conditions leading to poor crops
	Lack of forage due to weather
	The snow and then the drought
	Excessive rainfall followed by excessive heat
	Weather, which impacted cash flow and a reduced income.
	Weather last spring prevented work to be carried which backed up and meant jobs were not completed properly. Then in June, the drought took hold which once again caused loss of work and affected crops which is now having a financial impact.
	Cold wet spring, very dry summer, poor veg yields.
	Wet weather during lambing. Feed shortages
	Dry and hot weather 2018/hot weather
	Silage shortage in spring due to exceptionally cold weather.
	Prolonged drought effecting performance of stock, and stocks of fodder
Livestock concerns	Loss of herd to TB/TB/TB outbreak in herd/losing cattle to TB/ TB Reactors found
	Yew tree poisoning in eight cattle, seven died
	Disease/chronic disease problems
	Scab
	No calves have been produced
	Sheep sent away from home and not looked after properly and suffered badly from fluke! This caused a lot of immediate health problems and a few deaths and also longer-term problems.
	Death of a calf/ High mortality rate at calving
	Sale of most of my livestock
	Wet 3rd cut silage cattle not thriving
	Low sale prices for year old calves/ prices of finished stock
	Livestock losses despite good care

	Cattle with pneumonia adding extra cost
	A young calf fell into the slurry tank due to a broken concrete slat. We got the calf out alive but it was a very stressful time
	Electrocuted a cow
	Drought effecting performance of stock
	Sheep aborting just before lambing time, also snow trapping ewes
Finances and trading concerns	Abattoir on our island suddenly closed with no notice
	Milk price/ Low milk price, rising costs
	Weather, which impacted cash flow and a reduced income. Worry about making ends meet
	Poor returns from supermarkets
	Low sale prices for year old calves/ prices of finished stock
	Brexit uncertainty - we will [will we?] still be supported by the government
	Reducing budgets and increasing workload
	Did not get rural payments as I had messed up on the form, so we were nearly 8000 down. tractor broke, stopped opening letters/ bills/ debts mounted up. Began work outside the farm, which was good, but impacted on what was happening at home. Movement restrictions kicked in, had to sell my jewelry that I had inherited from my mother to pay for tractor repairs.
	Weather last spring prevented work to be carried which backed up and meant jobs were not completed properly. Then in June, the drought took hold which once again caused loss of work and affected crops which is now having a financial impact.
	[….] All of them where in very poor condition and a lot of extra feed had to be brought in to try and regain some body condition before lambing which had big financial costs. They also had to receive a number of extra treatment and the worst ones had to be housed for a time to help them recover. The barren ones had to be fattened and sold to try and recoup some money!
	End of tenancy dispute […]. However, although the amount paid to the landlord in compensation was minimised the total legal and professional fees in defending the claim were significant albeit still at least half the landlord's claim for compensation. Although the financial damage was minimised it was still significant for a small family farm business
	We set up another business 3 years ago and this business has expanded 4 fold; we have been waiting for a loan/overdraft extension for the business and our bank

	has been terrible thus putting ourselves and our fellow directors under a lot of pressure due to banks inability to properly help
	Delayed installation of major investment project in robot milking
	Part non-payment of BPS for 2013, 2014, 2015, 2016, 2017

Appendix N: Approval letter from the university ethics' committee

15 June 2018

Dear Prof Corcoran

I am pleased to inform you that your application for research ethics approval has been approved. Application details and conditions of approval can be found below. Appendix A contains a list of documents approved by the Committee.

Application Details

Reference: Project Title: Principal Investigator/Supervisor: Co-Investigator(s): Lead Student Investigator: Department: Approval Date: Approval Expiry Date:

2566 An investigation into the relationship between adverse events on the farm and thoughts of suicide Prof Rhiannon Corcoran Miss Laura Phalp, Dr Catrin Eames - Psychological Sciences 15/06/2018 Five years from the approval date listed above

Central University Research Ethics Committee A

The application was **APPROVED** subject to the following conditions: **Conditions of approval**

All serious adverse events must be reported via the Research Integrity and Ethics Team (ethics@liverpool.ac.uk) within 24 hours of their occurrence. If you wish to extend the duration of the study beyond the research ethics approval expiry date listed above, a new application should be submitted. If you wish to make an amendment to the research, please create and submit an amendment form using the research ethics system. If the named Principal Investigator or Supervisor leaves the employment of the University during the course of this approval, the approval will lapse. Therefore, it will be necessary to create and submit an amendment form using the research ethics system. It is the responsibility of the Principal Investigator/Supervisor to inform all the investigators of the terms of the approval.

Kind regards,

Central University Research Ethics Committee A ethics@liverpool.ac.uk CURECA