Title: Protocol for a systematic review and meta-analysis: prevalence of depression among farmers and agriculturalists worldwide

Study Registration

This systematic review and meta-analysis protocol will be archived in the University of Guelph Online Repository (https://atrium.lib.uoguelph.ca/xmlui/handle/10214/10046). The systematic review protocol will be reported in accordance with to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses-Protocol (PRISMA-P) 2015 check-list (Moher D, Liberati A, Tetzlaff J, Altman DG, 2009).

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INTRODUCTION

Rationale

Mental health issues present a significant global health concern as depressive mental illnesses present the largest disease burden in higher-income countries (World Health Organization, 2004). One occupational group, farmers, experience significantly higher prevalence of mental illness compared to the general population and experience higher levels of depressive symptoms. The higher prevalence of mental illness in the farming population can be seen as a product of the unique stressors that they experience.

In a study conducted in Australia, farming was identified as one of the most stressful occupations (Kerby, 1992). Stressors are the factors impacting the mental health of an individual and contributing to the outcome of stress. The farm stress survey identified 6 stressors that serve to predict the outcome of stress through the use of the following metrics: emotional strain; frequency of illness; and life satisfaction (Eberhardt & Pooyan, 1990). These stressors included

hazardous working conditions; climatic conditions; general economic conditions; geographic isolation; time pressure; and personal finances. Two factors, personal finances and time pressure, were identified as being predictive of all three metrics (Eberhardt & Pooyan, 1990). Additionally, geographic isolation was identified as being predictive of only emotional strain and frequency of illness (Eberhardt & Pooyan, 1990). All six interpretable factors were considered moderately predictive of the metrics used to assess stress (Eberhardt & Pooyan, 1990). Other studies have identified weather as a significant stressor in farming populations (Firth, Williams, Herbison, & McGee, 2007). One such study, examining stressors in a sample of 128 farmers in North Carolina, identified bad weather as "very stressful" in 60.2% of the sample (Kearney, Rafferty, Hendricks, Allen, & Tutor-Marcom, 2014). In the same study, a series of other common stressors were identified, including market prices for crops and livestock, taxes, and healthcare costs (Kearney et al., 2014).

Stressors and stressful life events are found to be significantly associated with depressive symptoms (Hirsch & Cukrowicz, 2014; Lorenz, Elder Jr., WanNing, Wickrama, & Conger, 2000). Examinations of suicide, one outcome of poor mental health, have determined that farmers and agriculturalists are subject to a higher risk of death by suicide than other occupational groups of similar socioeconomic status (Milner, Spittal, Pirkis, & LaMontagne, 2013). High risk of death by suicide represents a troubling indicator of poor mental health and stressful conditions. Upon examination of cases of death by suicide in farming populations, the most common previously diagnosed illness was depression which is present in 94% of cases (Booth, Briscoe, & Powell, 2000). As such, depression is identified as a significant risk factor for death by suicide, as well as suicidal ideation in this population (McLaren & Challis, 2009; Schneider et al., 2006). In addition, depression is associated with an 11% increase in age- and sex-adjusted risk all-cause mortality, including suicide, as well as mortality resulting from

accidents and disease (Letnes, Torske, Hilt, Bjørngaard, & Krokstad, 2016). This concern further outlines the importance of investigating depression in farming populations.

Examinations of depression within farming populations have determined that farmers and agriculturalists experience high levels of depressive symptoms (Feng, Ji, & Xu, 2015; Grzywacz et al., 2014, 2010; Hanklang, Kaewboonchoo, Morioka, & Plernpit, 2016). Although suicide and other mental health outcomes have been examined globally, a worldwide estimate of the prevalence of depression in farmers and agriculturalists has not yet been undertaken. Estimating the global prevalence of depression in farming populations could determine how widespread the issue is across various parts of the world and would assist in determining whether additional resources should be allocated to intervention and screening for mental illness. A determination of the risk factors associated with depression in this community will provide helpful information in two areas. First, mental health professionals will be able to better target screening and intervention programs, as well as tailor the delivery of these programs to individuals and geographic areas that present a higher risk for depression. Secondly, understanding risk factors associated with depression is helpful for the farming population itself. Being attentive to risk factors that put farmers and agriculturalists at higher risk for mental illness can aid in management of these factors on both an individual and community level.

Furthermore, assessments of heterogeneity and risk of bias can provide crucial information. Heterogeneity refers to the degree to which studies differ depending on participants, methods, and outcomes that are assessed. Assessing the risk of bias determines the degree of bias introduced in the methodology of individual studies. Both of these assessments provide crucial information regarding the quality of the estimate produced in the meta-analysis as well as guide directions for future research. Identifying areas of weakness and inconsistency in

methodology serves to provide useful information for future researchers who seek to conduct better quality research and provide means for effective comparisons across studies.

Objectives: The objective of this protocol is to outline the methods of a systematic review and meta-analysis that aims to fulfil the following research objectives: to quantify the prevalence of depression among farmers and agriculturalists worldwide and assess the risk of bias and heterogeneity in the literature.

METHODS

Eligibility Criteria

Studies are eligible for inclusion in the systematic review if they are: primary research articles; available in English; and examine prevalence of depression in a farming population.

Information sources

Electronic searches for the present systematic review will be conducted using the following databases: Agricola (via Proquest); PubMed (via NCBI); Web of Science (via ProQuest); and Medline (via Ovid). No date restrictions in the search were placed, aside from those imposed by the databases themselves (Agricola, 1970; PubMed, 1946; Web of Science, 1864; Medline, 1879). The literature search will include articles published before January 1, 2019. The results of this literature search will be cross-referenced with the results of the literature search conducted in the aforementioned scoping review, which included articles published before January 1, 2018.

Search strategy

The list of search terms is provided here in table 1.

Table 1: Search String to identify studies examining depression in farming populations conducted in PubMed via NCBI on December 11th, 2018

447305	("Mental health" OR "Mental illness" OR "anxiety OR "depress*" OR "occupational stress") = 2
496668	(farm* OR agricultur*) = 1
2185	1+2

Study Records

i)   Data Management

Articles will be imported into a systematic review software (DistillerSR, Evidence Partners Inc., Ottawa, ON) from a reference management software (EndnoteX7, Clarivate Analytics, Philadelphia).

Selection Process

The first 10 articles will be used to pre-test the title/abstract screening form between all reviewers. Articles will then be screened independently in duplicate. Title and abstract will be assessed by the reviewers with the following questions: (1) is the study available in English?; (2) is the article a primary study? (including the use of census data); and (3) does the study examine depression in a farming population? Response options for these questions will include 'yes', 'no', and 'unclear'. To move on to full-text screening, the article must receive a 'yes' or 'unclear' response to all three questions. The articles which the reviewers both agree do not meet eligibility criteria (by answering 'no' to one of the questions, will be excluded. Agreement for title/abstract screening will be at the form level. Conflicts arising between reviewers during the title and abstract screening will be resolved by a third reviewer (AJB).

Following title and abstract screening, articles will undergo full-text screening. Full-text versions of those articles which are not excluded in the title and abstract screening will be obtained. The full text screening form will be pre-tested with 10 articles by all reviewers, after which articles will be screened independently in duplicate. If the reviewers do not answer 'yes' to each of the questions in the full-text screening of an article, the article will be excluded from the review. The questions used to assess eligibility of an article in the full-text screening stage are as follows:

1) Is the full-text article available?

2) Is the study available in English?

3) Is the article a primary study? ('yes' including the use of census data)

4) Does the study attempt to quantify depression in a farming population?

If conflicts arise between answers by the reviewers on a question during the full-text screening stage, the reviewers will discuss until a consensus will be reached. In the event that a consensus cannot be reached by the two reviewers, a third party (AJB) will be used in order to reach the consensus on that particular question. Agreement for full text screening will be at the answer level. Articles excluded at full text will be reported in the PRIMSA flow diagram, with reasons for exclusion.

ii)   *Data Collection Process*

Prior to the selection and data extraction stages, two reviewers (JW and BH) will be trained on the use of data extraction forms and the systematic review protocol for consistency between the reviewers. Information pertinent to the research objectives will be collected in DistillerSR. The data-extraction tool will be pre-tested on a minimum of 10 articles in order to ensure clarity of questions and consistency in answering said questions in the form.

Data Items

The following data items will be used to collect information pertinent to the research objectives:

1) Year the article was published

2) Year the study was conducted

3) Target population of the study

4) Gender distribution of the sample

5) Size of the sample

6) Participant selection procedure

7) Study design that was used in this study

8) How depression was measured?

9) Was a validated scale used in the quantification of depression in this population?

10) Were risk factors for depression in the farming population identified?

11) List depression risk factors that were identified in the article

Outcomes and Prioritization

The following outcome data will be collected for articles that use CES-D as a validated scale for quantifying depression in the farming population:

1) Number of participants that had depression

2) Number of participants that were assessed for the outcome of interest

Risk of Bias in Individual Studies

Risk of bias will be assessed in eligible studies attempting to quantify depression in a farming population. This risk of bias assessment will utilize the Risk of Bias Assessment in Non-randomized Studies of Interventions (ROBINS-I) (Sterne et al., 2016). These questions will be modified in order to assess the risk of bias in observational studies quantifying depression

regarding participants selection, methodology, and examination of depression in the farming population.

Data Synthesis

Meta-analysis

A meta-analysis will be conducted for the prevalence of depression in each study that quantified depression using a validated scale. The meta-analysis will be conducted in R 3.3.3(R Foundation for Statistical Computing, Vienna, Austria), using RStudio version 1.0.136 (RStudio Inc., Boston, MA) using the 'metafor' package (Viechtbauer, 2016). A random effects approach with the inverse variance method to weight studies will be used. A forest plot will be used to describe prevalence of depression across articles. Heterogeneity will be assessed using the I^2 statistic (Viechtbauer et al., 2010) with a value of > 50 % indicating substantial heterogeneity. A sub-group analyses will be conducted for population type (farmers, migrant-farmworkers, and permanent farm-workers), to examine potential heterogeneity. Another sub-group analysis will be conducted on the type of validated scale used to quantify depression in the population.

Meta-Biases

If more than ten studies are included in the meta-analysis, potential publication bias will be visually assessed by use of a funnel plot (effect estimate by inverse of the standard error).

Confidence in Cumulative Evidence

Quality of evidence from each of the articles included will be assessed following criteria provided by GRADE (Dijkers, 2013), examining indirectness, imprecision, risk of bias at the study level, inconsistency, and risk of publication bias.

DISCUSSION

The proposed systematic review will be the first to synthesize the global prevalence of depression in farmers and agriculturalists. It is anticipated that the results of the meta-analysis will estimate a prevalence of depression in farmers and agriculturalists that is higher than the general population, demonstrating that the issue is widespread and presents a global health concern. Secondly, it is anticipated that the articles included in the review will identify risk factors for depression in farming populations. This information can help inform the targeting of screening and intervention programs by mental health professionals to farmers and agriculturalists, as well as informing the population of interest regarding these risk factors in their own lives. Lastly, it is anticipated that there will be a lack of consistency in the scales used to quantify depression in this population. This lack of standardized methodology is likely to present barriers in terms of data-synthesis, as only a single scale can be used; thus, limiting comparison of prevalence of depression across studies. The scales used to examine prevalence of depression in farming populations will be reported, as well as the advantages and disadvantages of using these scales.

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