

Evidence Check

Emergency Drought Relief Package: Health and Resilience Services

An **Evidence Check** rapid review brokered by the Sax Institute for the NSW Ministry of Health, January 2019.

This report was prepared by:

Sarah Wheeler, Alec Zuo, Ying Xu, Quentin Grafton and Sahar Yazd

January 2019

© NSW Ministry of Health/the Sax Institute 2019

This work is copyright. It may be reproduced in whole or in part for study training purposes subject to the inclusions of an acknowledgement of the source. It may not be reproduced for commercial usage or sale. Reproduction for purposes other than those indicated above requires written permission from the copyright owners.

Enquiries regarding this report may be directed to the:

Manager
Knowledge Exchange Program
Sax Institute
www.saxinstitute.org.au
knowledge.exchange@saxinstitute.org.au
Phone: +61 2 9188 9500

Suggested Citation:

Wheeler S, Zuo A, Xu Y, Grafton Q. Emergency Drought Relief Package — Health and Resilience Services: an Evidence Check rapid review brokered by the Sax Institute (www.saxinstitute.org.au) for the NSW Ministry of Health, 2019.

Disclaimer:

This **Evidence Check Review** was produced using the Evidence Check methodology in response to specific questions from the commissioning agency.

It is not necessarily a comprehensive review of all literature relating to the topic area. It was current at the time of production (but not necessarily at the time of publication). It is reproduced for general information and third parties rely upon it at their own risk.



Emergency Drought Relief Package: Health and Resilience Services

An **Evidence Check** rapid review brokered by the Sax Institute for the NSW Ministry of Health.
January 2019.

This report was prepared by Sarah Wheeler, Alec Zuo, Ying Xu, Quentin Grafton and Sahar Yazd.



Contents

Executive summary.....	5
Background	9
Methods	10
Findings.....	12
Discussion	27
Conclusion	30
References	32
Appendix 1: NHMRC Levels of Evidence.....	37
Appendix 2: Question 1 studies (excluding review studies).....	38
Appendix 3: Included papers for intervention evaluations.....	42

Tables and figures

Table 1. Countries and numbers covered in review studies.....	12
Table 2. Study types and numbers of reviewed studies	13
Table 3. Numbers of reviewed studies on subgroups of population	17
Table 4. Study numbers and evaluations of intervention outcomes in reviewed studies.....	23
Table 5. Mean evaluation scores for each intervention under different intervention outcomes	25
Table A1. NHMRC Levels of Evidence	37
Table A2. NHMRC matrix to summarise the evidence base.....	37
Figure 1. Flow chart of the literature selection process	11
Figure 2. Publication time of review studies	12
Figure 3. Risk systems casual pathways between drought and mental health	21

Executive summary

Background

This Evidence Check was carried out by the Centre for Global Food and Resources, University of Adelaide, and Professor Quentin Grafton (ANU) and was commissioned by the Sax Institute on behalf of the NSW Health Mental Health Branch. NSW Health has been tasked with delivering health and resilience services under the NSW Emergency Drought Relief Package. This includes an initial \$6.3 million funding for mental health support and counselling to respond to the traumatic impact of drought. The aim of this review is to assess the outcomes of previous drought relief mental health support programs and advise on intervention target points for current and future support.

Evidence Check review questions

This review aimed to address the following questions:

Question 1: What are the causal pathways through which drought affects the mental health of people living in rural and regional communities? And what are the characteristics of groups and individuals that are at particularly high risk of harm from drought?

Question 2: What has been the effectiveness of community-based interventions that aim to improve mental health outcomes for people living in drought-affected communities?

Summary of methods

This Evidence Check followed the standard Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), and searched the literature from January 1998 to December 2018 in electronic databases PsycINFO, PubMed, Web of Science and Google Scholar, and ProQuest using the following keywords:

"Drought" AND "mental health" OR "mental disorder" OR "depression" OR "distress" OR "anxiety" OR "stressors" OR "emotional distress" OR "psychological distress" OR "suicide" OR "suicide ideation" OR "schizophrenia" OR "bipolar" OR "manic depression" OR "adjustment disorders" OR "wellbeing" OR "stress" OR "resilience" OR "rural connectivity" OR "coping" OR "community" OR "communities".

From this electronic database identification search we screened the titles and abstracts of 1450 citations using a specific set of criteria. In total, we assessed 250 full-text articles for eligibility and we noted information from 144 studies, with 130 providing information on Question 1 (74 studies were original research — citations are provided in Appendix 2) and 23 providing some information on Question 2 (14 studies provided more detailed information for evaluation outcome purposes — see Appendix 3), and 5 studies provided information for NHRMC evidence grading). In addition, to answer Question 2 we searched and collected all available grey literature.

Evidence grading

Each study that used quantitative methods was rated using the NHMRC evidence hierarchy, which offers six levels of evidence (see Table A1, Appendix 1). An overall assessment of the quality and strength of the evidence was made according to the NHMRC Body of Evidence Matrix ⁽¹⁾ (see Table A2, Appendix 1), which has four assessment levels (excellent, good, satisfactory and poor).

For Question 1, 36 of the 74 original research studies used quantitative methods and each was rated accordingly. For Question 2, the evaluation outcomes for applicable studies were assigned one of three ratings (1 = weak, 2 = moderate and 3 = strong) to indicate the strength of the interventions with regard to the outcome achieved. We had one author do all this rating for consistency purposes. For Question 1, we

rated the overall evidence for the majority (75%) of the studies at NHMRC evidence Grade C (satisfactory — level III studies with low risk of bias).

Overall, for Question 2, we found the overall evidence to be NHMRC evidence Grade D (poor — level IV studies, or level I–III studies with high risk of bias).

Key findings

Definitions of drought

We found a huge variety of drought definitions among the studies, reflecting the four types of drought definitions used (e.g. meteorological, agricultural, hydrological and socioeconomic). Forty-nine studies did not define drought.

Drought has immediate (e.g. crop failure), cumulative (e.g. negative environmental changes that accumulate over time) and after-effects (e.g. debt accumulation).

Question 1: What are the causal pathways through which drought affects the mental health of people living in rural and regional communities? And what are the characteristics of groups and individuals that are at particularly high risk of harm from drought?

We suggest there are five direct areas of a causal link between drought and mental health:

1. **Decline in agricultural production and livelihoods:** Reduced rainfall, increased temperature and reduced water allocations can cause reduced agricultural production, crop loss, livestock death and reduced animal productivity. Drought can also cause increased feed costs, increased water purchase costs and increased labour workload, all reducing net farm income and farm return.
2. **Changed environmental conditions:** Drought generally has a cumulative negative effect on environmental assets. Excessive heat, native tree damage, loss of topsoil in drought dust storms, declining green space and dying wildlife all reduce social benefits.
3. **Reduced employment and depressed rural community:** The stronger the link between a rural community economy and farm production, the more rural communities may suffer (decreased gross regional product, decreased employment) during droughts.
4. **Migration and separation of family:** A direct consequence of reduced farm profitability and a depressed rural community is that some farmers and associated workers may need to migrate (temporarily and/or permanently) away for employment.
5. **Harm to physical health:** Although our Evidence Check did not explicitly focus on the physical health impact of droughts, a number of studies did identify various potential links (e.g. stress leading to increased domestic violence, excessive alcohol consumption, famine, respiratory symptoms, heat exhaustion, heart attacks and strokes).

On the whole, rural communities in drought seem to have worse distress than urban residents (although some studies found no significant association), and farmers in drought experienced greater mental health distress (or wellbeing/self-reported mental health) than residents living in rural communities in drought or farmers not in drought (but again some studies found no significant association).

One reason for the lack of association is that resilience, and adaptive capacity for change, is a multifaceted concept that can be influenced by a variety of capitals: a) social capital; b) human, financial and physical capital; and c) natural capital. These are the 'controls' that can potentially reduce the impact of drought from actual drought stress encountered.

There was evidence that being young or old, unemployed, less educated, in poor health, Indigenous, as well as remoteness, lack of financial capital, lower personal hope/optimism, higher neuroticism/stoicism, a greater sense of place, less natural resource management (NRM) activities and less connection to local

communities increased the likelihood of greater drought-related mental distress. The evidence was mixed for gender.

We developed a risk systems causal pathways analysis of the association between drought and mental health that consists of five components: (i) identifying the driver (e.g. drought); (ii) identifying the triggers (namely the events that are the immediate cause of drought); (iii) assessing causal risks; (iv) identifying and analysing controls (actions/characteristics that modify the triggers) and mitigants (actions/policies that reduce the likelihood of consequences); and (v) identifying risk events which in turn contribute to consequences — namely psychological distress and suicide in drought-affected rural and remote communities (see Figure 3 on page 19).

There are four main policy mitigants that can be put in place for reducing the consequences of distress and suicide in drought-affected communities: 1) drought farming policy; 2) mental health policy; 3) natural resource management (NRM)/extension policy; and 4) rural economic and social development policy. Obviously, different government agencies have different remits, and health agencies have more control over mental health policy; however, there is a need for an integrated and multi-pronged approach to reduce mental health problems overall. Greater research is needed on the link between these types of policies and their impact on overall farmer wellbeing.

Question 2: What has been the effectiveness of community-based interventions that aim to improve mental health outcomes for people living in drought-affected communities?

We identified and assessed nine categories of intervention outcomes within 14 evaluation studies (a number of them evaluations of the same programs at different years). The strongest evidence of an intervention achieving its outcome was found for, respectively, psychological treatment programs, mental health outreach and care coordination, online and telephone support, health literacy programs, mental health first aid and training support.

Evaluation studies have focused on assessing the following outcomes, respectively: 1) reach of the interventions; 2) acceptability for health workers and community members; 3) implementability and program sustainability; 4) coordination of services; 5) confidence and/or willingness of community members to seek help/provide mental health information; 6) cultural and attitudinal change; 7) improved mental health wellbeing; 8) strategies that build individual, household or community strength; and 9) a decrease in suicide or self-harm.

For Question 2, there was a lack of evaluation of outcomes relating to: cultural and attitudinal change; improved mental health wellbeing; strategies that build individual, household or community strength; and a decrease in suicide or self-harm. There needs to be more assessment of the impact of the implementation of policies across time and space, potentially using impact assessment techniques such as before and after policy implementation across rural NSW, or a time-series analysis of suicide rates/attempts across time and space.

Gaps in the evidence base

In terms of gaps in the evidence, there is a lack of large-scale, multidisciplinary projects and a co-generation of knowledge to understand the links between mental health risks in drought-affected communities. Nearly all of the projects we reviewed were situated within certain fields of discipline knowledge. There are also clear missing links between farms' environmental conditions and farmer mental health, as well as the impact of a farm's condition and its financial capital, and then the link between farm financial capital and mental distress.

The common thread in much of the literature was the need for prevention rather than mitigation. In other words, prevent rural mental health risks from drought rather than manage the consequences afterwards. To

do this, longer-term strategies are essential, ongoing rural mental health care needs to be always available (with the most important being after-care and crisis care; psychosocial and pharmacotherapy treatments; and GP capacity building and support) and not subject to budget cycle-driven funding. The need for a continuity (at a base level) of service funding with less reliance on crisis-driven responses, as well as increased community capacity building was highlighted by many. Finally, a multi-pronged approach between the four different arms of policy (drought policy, mental health policy, land and water policy and rural and social development policy) is essential in minimising the cost of mental health problems and suicide in rural communities.

Background

This Evidence Check was carried out by the Centre for Global Food and Resources, University of Adelaide, and Professor Quentin Grafton (ANU) and was commissioned by the Sax Institute on behalf of the NSW Health Mental Health Branch.

NSW Health has been tasked with delivering health and resilience services under the NSW Emergency Drought Relief Package. This includes an initial \$6.3 million funding for mental health support and counselling to respond to the traumatic impact of drought. The aim of this review is to assess the outcomes of previous drought relief mental health support programs and advise on intervention target points for current and future support.

This Evidence Check aimed to address the following questions:

Question 1: What are the causal pathways through which drought affects the mental health of people living in rural and regional communities? And what are the characteristics of groups and individuals that are at particularly high risk of harm from drought?

Question 2: What has been the effectiveness of community-based interventions that aim to improve mental health outcomes for people living in drought-affected communities?

Methods

Peer review literature

This Evidence Check followed the standard Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), namely: 1) identification of literature; 2) screening questions; and 3) eligibility using inclusion criteria.

We conducted a search of the literature from January 1998 to December 2018 in electronic databases PsycINFO, PubMed, Web of Science and Google Scholar, ProQuest, using the following keywords:

"Drought" AND "mental health" OR "mental disorder" OR "depression" OR "distress" OR "anxiety" OR "stressors" OR "emotional distress" OR "psychological distress" OR "suicide" OR "suicide ideation" OR "schizophrenia" OR "bipolar" OR "manic depression" OR "adjustment disorders" OR "wellbeing" OR "stress" OR "resilience" OR "rural connectivity" OR "coping" OR "community" OR "communities".

From the electronic database search and desktop grey literature search we screened the titles and abstracts of 1450 citations using the following criteria to identify whether to include a citation in the full-text review:

- In English
- A peer-reviewed and published journal article
- Available for review
- Includes a human response in a rural community (e.g. farmers, farm workers and rural communities) to an aspect of drought.

The following inclusion criteria were then applied:

1. Does the study clearly mention which risk factors/stressors affect rural communities' mental health?
2. Is the study either: original research, a historic case study, a program/policy analysis, or a review article? If not, it was excluded.

A flow chart of the literature selection process is included in Figure 1 on the next page.

Evidence grading

We used the NHMRC levels of evidence and matrix guidelines to rate the quantitative studies reviewed in this Evidence Check (see Appendix 1). Hence, the qualitative and overall review studies were not rated for quality purposes. Each study that used quantitative methods was rated at a level of the NHMRC evidence hierarchy, which offers five levels of evidence. An overall assessment of the quality and strength of the evidence base was made according to the NHMRC body of evidence matrix ⁽¹⁾, which has four assessment levels (excellent, good, satisfactory and poor) (Table A2 in Appendix 1). For Question 1, 36 of the 74 original research studies (e.g. not reviews) used quantitative methods and each was rated for the level of evidence according to NHMRC levels of evidence⁽¹⁾, and the 74 studies are reported in Appendix 2. For Question 2, 14 of the 23 studies provided some more information about outcomes of the program (reported in detail in Appendix 3), of which only five had quantitative methods available for us to apply the evidence grading. In addition for Question 2, the evaluation outcomes for applicable studies were assigned one of three ratings (1 = weak, 2 = moderate and 3 = strong), to indicate the strength of the interventions with regard to the outcome achieved.

Grey literature

We conducted a desktop search for relevant grey literature (focusing predominantly on documents published since 1998), as well as asking various institutions and organisations to provide any relevant evaluation reports or findings relating to drought mental health programs in Australia.

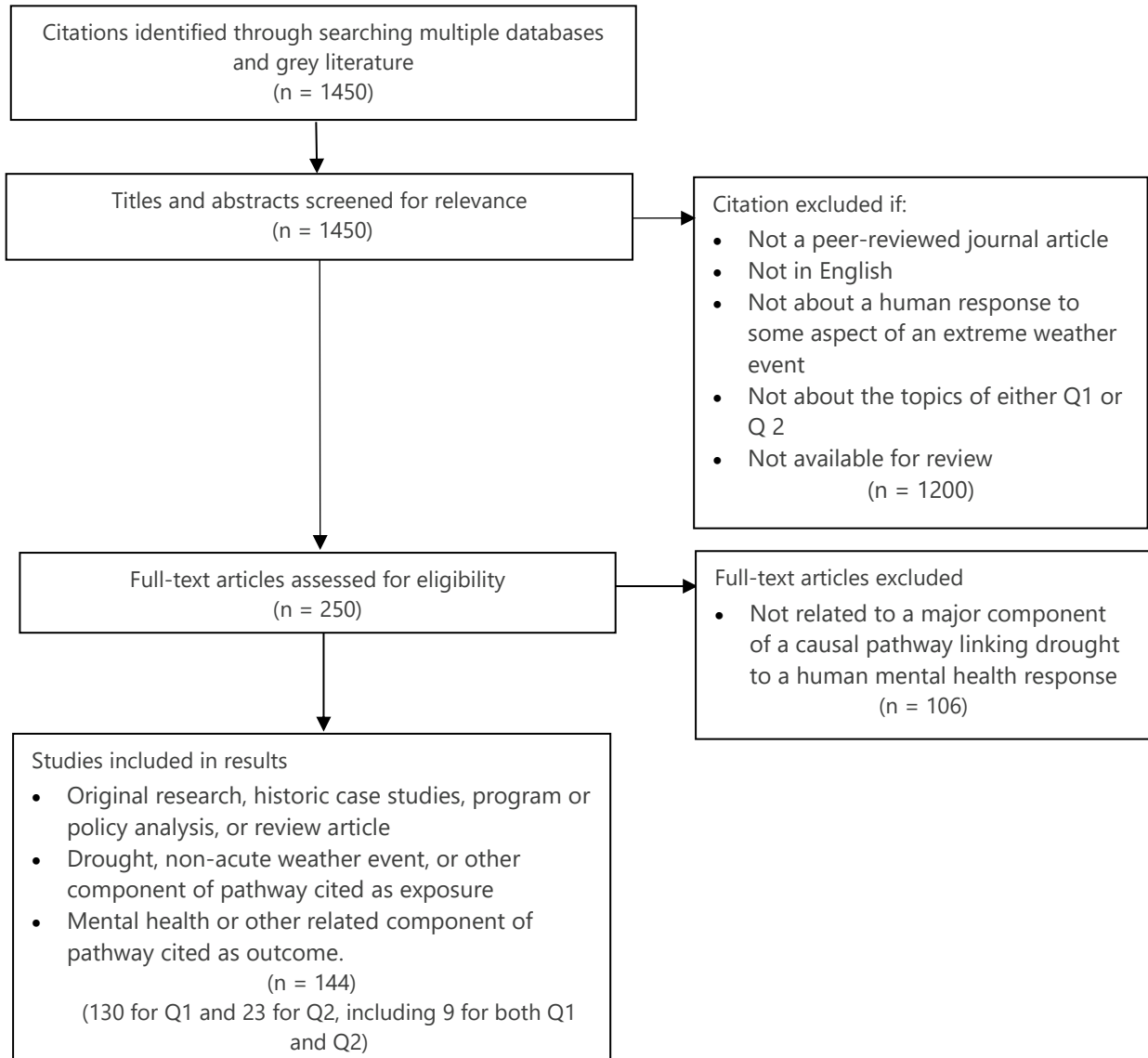


Figure 1. PRISMA Flow chart of the literature selection process

Findings

Question 1

Countries

We identified 130 studies for Question 1, including 56 review studies that often covered multiple countries. The countries covered in our systematic review are shown below. Excluding review studies, most studies were from Australia (56), followed by the US (6), Africa (4), India (3), New Zealand (2), Brazil (1), Iran (1) and Thailand (1). The large number of studies from Australia highlights the significance of drought and mental health issues in this country.

Table 1. Countries and numbers covered in review studies

Country / Region	Number of studies
Africa	4
Australia	56
Brazil	1
India	3
Iran	1
New Zealand	2
Thailand	1
US	6

Timing

Considering our time frame was from 1998 onwards, most studies on mental health issues in drought-affected communities were published post 2006, and this show no signs of abating.

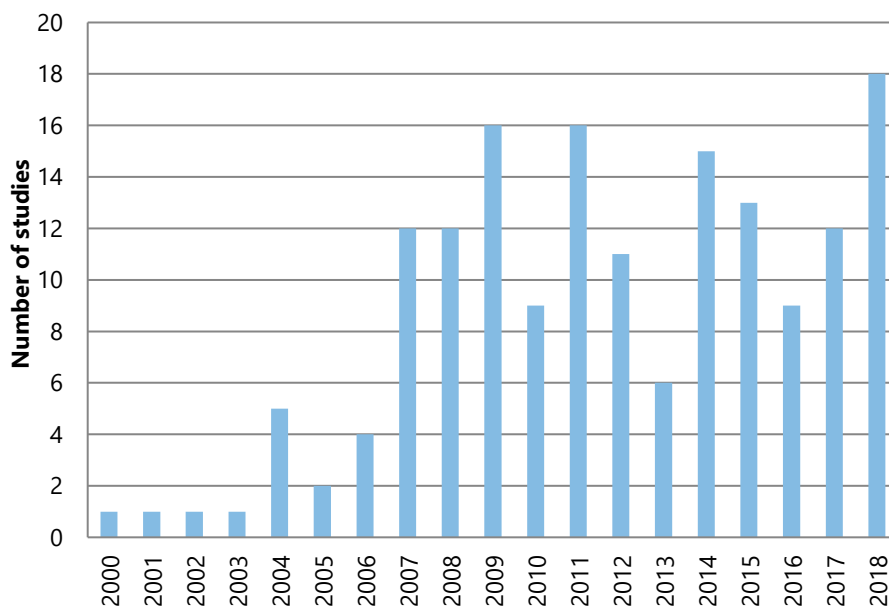


Figure 2. Publication time of review studies

Study design

Most studies were qualitative in nature; 56 were review articles, such as overview pieces, systematic reviews and meta-analyses, summarising links between drought, climate change and mental health issues (with some focus on rural and remote communities). Of the 74 original research articles, 38 were purely qualitative research (using methods such as on-farm interviews, in-depth interviews with drought support personnel, focus groups, workshops and longitudinal interviews over time), 27 were purely quantitative in nature, with the majority of them using population representative surveys (e.g. in Australia this included the Household, Income and Labour Dynamics in Australia (HILDA) survey, the Australian Rural Mental Health Study (ARMHS), Australian Longitudinal Study on Women's Health, and other large farmer surveys such as the Centre for Global Food and Resources' irrigator survey). Nine studies used both quantitative and qualitative methods.

Table 2. Study types and numbers of reviewed studies

Study design	Number of studies
Review articles (e.g. systematic reviews, meta-analyses, overviews)	56
Qualitative studies (e.g. in-depth interviews, focus groups, workshops, case studies, longitudinal interviews)	38
Quantitative studies (e.g. population surveys, suicide/death data, weather data)	27
Mixed methods studies (e.g. quantitative and qualitative)	9

Defining drought

In understanding what is meant by 'drought', it is important to note that drought declaration is the responsibility of state and federal governments in Australia, and although it is common to define drought by a deficiency of frequent rain events over an extended period of time resulting in a water shortage, factors apart from rainfall deficiencies are often used in a drought declaration. Hence, organisations such as the Bureau of Meteorology do not declare drought, though they provide information on areas considered to be suffering from a serious or severe rainfall deficiency. Rainfall deficiencies are determined by examining rainfall periods of three months or more across Australia to see whether they lie below the 10th percentile (lowest 10% of records). A serious rainfall deficiency is where the rainfall lies above the lowest 5% of recorded rainfall but below the lowest 10% (decile range 1) for a given period (at least three months initially), while a severe rainfall deficiency is where rainfall is at or below the lowest 5% of recorded rainfall for the period in question.

In part, how drought is defined can depend on a number of circumstances. Drought was defined by Hennessy, et al. (2008)⁽²⁾ in four different ways:

1. Meteorological drought (a period of time with less rainfall)
2. Agricultural drought (dryness of surface soil layers because of evapotranspiration)
3. Hydrological drought (prolonged moisture deficits and water stream flow/storage decreases)
4. Socioeconomic drought (the effect of elements of the droughts on supply and demand of economic, social and environmental goods).

Hence, the difficulty in defining drought is reflected in any assessment of its consequences. More than 100 drought indices are available, with no consensus on what is the best measure.⁽³⁾ The difference in what people regard as drought is shown in the literature surveyed, with different fields defining drought in various ways. For example, O'Brien, Berry, Coleman and Hanigan (2014)⁽⁴⁾ used rainfall data in Australia to create five drought patterns (zero to moderate, very dry, recent long period, constant, constant and recent long period).

The majority of the literature (49 out of the 74 original research articles) either relied on no specific drought definition, that is, studies tended to rely on people's perceptions of drought existence in their own area, or the fact that certain years had been classified as drought periods (particularly relevant for the Millennium Drought). Sixteen studies used a standard definition of drought (e.g. rainfall deficiency and above-average temperature) as their drought classification, while a smaller number of studies (nine) used more sophisticated drought definitions such as the Hutchinson Drought Index.⁽³⁻¹⁰⁾

Defining mental health stress

A person's mental health includes their state of wellbeing, namely their emotional and psychological state. Mental health disorders can include depression, anxiety, stress, schizophrenia, bipolar disorder and emotional/psychological distress. Mental health can be (and has been) defined in numerous ways. Some studies used perceptions only (e.g. self-rated mental health, a measure of wellbeing overall), while others quantified it for the general population using measures such as the Center for Epidemiologic Studies Depression Scale, questionnaires, the Kessler 10, the Hospital Anxiety and Depression Scale, clinical tests, the Mini-Mental State Examination and the SF-36.

Several measures have also been constructed to measure agricultural-related stress in farmers in particular, including the Farm/Ranch Stress Scale, the Edinburgh Farming Stress Inventory, Welke's Farm Ranch Stress Inventory and the Migrant Farmworker Stress Inventory.⁽¹¹⁾ In relation to drought Austin et al. (2018)⁽³⁾ and Sartore et al. (2008)⁽¹²⁾ developed measures of personal drought-related stress and community drought-related stress. These measures can impact on various interpretations of mental health. For example, Austin et al. (2018)⁽³⁾ argued the differences in factors that influence personal drought-related stress, community drought-related stress and psychological distress confirm that drought stress can contribute to general psychological distress, but is distinguishable from it. This was shown by Stain et al. (2011)⁽⁶⁾ in their sample of NSW residents, where they found that 24% of their sample had high drought worry (although only 16% were exposed to actual drought for at least six months of the past year), and 31% were classified as having high psychological distress. However, only about 10% of those classified as having high distress also had high drought worry, and only 2% of the sample had high drought worry, high psychological distress and high drought exposure. Also, Stain et al. (2008)⁽¹³⁾ found drought stress was not necessarily a predictor of psychological distress.

In terms of the cost of mental health Lee et al. (2017)⁽¹⁴⁾ estimated mental and behavioural health disorders were the third biggest disease burden in Australia, with a total cost of at least AUD\$12.7 billion in 2007; while Berry et al. (2011)⁽¹⁵⁾ reported the service costs alone in 2007–08 accounted for \$3.3 billion. No direct estimates of the cost of drought-related mental health were found.

Causal links between drought and health in general

The fact that drought is defined in a variety of ways has an impact on any evaluation of its consequences. Drought can have an immediate effect (e.g. drop in rainfall and increased temperatures cause crop failure), a cumulative effect (e.g. ongoing water scarcity causes environmental changes that accumulate over time) and an after-effect (e.g. debt accumulation from drought decreases farm resilience). Similarly, it has direct (e.g. exposing people to trauma through reduced crops, depressed economies) and indirect impacts (e.g. depressed economy, loss of public services).

Extended periods of drought can result in increased airborne dust (e.g. from reduced land cover); reduced water quality (e.g. from reduced stream water flows and groundwater reserves); increased probability of bushfires; reduced green space (e.g. trees, vegetation, grasses); increased damage from future floods (e.g. lack of vegetation near rivers increases flood damage and worsens water quality); and damages infrastructure (e.g. ground subsidence from increased groundwater pumping damages roads, bridges, infrastructure). There has been some research on the relationship between drought and population health in

general, with the literature suggesting links between poorer water quality and disease ⁽¹⁶⁾; asthma, respiratory allergies, airways disease and increased dust and particulate air pollution ⁽¹⁷⁾; higher night-time heat and poorer sleep ⁽¹⁸⁾; heatwaves and psychiatric hospital presentations ⁽¹⁹⁾; heatwaves and hospital admissions for heat exhaustion, acute renal failure, heat stroke, dementia, kidney disease, degenerative diseases and death ⁽²⁰⁻²²⁾; heatwaves reduce some psychoactive medicine effectiveness ⁽²³⁾; temperature increase was positively associated with dehydration, acute renal failure and heat stroke ⁽²²⁾; and drought and work productivity.^(24, 25)

Causal links between drought and mental health

There is an increasingly recognised link between mental health and climate ⁽²⁶⁻²⁹⁾, and a growing body of literature in general in this space, although there remains a paucity of quantitative epidemiological evidence relating mental health and drought per se. The evidence re one potential aspect of drought, high temperatures, has been increasingly studied, especially in Australia. Ding, Berry and Bennett (2016)⁽³⁰⁾ found a one-unit increase in temperature and vapour pressure was associated with an increase in the occurrence of very high mental health distress in sample of a NSW population by 0.1%, while Xu, Wheeler and Zuo (2018)⁽³¹⁾ found an increase in the annual average daily maximum temperature worsened Australian childhood mental health. Some of the identified reasons included the impact of higher temperatures on sleep, medicine effectiveness and reduced exercise, although there were a number of other possible pathways — for example, the cumulative impact of stress from drought, where stress anxiety builds up over time, resulting in more negative health impacts such as headaches, gastrointestinal complaints, increased risk-taking behaviour, increased alcohol and drug use ⁽¹³⁾, changed sleep patterns, fatigue, helplessness, sadness, avoidance or denial and lack of concentration.

This Evidence Check builds on work initiated by Vins et al. (2015)⁽²⁸⁾ and Berry et al. (2018)⁽²⁹⁾ and uses a framework from Grafton et al. (2016)⁽³²⁾ in trying to delineate a causal systems approach to the link between drought and mental health outcomes. Our causal figure provides an overview of the direct (*Triggers*) and indirect (*Risk events*) links between drought and its outcomes (*Consequences*). We define five direct areas of a link between drought and mental health: 1) Decline in agricultural production and livelihoods (32 studies mentioned this); 2) Changed environmental conditions (12 studies); 3) Reduced employment and depressed rural community (36 studies); 4) Migration and separation of family (19 studies); and 5) Harm to physical health (3 studies).

- 1. Decline in agricultural production and livelihoods:** Less rainfall, increased temperature and reduced water allocations can cause reduced agricultural production, crop loss, livestock death and lower animal productivity.⁽³³⁻⁴⁴⁾ Drought can also cause an increase in costs, through increased feed costs and water purchase costs, all reducing net farm household income ^(12, 45-48) and increased infrastructure damage and replacement; plus increased workloads (e.g. hand feeding, more stock checking, greater travel distance).^(33-37, 43, 49) If the loss of production and the increase in costs is not compensated by an increase in revenue (for example, through increased commodity returns through improved prices or an increase in off-farm income), then many farmers experience a reduction (or a loss) in net farm income and an increase in debt and hence financial difficulties. Drought can also destroy the natural capital of a farm, such as the loss of topsoil where preventive measures have not been taken or unforeseen events occur and hence has implications for future land productivity and land value. Increased financial difficulty is strongly associated with increased farmer stress.⁽⁴⁶⁻⁴⁸⁾ A decline in agricultural production results in poor livelihoods, with anxiety about the future, shame and humiliation, increased stress, tension and divorce.^(33, 35, 36, 40, 44, 49-53) Another livelihood impact is that children may be less likely to attend school.⁽⁴³⁾
- 2. Changed environmental conditions:** Drought generally has a cumulative effect on environmental assets, although a number of environmental assets (e.g. community playing fields, European trees and gardens, fish stocks) can be lost quickly in heatwaves and/or watering restrictions. Excessive heat, native

tree damage, loss of topsoil in drought dust storms, declining green space and dying wildlife can all reduce the benefits humans often receive from being outside and engaging with nature. It has been well established that being outside and engaging with green space (and even just seeing green space) can encourage physical activity and improve memory and attention⁽⁵⁴⁾; positive moods⁽⁵⁵⁾; happiness⁽⁵⁶⁾; and reduce stress and negative emotions.⁽⁵⁷⁾ Dying livestock, orchards, vines and wildlife can also cause distress.^(58, 59) A drought, especially one in rural areas, can diminish all the mental health advantages that are derived from environmental benefits.^(42, 60) It can also impact on water quality (and quantity), with resultant effects on human physical and mental health. Changed environmental conditions in the home environment lead to the concept of solastalgia, the feeling of distress that is produced by a degrading/destroyed home base.^(35, 61)

3. **Reduced employment and depressed rural community:** The stronger the link between a rural community and farm production, the more rural communities can suffer with reduced employment during droughts.^(12, 33-37, 39, 40, 42, 44, 45, 49) However, the causal links between changing agricultural production over time and rural communities have not been well studied, although a drop in the population of a town is often followed by a reduction in community resources, services and support systems, which in turn can increase migration out of a town. Edwards, Gray and Hunter (2018)⁽⁴⁷⁾ found a loss of services perceived by those in non-agricultural employment as a consequence of drought.
4. **Migration and separation of family:** A direct consequence of reduced net farm incomes and reduced spending in rural communities is that many farmers and associated workers in rural communities may need to migrate (temporarily and some permanently) for employment.^(35, 42, 51, 62-65)
5. **Harm to physical health:** Although we did not explicitly focus on the physical health impact of droughts, our review indicated that in drought-affected communities, young people were exposed to increased domestic violence, parents' excessive alcohol consumption at home and their reluctance to seek help.⁽⁶⁶⁾ Stigma may prevent people from seeking help for mental health problems associated with droughts and induce physical harm to themselves, even suicide in an extreme case.⁽³⁶⁾ Drought has been shown to result in harm to physical health in the wider literature. For example, crop failure and food shortages thanks to drought can cause famine and harm to children's wellbeing in developing countries.⁽⁶⁷⁾ Drought-induced wildfires can increase the incidence of functional limitations and respiratory symptoms.⁽⁶⁸⁾ The effects of heatwaves such as heat exhaustion, heart attacks and strokes may also present during drought and are a major health risk for older people in rural areas.⁽⁶⁹⁾

Population studied

A report by the Senate Community Affairs and References Committee⁽⁷⁰⁾ found that although mental illness outside capital cities and major urban areas was marginally lower than in capital cities (based on the 2007 National Mental Health Survey), the rate of suicide from 2010-2017 in remote (very remote) areas was almost double (almost 2.5 for very remote) that of major cities (driven significantly by Indigenous suicide). In addition, people living in remote areas accessed Medicare subsidised mental health services at a rate of three times less than those in major cities in 2016-2017.

Bearing in mind that this Evidence Check focused on the effects of drought on the mental health of people in rural and regional communities, we found that the majority of studies we reviewed looked at farmers (46 studies); the general population within rural and remote areas (26); farming families (19); farm workers (17); children (6); and Indigenous people (5). Studies of the general population included six studies of service providers (e.g. GPs, social workers, community mental health workers).

Table 3. Numbers of reviewed studies on subgroups of population

Population of interest	Number of studies*
Farmers	46
Farm workers	17
Families of farmers and farm workers	19
General population of people living in rural and remote communities in drought affected areas (including service providers n = 6)	26
Indigenous people	5
Children	6

Note: * a number of populations could be studied within one reference

The large number of farmer studies in the literature highlights findings from several studies that have suggested farmers have greater mental health issues than the general population^(71, 72), or lower life satisfaction.⁽⁷³⁾ Reasons identified in a systematic review by Yazd, Wheeler and Zuo (2019)⁽¹¹⁾ for higher mental health issues in farmers across the world (in order of importance) included greater pesticide exposure (exposure to neurotoxins directly affects neural systems known to cause mental illness and depression⁽⁷⁴⁾; financial difficulties⁽⁴⁸⁾; weather^(6, 8); physical health injuries; farming workload; government paperwork; isolation; future farm uncertainty; and work/family conflict. However, when Yazd, Wheeler and Zuo (2019)⁽¹¹⁾ analysed the reasons for poor farmer mental health in Australia only, the main reason given was weather, followed by financial factors.

Risk factors, protective factors and coping mechanisms identified

The literature is not conclusive as to whether an individual living in a drought-affected rural community is at greater distress. Part of the reason for this inconclusiveness may be the definition of drought (as discussed previously, and as found by Edwards, Gray and Hunter (2009).⁽⁵⁾ O'Brien et al. (2014)⁽⁴⁾ compared distress for rural and urban residents across Australia in 2007-2008 within their five classified drought patterns (zero to moderate, very dry, recent long period, constant, constant and recent long period). They found the 'constant and recent long period' of drought was associated with increased mental distress in rural areas, but not in urban areas. Friel et al. (2014)⁽⁷⁵⁾ had similar findings. A longitudinal study Powers et al. (2015)⁽⁹⁾ found rural women aged 45-61 living in drought were seemingly not at greater mental health risk, while Austin et al. (2018)⁽³⁾ found farmers living in moderate-dry drought conditions were much more likely to be in psychological distress. Brew et al. (2016)⁽⁷⁶⁾ found farmers reported higher drought stress than other rural workers in a longitudinal study, and Edwards, Gray and Hunter (2015)⁽⁸⁾ also found greater mental health distress for farmers and farm workers who were experiencing drought (but note: this is under a 'social' definition of drought as opposed to a rainfall definition) compared with others in rural communities.

In terms of rural communities overall, there is stronger evidence that the more remote an individual's community is (as opposed to rural or regional), the higher their psychological distress (especially in times of drought).^(3, 76) Brew et al. (2016)⁽⁷⁶⁾ found farmers had worse mental health than non-farmers in remote communities, but there was no significant difference between farmers and non-farmers in rural communities. Other factors also included greater Indigenous populations in remote communities. However, the study also found that on 'wellbeing measures' and self-reported mental health, farmers fared worse than non-farm workers. Stain et al. (2011)⁽⁶⁾ found living on a farm increased high drought stress, but not psychological distress. However, Edwards, Gray and Hunter (2018)⁽⁴⁷⁾ found a higher impact of drought on mental health outcomes for farmers and farm workers than on others.

The systematic review found slightly more studies indicated women were at greater risk of poor mental health and harm from drought^(7, 33, 48, 49, 52, 77-80) than men.^(7, 37, 38, 52, 80, 81) When focusing on farmer studies

only, there is more evidence that female farmers are at greater risk of psychological distress than male farmers^(38, 48, 77, 78), although there is some evidence otherwise⁽³⁾, and also the finding that male farmers (and workers) are more likely to commit suicide.^(7, 52, 82) King et al. (2009)⁽³⁸⁾ also found women farmers may be quicker in recovering from drought, which Stain et al. (2011)⁽⁶⁾ relates to the social demands of drought on women ending when drought ends. This is similar to the findings of Hanigan, Shirmet and Niyonsenga (2018)⁽¹⁰⁾ that older women living in rural communities (which includes farming women) suffered less mental distress from drought than younger rural women. The length of time of drought is obviously a risk factor, with the literature finding that individuals who have greater and repeated exposure to traumatic events over a longer period have much poorer mental health outcomes compared with those who experience discrete trauma.⁽⁸³⁾

Again, the evidence is mixed as to which age groups are most at risk of psychological distress from drought. There is evidence that younger groups are more at risk^(3, 35, 48, 66, 79, 84, 85), although other studies found older groups to be more vulnerable^(52, 81, 86) and King et al. (2009)⁽³⁸⁾ suggests older populations recover more slowly from the distress of drought. Children are at particular risk, with impacts on their schooling, emotional wellbeing and suicide rates.^(35, 66)

The unemployed^(3, 5) had much greater psychological distress and drought stress⁽⁶⁾, while retired farmers⁽³⁾ had less psychological distress. Smaller farms and assets were associated with greater distress^(39, 43, 48, 87, 88). There is evidence that farmers earning more of their income from the farm faced greater challenges⁽⁸⁹⁾, and that drought had a negative impact on farmer household income and financial stress (but no significant impact on farm workers or non-agricultural employment).⁽⁴⁷⁾ A greater number of adverse life events were associated with considerable psychological distress.^(3, 6, 13) Marital status had a variety of influences, with farmers who had never married experiencing worse psychological distress than others^(3, 10), although this may have been confounded with age factors; also, Stain et al. (2011)⁽⁶⁾ found an association of marital status with high psychological distress in drought areas. Those with worse physical health tended to have worse mental health^(3, 10), and farmers were also much less likely to visit a GP than non-farm workers.⁽⁷⁶⁾ Wheeler, Zuo and Loch (2018)⁽⁴⁸⁾ found the more fellow farmers with mental health issues that irrigators knew, the higher their psychological distress levels were. Although a number of qualitative studies⁽⁹⁰⁾ identified increased alcohol use by farmers as a coping strategy in times of drought/high stress, others found no significant differences between farmers' alcohol use and other groups (non-farming, farm workers)^(13, 76); and Edwards, Gray and Hunter (2009)⁽⁵⁾ suggested that there might even be lower rates of high or hazardous drinking in drought areas (under both rainfall and social definitions of drought). Edwards, Gray and Hunter (2009)⁽⁵⁾ found farmers and the unemployed were more likely to be taking medication for stress if they believed they were in a drought (under a social definition of drought) compared with those who did not believe they were living in a drought, while no significant difference was found for farm workers or non-farm workers.

Studies indicating concerns regarding worse Indigenous mental health in times of drought in rural and remote communities include Hunter (2009)⁽⁹¹⁾, Hart, Berry and Tonna (2011)⁽⁷⁹⁾; McNamara and Westoby (2011)⁽⁹²⁾; Rigby et al. (2011)⁽⁹³⁾ and Pearce et al. (2015).⁽⁶⁵⁾ Indigenous groups seem under-represented in the literature, potentially because of many of the methods of collecting data (e.g. postal mailout surveys).

In terms of particular farming groups, there has been an increasing emphasis on irrigators' mental wellbeing, with evidence that they may have worse mental health than other dryland farmers^(46, 48, 94). Wheeler, Zuo and Loch (2018)⁽⁴⁸⁾ suggested the irrigator groups most at risk were horticultural irrigators, with their mental health driven significantly by increased costs (electricity and water) and reduced commodity prices.

In terms of attitudes, Brew et al. (2016)⁽⁷⁶⁾ found that attitudes of both farmers and non-farm workers were the highest barrier to their seeking mental health help. The personality attributes that have been considered in the drought mental health literature include:

- **Personal hope and optimism:** Greater levels of sense of purpose, meaning and hope have been found as important in dealing with, and recovering from, drought ^(6, 35, 81, 95)
- **Neuroticism:** Greater levels of neuroticism (those who are more likely to be moody and experience anxiety issues, etc.) are associated with greater psychological distress and drought worry ^(6, 13)
- **Stoicism:** Greater levels of stoicism (e.g. not displaying feelings or complaining about pain or hardship). Also known as the 'bush identity' — are associated with lower wellbeing but not significantly related to psychological distress ^(36, 96)

Personality attributes are part of human capital factors. Great resilience is often portrayed in the literature as relying on a variety of capitals such as human capital (e.g. age, education, personality attributes), financial capital (e.g. farm profitability, farm debt), physical capital (e.g. farm size, infrastructure, regional factors), natural capital (e.g. environmental factors), and social capital (networks, friends, etc.). Social capital such as social support, social and community connectedness (e.g. involvement in voluntary organisations, informal networks), levels of trust and socioeconomic status are known to significantly affect individual psychological outcomes.^(3, 6, 13, 97) King et al. (2009)⁽³⁸⁾ found social capital enables farmers to achieve wellbeing through information sharing and social support. Thus, better social and community support and connectedness, and higher socioeconomic status are linked to better mental health. Access to more capital contributes to higher resilience, thereby increasing farmers' capacity to deal with mental health issues in the face of drought. For example, human capital factors such as better education were associated with reduced psychological distress for both farmers and rural communities in general.^(3, 10, 48) Higher family financial income and lower debt was associated with reduced psychological distress.^(3, 46, 48, 88)

On the other hand, the more individuals had a 'sense of place' (e.g. connection to one's home or surrounding land and the positioning of one's identity as a symbolic extension of self and environment), the more they suffered psychological distress in times of drought ^(3, 13), or suffered high drought worry.^(6, 13) Brew et al. (2016)⁽⁷⁶⁾ found that farmers and farm residents were more likely to have a higher sense of place than other rural residents. Sense of place is linked to nostalgia, the distress felt in response to environmental change.^(61, 98) Very few studies have sought to look at actual land-induced environmental change and mental health, but Speldewinde et al. (2009)⁽⁶³⁾ did find an association between increased dryland salinity and mental health in rural communities in Western Australia, while Yazd, Wheeler and Zuo (2019)⁽⁹⁹⁾ found a positive association between being certified organic and lower psychological distress in horticultural irrigators in the Murray–Darling Basin.

In terms of the influence of natural capital factors on reducing mental health, there is also emerging literature on the potential link between natural capital, farm management and mental health ^(57, 99, 100), with greater wellbeing and less distress associated with alternative farming and natural resource management (NRM) practices.

Quality of evidence rating

Thirty-six of the 74 studies used quantitative methods or mixed methods and each was rated for the level of evidence according to NHMRC guidelines.⁽¹⁾ The majority (75%) of the studies are rated at evidence level III (four studies at III-1, a pseudo-randomised controlled trial; 10 studies at III-2, a comparative study with concurrent controls; and 13 studies at III-3, a comparative study without concurrent controls). Nine (25%) studies are rated at evidence level IV, case series with either post-test or pre-test/post-test outcomes. In our view, the quality of the evidence base is NHMRC evidence Grade C (satisfactory — level III studies with low risk of bias).

Drought and mental health casual pathways analysis

Our causal map, below, is based on a risk system's causal pathways analysis as suggested by Grafton et al. (2016).⁽³²⁾

Our risk systems casual pathways between drought and mental health include five components: (i) identifying the driver (e.g. drought, the duration and severity of which, it is argued, will increasingly be driven by climate change); (ii) identifying the triggers (namely the events that are the immediate cause of drought stress — such as: a decline in agricultural production and livelihoods; changed environmental conditions; reduced employment and a depressed rural community; and migration and separation of family); (iii) assessing causal risks; (iv) identifying and analysing controls (actions/characteristics that modify the triggers) and mitigants (actions/policies that reduce the likelihood of consequences); and (v) identifying risk events (e.g. an event with uncertain consequences such as increased stress, anxiety, alcohol abuse, uncertainty, humiliation and shame, nostalgia, depression, domestic abuse, dietary changes), which in turn contribute to consequences (namely psychological distress, including new and exacerbated pre-existing mental health issues, and suicide). The five capital controls and the four policy mitigants are considered in more depth in the Discussion section. Note that each component of the assessment (with steps within each) builds on previous components, and it is an iterative and adaptive process. The figure also illustrates how outside triggers (e.g. negative life events, floods) can impact on risk events and consequences.

Commentary on relevance to NSW

We believe that this Evidence Check is highly relevant to NSW for two main reasons: 1) most of the studies reviewed were Australian, and 2) the majority of the Australian studies focused on NSW farmer and rural populations.

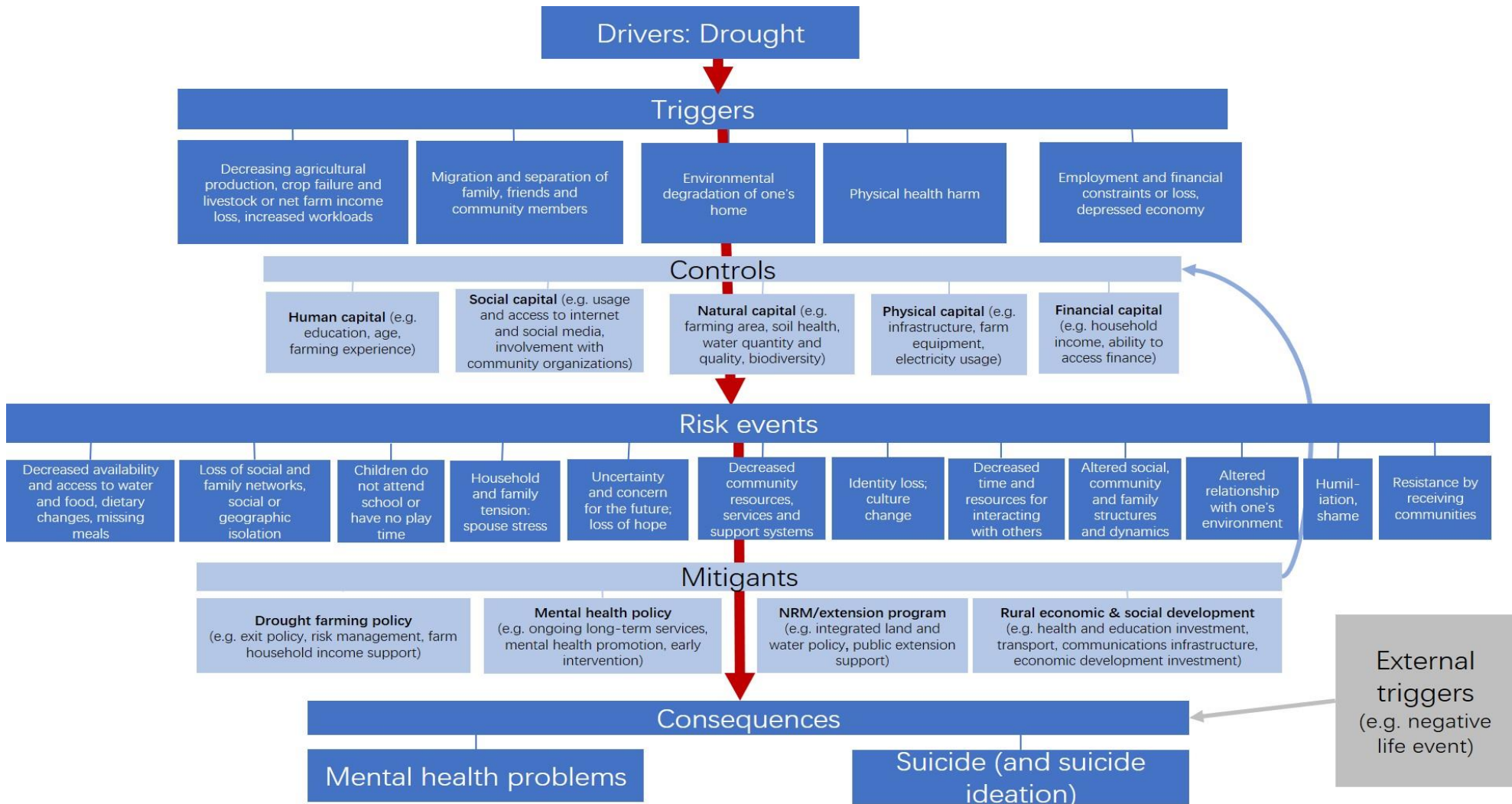


Figure 3. Risk systems casual pathways between drought and mental health

Question 2

As Funk and Minoletti (2005)⁽¹⁰¹⁾ report, mental health interventions and services for drought-affected communities comprise a considerable mix of delivery channels for drought-affected communities. This includes:

1. **Self-care and informal healthcare:** Self-care includes both peers and family, plus professions that offer part of general wellbeing (e.g. hairdressers, researchers, massage therapists, leisure and recreation) and other farm-related services (e.g. vets, stock agents, rural financial counsellors, agronomists, extension officers). Informal healthcare includes helpline and counselling services; accommodation support and outreach; information, advocacy and promotion.
2. **Primary healthcare:** Primary services for mental health, GP, nurse, first-aid courses, etc.
3. **Special healthcare:** Includes psychiatric services in hospitals, community mental health services, long-stay facilities, special suicide prevention services and other specialist services.

Ridani et al. (2016)⁽¹⁰²⁾ recommend that the best way to reduce suicide is a nine-pronged strategy (in order of importance):

1. **After-care and crisis care:** improve the care received by people after a suicide attempt with brief contact interventions and coordinated, assertive after-care.
2. **Psychosocial and pharmacotherapy treatments:** provide accessible and appropriate mental health care through specialist help (e.g. cognitive behaviour therapy, multi-systemic therapy, dialectical behaviour therapy, problem-solving therapy, psychodynamic interpersonal therapy, attachment-based family therapy) and treatments (e.g. antidepressants).
3. **GP capacity building and support:** improve access to, and quality of, GP care and encourage a systems approach.
4. **Frontline staff:** improve training of designated gatekeepers (GPs, nurses, social workers).
5. **Gatekeeper training:** improve training of emergent gatekeepers (police, clergy, teachers, counsellors, hairdressers, family, friends, extension officers).
6. **School programs:** provide training and programs to increase help-seeking.
7. **Community campaigns:** increase campaigns to help people to recognise risk factors, improve help seeking, reduce stigma and improve understanding.
8. **Media guidelines:** encourage the use of guidelines to report suicide accurately, responsibly and ethically.
9. **Means restrictions:** restrict access to means of suicide.

Dunbar et al. (2007)⁽¹⁰³⁾ provided an overview of the problems in rural and remote Australia (e.g. lack of access to GPs and specialist services); and suggested a variety of potential solutions. One such solution focuses on how to develop a rural and remote workforce strategy (with particular rural training programs designed to encourage professionals to stay in rural and remote regions). Examples of programs include the LifeForce (Wesley Mission) suicide prevention program (facilitates suicide prevention programs in rural and remote communities); Wings: Social and Emotional Wellbeing in the Early Years training for professionals to support children's wellbeing in drought-affected communities⁽¹⁰⁴⁾; NSW Farmers Blueprint for Mental Health; the Rural Adversity Mental Health Program (RAMHP) detailed further below^(79, 105); Men's Health Pit-Stop programs; Women's Pamper Days; Black Dog Youth Insight programs; Mate Helping Mate⁽⁷⁹⁾; drought wellbeing service and men's sheds by the Royal Flying Doctor Service; mental health first aid training^(12, 90, 106); public agricultural extension⁽¹⁰⁷⁾; Rural Resilience Program (e.g. includes workshops such as wellness days, women's retreats, Tune Up for Farmers, Shaping our Futures Together, and business programs such as the Farm Office Efficiency workshops, back to business basics training programs, disaster leadership projects, future options workshops).⁽¹⁰⁸⁾

The NSW Rural Adversity Mental Health Program (RAMPH) was founded in 2007 with an original focus including: 1) *mental health promotion*: components included mental health first aid training for rural communities and agencies working with farming households; community mental health and drought information forums; and booklets for rural health and agricultural service providers providing brief information about how to locate agricultural, financial and mental health services; and 2) *early intervention*: strategies to target people showing early signs of mental stress, such as service network planning workshops; community-based mental health liaison workers and rural telephone support lines.⁽¹⁰⁹⁾ In 2010 it changed focus to address rural adversity on mental health, and in 2016 it was re-funded to concentrate on: a) identifying individuals and communities experiencing or at risk of developing mental ill-health, and b) to link them to resources.⁽¹¹⁰⁾

Evaluation of healthcare interventions

The Centre for Rural & Remote Mental Health ^(110, 111) evaluated the program on the basis of i) fidelity; ii) reach; iii) satisfaction; iv) sustainability; and v) context. These evaluations are included in the overview of interventions below.

Table 4. Study numbers and evaluations of intervention outcomes in reviewed studies

Healthcare interventions	Study (n)	Evaluations of intervention outcomes*
Health literacy programs ¹	6	2.60
Peer-to-peer support programs ²	1	N.A.
Soft entry psychology programs (such as farm gate counselling) ³	6	2.62
Mental health outreach and care coordination ⁴	10	2.83
Online and telephone support ⁵	7	2.71
Mental health first aid and training and support ⁶	9	2.67
Mental health promotions, events and community supports ⁷	12	2.76
Psychological treatment programs ⁸	5	3.00
Other (e.g. natural resource management (NRM) practices) ⁹	1	2.00
Total number of studies	23	

* Strength of outcome rating: 1 = weak, 2 = moderate and 3 = strong.

Specific studies mentioning each intervention (studies are not mutually exclusive):

1 (79, 105, 109-114), 2(105, 113, 115-117),

3 (12, 105, 107, 110, 111),

4 (12, 105, 108-111, 113, 118-120),

5 (105, 109-112, 115, 121, 122),

6 (12, 79, 90, 105, 106, 109-111, 123-125),

7 (36, 69, 79, 98, 104, 105, 108-114, 116, 118, 120, 126),

8 (51, 103, 105, 119, 127, 128), 9(57).

The Evidence Check found a total of 23 studies relating to community-based interventions that aim to improve mental health outcomes for people living in drought-affected communities. Within the 23 studies, we broke down interventions into nine main categories, which are summarised in the table above, together with their evaluation.

The strongest evidence, respectively, was found for psychological treatment programs; mental health outreach and care coordination; mental health promotions; events and community supports; online and telephone support; mental health first aid and training support; soft entry psychology programs; health literacy programs; and other strategies.

Of the 23 studies mentioning specific programs/policies, 14 included evaluations of intervention outcomes.ⁱ The evaluations were undertaken by those studies in question and we assigned one of three ratings (1 = weak, 2 = moderate and 3 = strong) to indicate the strength of the interventions with regard to the outcome achieved. The table below lists the mean evaluation scores for each of the interventions under each outcome. For example, there are four studies that evaluated the intervention outcomes for health literacy programs. All four studies evaluated the outcomes in terms of reach of the interventions, which achieved an average score of 2.25 out of a scale of 3. Two studies evaluated the outcomes in terms of coordination of services, which was rated as strong.

The results highlight that most of the evaluation studies have focused on assessing the following outcomes respectively:

1. Reach of the interventions
2. Acceptability for health workers and community members
3. Implementability and program sustainability
4. Coordination of services
5. Confidence and/or willingness of community members to seek help/provide mental health information
6. Cultural and attitudinal change
7. Improved mental health wellbeing
8. Strategies that build individual, household or community strength
9. A decrease in suicide or self-harm.

The limitations of this analysis include the fact that many other programs that we identified had no evaluation available; second, there was no evaluation of any peer-to-peer support intervention and, finally, the reach of the program was often difficult to discern, in terms of the number of people using more than one service or reading online material, etc.

Five of the 14 studies used quantitative methods and each was rated for the level of evidence according to NHMRC (1)¹ guidelines. One study was rated as III-2 (a pseudo-randomised controlled trial), and four were rated as IV (case studies with either post-test or pre-test/post-test outcomes). In our view, the quality of the evidence base was NHMRC evidence Grade D (poor, level IV studies, or level I-III studies with a high risk of bias).

ⁱ It is important to note that a number of the evaluations are of the same program and are based on assessing the program at particular points in time. It is also important to note that there may be a number of other evaluations conducted that were not available to us at the time of review.

Table 5. Mean evaluation scores for each intervention under different intervention outcomes

Healthcare intervention outcomes	Health literacy programs (total n = 4)	Soft entry psychology programs (total n = 4)	Mental health outreach and care coordination (total n = 6)	Online and telephony support (total n = 3)	Mental health first aid and training and support (total n = 6)	Mental health promotions, events and community support (total n = 8)	Psychological treatment programs (total n = 1)
Reach of the interventions	2.25 (4)	2.33 (3)	2.60 (5)	2.67 (3)	2.25 (4)	2.43 (7)	3 (1)
Coordination of services	3 (2)	3 (1)	3 (4)	3 (2)	3 (2)	3 (5)	NA
Acceptability for health workers and community members	3 (3)	3 (2)	3 (5)	3 (3)	3 (3)	3 (6)	3 (1)
Improved mental health wellbeing, including resilience and reduction of symptoms	NA	NA	3 (2)	NA	NA	2.5 (4)	NA
Decrease in suicide or self-harm	NA	2 (1)	NA	NA	NA	NA	NA
Confidence and/or willingness among community members to seek help	3 (1)	3 (1)	3 (3)	3 (1)	3 (1)	3 (4)	NA
Strategies that build individual, household and community strength	NA	NA	3 (2)	NA	3 (1)	3 (3)	NA
Confidence and/or willingness among community members to provide mental health information	3 (1)	2 (2)	2 (2)	3 (1)	3 (2)	3 (1)	NA
Cultural and attitudinal changes (e.g. stoicism, self-reliance, toughness, social acceptability of help seeking)	3 (1)	3 (1)	3 (3)	3 (1)	3 (1)	3 (4)	NA
Implementability and program sustainability	2 (3)	2 (2)	2 (3)	2 (3)	2 (3)	2.25 (4)	NA

Notes: 1 is weak, 2 is moderate, 3 is strong. Numbers in brackets represent the number of studies for evaluation.

Gaps in the evidence

In answering Question 1 (causal pathways through which drought affects the mental health of people living in rural and regional communities), we found many gaps in the evidence regarding the links between drought and worsening mental health in rural and remote communities. As outlined by Berry et al. (2018)⁽²⁹⁾ there is a need for large-scale, complex, multidisciplinary projects and a co-generation of knowledge to understand the links. Nearly all of the projects we reviewed were situated within certain fields of discipline knowledge, without incorporating or considering the multitude of potential factors influencing mental health and wellbeing. For example, there is an emerging scientific field linking exposure to environmental microbiomes and a healthy environment to health/mental health.^(63, 129) But a healthy rural environment is dependent on farmer action (and attitudes), local, state and federal regulation and policy, climate and the effectiveness of natural resource management practices. Literature is only starting to emerge regarding farmers who undertake certain activities (e.g. natural resource management techniques) and their overall mental health and wellbeing⁽⁵⁷⁾; and there has not been any research to date on the links between the actual environmental condition (not just perceptions or status) of the farm and farmers' wellbeing/mental health. In addition, solastalgia research is still in its infancy.⁽⁶¹⁾

Another under-researched area is the causal relationship of economic factors and risk management, particularly by farmers, with mental health stress. Although some farmer studies have considered this^(46, 48), the area remains under-studied, and others who have considered it have looked only at broad financial factors such as the three different levels of financial security.⁽³⁾ Farm factors such as debt levels, farm assets, farm income and farm income diversity (e.g. level of off-farm income) need greater consideration in drought-related mental health studies. One reason for this missing evidence is that population-based studies (e.g. HILDA) often do not collect the farm-level information needed for such assessment.

There were few studies that considered the length of time of a drought (plus its severity) as a factor in driving mental health stress (O'Brien et al. (2014)⁽⁴⁾ is a notable example that did). Most studies focused solely on perceptions and common understanding that an area was in drought to interpret its impact on mental health.

Finally, studies considering the physical impact of drought on actual health are limited in scope, with more research needed in many areas. For example, the impact of drought (and its accumulated stress) on stillbirth is one such area. Other areas where there are clear gaps in the literature include Indigenous studies, children in general, and children living on farms.

In answering Question 2 (the effectiveness of interventions), our overview has illustrated that there are many gaps in the evidence, with a dearth of evaluation studies available. But in particular there was a lack of evaluation of outcomes concerning cultural and attitudinal change; improved mental health and wellbeing; strategies that build individual, household or community strength; and decrease in suicide or self-harm. There needs to be more assessment of the impact of the implementation of policies across time and space, potentially using impact assessment techniques such as before and after policy implementation across rural NSW, or a time-series analysis of suicide rates/attempts across time and space.

Moreover, detailed information is needed regarding impact heterogeneity — the possibly varying effectiveness of interventions among subgroups of population broken down by factors such as gender, age, income, climate zones, and/or rurality of residence. These could potentially improve the targeting accuracy of future interventions and thus possibly improve their cost-effectiveness.

Discussion

Australian studies dominated this Evidence Check, with the majority of them reviews, followed by qualitative and then quantitative studies. Most of the studies focused on farmers' mental health issues. We found there were five direct areas of a link between drought and mental health: 1) a decline in agricultural production and livelihoods; 2) changed environmental conditions; 3) reduced employment and depressed rural community; 4) migration and separation of family; and 5) harm to physical health.

Drought is not necessarily the main driver of psychological distress; even the existence of drought itself isn't necessarily associated with high drought worry.⁽⁶⁾ A person's level of resilience is one reason why some people do not suffer significant distress, where resilience is defined as their ability to successfully adapt to adversity and to capitalise on opportunities.⁽⁵⁷⁾ Resilience (and adaptive capacity to change) is often described as relying on a variety of capitals: a) social capital (e.g. how interconnected someone is within society); b) human (e.g. age, education), financial (e.g. farm profitability, farm debt) and physical capital (e.g. farm size, infrastructure, regional factors); and c) natural capital (e.g. environmental factors). As King et al. (2009)⁽³⁸⁾ outlined, the resilience of farm families is therefore not about the absence of psychological distress, but about how such distress is managed; nor is it about the capacity to stay on farm, but about the capacity of farm families to maintain a source of livelihood. Having greater access to such capital, and higher resilience, allows individuals (and communities) to better cope with adverse events such as drought than people or communities with low resilience. This is shown in our causal systems figure as the 'controls' that alleviate the pain of drought from the actual drought stress encountered.

Such an illustration of the causal impact of drought stress highlights the need to build resilience in rural communities through a variety of policies and mitigants to prevent serious distress and suicide occurring. The causal system figure provides four main policy mitigants for reducing the consequences of distress and suicide: 1) Drought farming policy (e.g. farm household assistance; farm management deposit schemes, exit packages); 2) Mental health policy (e.g. health promotion; early intervention); 3) NRM/extension policy (e.g. land and water policy; public extension support); and 4) Rural economic and social development policy (e.g. basic health and education services; communications and transport infrastructure; tourism policy). All these policy mitigants help to build up capital within rural communities and help protect them from the negative impact of drought.

The common thread in much of the literature is the need to prevent rural mental health risks from drought rather than manage consequences (i.e. move from a 'crisis response' approach towards a preventive and well planned, structured approach). As discussed by Hart, Berry and Tonna (2011)⁽⁷⁹⁾ longer-term strategies are essential, and the effectiveness of any specific drought program is linked irrevocably to available rural mental health care — with the most important elements of this being after-care and crisis care; psychosocial and pharmacotherapy treatments; and GP capacity building and support.⁽¹⁰²⁾ Our four defined policies are generally about preventive strategies (or building up various capitals and resilience), with the exception of farm household income support policy (which is designed to stop farm households falling into poverty) and after-care and crisis care for high-risk groups. However, annual budget cycle-driven funding, fluctuating drought-available funding and the short-term nature of funding for drought-specific supports have been reported as distorting program planning and implementation; disrupting long-term qualified staff retention and leading to a lack of skills and corporate knowledge, as well as creating financial inefficiencies and increased transaction costs. King et al. (2009)⁽³⁸⁾ reinforces this need for continuity (at a base level) of services, with less reliance on crisis-driven responses, as well as increased community capacity building.

This Evidence Check has concentrated on reviewing the evidence for the effectiveness of various levels of mental health policy and interventions in addressing rural community wellbeing, mental health distress and suicide risk factors. As illustrated, although there has been considerable money and effort invested in various mental health initiatives, there has not been a consequent widespread evaluation of effectiveness. Forty-three studies were found to relate to Question 2, with 23 of these providing detail on specific programs and policies, but only 14 of these included evaluations of any intervention outcomes (and it is important to note that this includes a number of studies of the same program, at different years). The strongest evidence of intervention outcomes was found for psychological treatment programs; mental health outreach and care coordination; online and telephone support; health literacy programs; mental health first aid and training support; and other assorted strategies.

Evaluation studies have focused on assessing the following outcomes respectively: 1) reach of the interventions; 2) acceptability for health workers and community members; 3) implementability and program sustainability; 4) coordination of services; 5) confidence and/or willingness of community members to seek help/provide mental health information; 6) cultural and attitudinal change; 7) improved mental health wellbeing; 8) strategies that build individual, household or community strength; and 9) a decrease in suicide or self-harm. Evaluation studies have focused on assessing the reach of interventions; acceptability; implementability and program sustainability; and coordination. Little attention has been paid to assessing cultural and attitudinal change; improved mental health wellbeing; strategies that build individual, household or community strength; and that decrease suicide or self-harm, especially over various regions.

Similarly, there has little research linking the existence of drought policy with farmer wellbeing. There was a 2008 review of drought policy by the Australian Government, which shifted the federal response from being predominantly a crisis response (e.g. exceptional circumstances payments) to a risk management approach, with a focus on sustaining productivity even during sustained dry periods.⁽⁴⁷⁾ Economists have written extensively about how to ensure the most effective and efficient form of drought protection, and advocated measures such as reducing subsidies for inputs and outputs and improving risk management (e.g. farm management deposit scheme, insurance, better decision-making). Subsidies for inputs and outputs are a very blunt mechanism as usually it is the supplier, not the farmer, who receives most of the support. In addition, the effectiveness of farm household income support measures have also been questioned, as they reduce incentives for farmers to implement drought prevention measures.⁽¹³⁰⁾ Others have advocated the use of exit packages ⁽⁴⁸⁾ to encourage vulnerable groups to exit farming and to alleviate some of the pain of leaving. Currently, expenditure for drought assistance by federal governments includes: concessional loan schemes, farm household allowance, national water infrastructure development fund, council funding. States are providing drought-related funding on transport subsidies, rates/licence/regio waivers; farm innovation funds; drought wellbeing services; counselling; and fence infrastructure.

There is increasing research starting to link farm performance with farm wellbeing ^(48, 57), and more work clearly needs to be done in this space. The climate change literature has found nations and individuals with the least ability to cope will be most vulnerable to climate change, whereas wealthier nations and individuals are more likely to have the required resources to adapt.⁽¹³¹⁾ Farm performance is therefore important as it represents the ability to manage and respond to adverse events.

One area that is linked both to farm performance and to drought preparation is the natural capital and management of the farm. Again, the research in this space is scant, but growing.^(57, 100) The identified link between farm performance and natural resource management indicates a need for an integrated NRM and public extension program. Also, there may be considerable drought resilience and preparation benefits to be derived from expanding carbon markets (e.g. currently \$10/tonne carbon dioxide for NRM soil carbon and deforestation projects) available through the Emissions Reduction Fund. As Hunt et al. (2011)⁽¹⁰⁷⁾ outlined, historically the farming sector in Australia had access to an abundance of government-sponsored information via extension services. Some of this extension did focus on NRM, farm management knowledge

and skills development. However, since the 1990s this investment in both extension and R&D has declined. Hunt et al. (2011)⁽¹⁰⁷⁾ noted that government extension officers often had multiple roles, and their loss has been felt by the farming community.

Conclusion

Australia, in particular, has seen a surge in mental health-related issues in drought-affected communities since the late 1990s. This is a reflection of the Millennium Drought period, with other water-scarce countries (or regions) such as the US and Africa also conducting research. Much of the literature was qualitative in nature (e.g. either an overall review or based on smaller sample sizes), while the quantitative studies focused predominantly on farmers. Drought (and mental health) was defined in many different ways, which is one reason why there was not consistent agreement within the literature regarding the impact of drought on mental health in rural communities. There was less significance (but still some significant associations) found between measures of psychological distress and drought than between measures such as wellbeing or drought stress and actual physical drought presence.

In terms of causal pathways, we suggested five main ways that the presence of drought can lead to worsening mental health: 1) a decline in agricultural production and livelihoods; 2) changed environmental conditions; 3) reduced employment and depressed rural community; 4) migration and separation of family; and 5) harm to physical health.

Resilience, and adaptive capacity for change, is a multifaceted concept and can be influenced by a variety of capitals: a) social capital; b) human, financial and physical capital; and c) natural capital. These are the 'controls' that alleviate the pain of drought from the actual drought stress encountered. The Evidence Check found socioeconomic and demographic factors — such as being a farmer, being young or old, being unemployed, having less community connection, being in worse financial shape, being Indigenous, remoteness, being less educated, having lower personal hope and optimism, higher neuroticism and stoicism, having a greater sense of place and having worse health — were all controls that increased the likelihood of drought having a more severe impact on mental distress. There is emerging evidence about the effect of NRM and alternative farming practices on farmer wellbeing that needs further investigation.

We identified very few studies that provided information on mental health programs in drought-affected communities, with the strongest evidence respectively found for psychological treatment programs; mental health outreach and care coordination; online and telephone support; health literacy programs; mental health first aid and training support; and other associated strategies. Evaluation studies have focused primarily on assessing factors such as the reach of the interventions; acceptability; implementability and program sustainability; and coordination. They have not focused much attention on confidence and/or willingness of community members to seek help/provide mental health information; cultural and attitudinal change; improved mental health wellbeing; strategies that build individual, household or community strength; and decreases in suicide or self-harm. There needs to be more assessment of the impact of the implementation of policies across time and space, potentially using impact assessment techniques such as before and after policy implementation across rural NSW, or a time-series analysis of suicide rates/attempts by considering the many definitions of drought.

Future research in this space should consider large-scale, complex, multidisciplinary projects and a co-generation of knowledge to understand the links between mental health risk in drought-affected communities, along with the four differing ways that policy mitigants that can be put in place for reducing the consequences of distress and suicide in drought-affected communities, namely: 1) drought farming policy; 2) mental health policy; 3) NRM/extension policy; and 4) rural economic and social development policy. A coordinated and integrated policy is necessary to reduce the negative potential consequences of drought.

In terms of mental health policy, the common thread in much of the literature was the need to prevent rural mental health risks from drought rather than manage consequences. To do this, longer-term strategies are essential, ongoing rural mental health care needs to be always available and not subject to budget or crisis cycle-driven funding. In addition, very similar conclusions apply to drought and land and water policy, which also needs to be driven by long-term considerations across both drought and good years.

References

1. NHMRC. NHMRC additional levels of evidence and grades for recommendations for developers of guidelines. National Health and Medical Research Council; 2009. Available from: <https://http://www.mja.com.au/sites/default/files/NHMRC.levels.of.evidence.2008-09.pdf>.
2. Hennessy H, Fawcett R, Kirono D, Mpelasoka F, Jones D, et al. An assessment of the impact of climate change on the nature and frequency of exceptional climatic events. CSIRO & Bureau of Meteorology; 2008. Available from: <http://www.bom.gov.au/climate/droughtec/ec-report.pdf>.
3. Austin EK, Handley T, Kiem AS, Rich JL, Lewin TJ, et al. Drought - related stress among farmers: findings from the Australian Rural Mental Health Study. *The Medical Journal of Australia*. 2018;209(4):159-65.
4. O'Brien L, Berry H, Coleman C, Hanigan I. Drought as a mental health exposure. *Environmental Research*. 2014;131:181-7.
5. Edwards B, Gray M, Hunter B. The impact of drought on mental health and alcohol use. Australian Social Policy Conference. 2009.
6. Stain HJ, Kelly B, Carr VJ, Lewin TJ, Fitzgerald M, et al. The psychological impact of chronic environmental adversity: Responding to prolonged drought. *Social Science & Medicine*. 2011;73(11):1593-9.
7. Hanigan IC, Butler CD, Kokic PN, Hutchinson M. Suicide and drought in new South Wales, Australia, 1970–2007. *Proceedings of the National Academy of Sciences*. 2012;109(35):13950-5.
8. Edwards B, Gray M, Hunter B. The Impact of Drought on Mental Health in Rural and Regional Australia. *Social Indicators Research*. 2015;121(1):177-94.
9. Powers JR, Dobson AJ, Berry HL, Graves AM, Hanigan IC, et al. Lack of association between drought and mental health in a cohort of 45-61 year old rural Australian women. *Australian and New Zealand Journal of Public Health*. 2015;39(6):518-23.
10. Hanigan IC, Schirmer J, Niyonsenga T. Drought and Distress in Southeastern Australia. *Ecohealth*. 2018;15(3):642-55.
11. Yazd S, Wheeler S, Zuo A. Mental health of farmers: A Systematic Review, Centre for Global Food and Resources. Working paper. Centre for Global Food and Resources; 2019 Jan 2019.
12. Sartore G, Kelly B, Stain H, Albrecht G, Higginbotham N. Control, uncertainty, and expectations for the future: a qualitative study of the impact of drought on a rural Australian community. *Rural and Remote Health*. 2008;8(3):950.
13. Stain HJ, Kelly B, Lewin TJ, Higginbotham N, Beard JR, et al. Social networks and mental health among a farming population. *Social Psychiatry and Psychiatric Epidemiology*. 2008;43(10):843-9.
14. Lee Y-C, Chatterton ML, Magnus A, Mohebbi M, Le LK-D, et al. Cost of high prevalence mental disorders: findings from the 2007 Australian National Survey of mental health and wellbeing. *Australian & New Zealand Journal of Psychiatry*. 2017;51(12):1198-211.
15. Berry HL, Hogan A, Owen J, Rickwood D, Fragar L. Climate change and farmers' mental health: risks and responses. *Asia Pacific Journal of Public Health*. 2011;23(2_suppl):119S-32S.
16. Kim KH, Kabir E, Ara Jahan S. A review of the consequences of global climate change on human health. *Journal of Environmental Science and Health*. 2014;32(3):299-318.
17. Hess J, Luber G, Maslak T, Radtke M, Strickman D, et al. A Human Health Perspective On Climate Change. Environmental Health Perspectives and the National Institute of Environmental Health Services; 2010. Available from: https://http://www.niehs.nih.gov/health/materials/a_human_health_perspective_on_climate_change_full_report_508.pdf.
18. Obradovich N, Migliorini R, Mednick SC, Fowler JH. Nighttime temperature and human sleep loss in a changing climate. *Science Advances*. 2017;3(5):e1601555.
19. Nitschke M, Tucker GR, Peng B. Morbidity and mortality during heatwaves in metropolitan Adelaide.(Clinical report). *The Medical Journal of Australia*. 2007;187(10):662-5.
20. Semenza JC, McCullough JE, Flanders WD, McGeehin MA, Lumpkin JR. Excess hospital admissions during the July 1995 heat wave in Chicago. *American Journal of Preventive Medicine*. 1999;16(4):269-77.
21. Epstein PR. Climate Change and Human Health. *The New England Journal of Medicine*. 2005;353(14):1433-6.
22. Green R, Basu R, Malig B, Broadwin R, Kim J, et al. The effect of temperature on hospital admissions in nine California counties. *International Journal of Public Health*. 2010;55(2):113-21.
23. Cusack L, de Crespigny C, Athanasos P. Heatwaves and their impact on people with alcohol, drug and mental health conditions: a discussion paper on clinical practice considerations. *Journal of advanced nursing*. 2011;67(4):915.
24. Zander K, Botzen W, Oppermann E, Kjellstrom T, Garnett S. Heat stress causes substantial labour productivity loss in Australia. *Nature Climate Change*. 2015;5(7):647-51.
25. Kjellstrom T, Briggs D, Freyberg C, Lemke B, Otto M, et al. Heat, Human Performance, and Occupational Health: A Key Issue for the Assessment of Global Climate Change Impacts. *Annual review of public health*. 2016;37(1):97.
26. Yusa A, Berry P, J JC, Ogden N, Bonsal B, et al. Climate Change, Drought and Human Health in Canada. *International journal of environmental research and public health*. 2015;12(7):8359-412.

27. Qi X, Hu W, Page A, Tong S. Associations between climate variability, unemployment and suicide in Australia: a multicity study. *BMC Psychiatry*. 2015;15:114.
28. Vins H, Bell J, Saha S, Hess JJ. The mental health outcomes of drought: a systematic review and causal process diagram. *International journal of environmental research and public health*. 2015;12(10):13251-75.
29. Berry HL, Waite TD, Dear KB, Capon AG, Murray V. The case for systems thinking about climate change and mental health. *Nature Climate Change*. 2018;8(4):282.
30. Ding N, Berry HL, Bennett CM. The Importance of Humidity in the Relationship between Heat and Population Mental Health: Evidence from Australia. *PloS one*. 2016;11(10):e0164190.
31. Xu Y, Wheeler S, Zuo A. Will boys' mental health fare worse under a hotter climate in Australia? *Population and Environment*. 2018;40(2):158-81.
32. Grafton RQ, McLindin M, Hussey K, Wyrwoll P, Wichelns D, et al. Responding to Global Challenges in Food, Energy, Environment and Water: Risks and Options Assessment for Decision-Making. *Asia and the Pacific Policy Studies*. 2016;3(2):275-99.
33. Alston M. 'I'd like to just walk out of here': Australian women's experience of drought. *Sociologia Ruralis*. 2006;46(2):154-70.
34. Alston M. "It's really not easy to get help": Services to drought-affected families. *Australian Social Work*. 2007;60(4):421-35.
35. Dean J, Stain HJ. The impact of drought on the emotional well-being of children and adolescents in rural and remote New South Wales. *The Journal of Rural Health*. 2007;23(4):356-64.
36. McColl L. The influence of bush identity on attitudes to mental health in a Queensland community. *Rural Society*. 2007;17(2):107-24.
37. Alston M, Kent J. The Big Dry: The link between rural masculinities and poor health outcomes for farming men. *Journal of Sociology*. 2008;44(2):133-47.
38. King D, Lane A, MacDougall C, Greenhill J. The resilience and mental health and wellbeing of farm families experiencing climate variation in South Australia. Report for the National Institute of Labour Studies Incorporated, Adelaide, Australia. 2009.
39. Ramin BM, McMichael AJ. Climate change and health in sub-Saharan Africa: a case-based perspective. *EcoHealth*. 2009;6(1):52.
40. Ng FY, Wilson LA, Veitch C. Climate adversity and resilience: the voice of rural Australia. *Rural Remote Health*. 2015;15(4):3071.
41. Carleton TA. Crop-damaging temperatures increase suicide rates in India. *Proceedings of the National Academy of Sciences*. 2017;114(33):8746-51.
42. Birhanu Z, Ambelu A, Berhanu N, Tesfaye A, Woldemichael K. Understanding Resilience Dimensions and Adaptive Strategies to the Impact of Recurrent Droughts in Borana Zone, Oromia Region, Ethiopia: A Grounded Theory Approach. *International Journal of Environmental Research and Public Health*. 2017;14(2):118.
43. Kureshi JS, Somsundaram K. Assessment of occupational stress among farmers in Aurangabad district, Maharashtra. *International Journal Of Community Medicine and Public Health*. 2018;5(4):1434-40.
44. Greene C. Broadening understandings of drought – The climate vulnerability of farmworkers and rural communities in California (USA). *Environmental Science and Policy*. 2018;89:283-91.
45. Sherval M, Askew LE. Experiencing 'drought and more': local responses from rural Victoria, Australia. *Population and Environment*. 2012;33(4):347-64.
46. Peel D, Berry HL, Schirmer J. Perceived profitability and well - being in A ustralian dryland farmers and irrigators. *Australian Journal of Rural Health*. 2015;23(4):207-14.
47. Edwards B, Gray M, Hunter B. The social and economic impacts of drought. *Australian Journal of Social Issues*. 2018;53(4):1–10.
48. Wheeler SA, Zuo A, Loch A. Water torture: Unravelling the psychological distress of irrigators in Australia. *Journal of Rural Studies*. 2018;62:183-94.
49. Stehlik D, Lawrence G, Gray I. Gender and drought: experiences of Australian women in the drought of the 1990s. *Disasters*. 2000;24(1):38-53.
50. Fennell KM, Jarrett CE, Kettler LJ, Dollman J, Turnbull DA. "Watching the bank balance build up then blow away and the rain clouds do the same": A thematic analysis of South Australian farmers' sources of stress during drought. *Journal of Rural Studies*. 2016;46:102-10.
51. Heaney AK, Winter SJ. Climate-driven migration: An exploratory case study of Maasai health perceptions and help-seeking behaviors. *International Journal of Public Health*. 2016;61(6):641-9.
52. Kunde L, Kolves K, Kelly B, Reddy P, De Leo D. Pathways to Suicide in Australian Farmers: A Life Chart Analysis. *International journal of environmental research and public health*. 2017;14(4).
53. Alston M, Clarke J, Whittenbury K. Limits to adaptation: Reducing irrigation water in the Murray-Darling Basin dairy communities. *Journal of Rural Studies*. 2018;58:93-102.
54. Berman MG, Kross E, Krpan KM, Askren MK, Burson A, et al. Interacting with nature improves cognition and affect for individuals with depression. *Journal of Affective Disorders*. 2012;140(3):300-5.
55. Hartig T, Mitchell R, de Vries S, Frumkin H. Nature and Health. *Annu Rev Public Health*. 2014;35:207-28.
56. Mackerron G, Mourato S. Happiness is greater in natural environments. *Global Environmental Change*. 2013;23(5):992-1000.

57. Brown DK, Barton JL, Gladwell VF. Viewing nature scenes positively affects recovery of autonomic function following acute-mental stress. *Environmental science & technology*. 2013;47(11):5562-9.
58. Chur-Hansen A. Grief and bereavement issues and the loss of a companion animal: People living with a companion animal, owners of livestock, and animal support workers. *Clinical Psychologist*. 2010;14(1):14-21.
59. Alston M, Whittenbury K. Does climatic crisis in Australia's food bowl create a basis for change in agricultural gender relations? *Journal of the Agriculture, Food, and Human Values Society*. 2013;30(1):115-28.
60. Murti M, Yard E, Kramer R, Haselow D, Mettler M, et al. Impact of the 2012 extreme drought conditions on private well owners in the United States, a qualitative analysis. *BMC Public Health*. 2016;16:430.
61. Albrecht G, Sartore G-M, Connor L, Higginbotham N, Freeman S, et al. Solastalgia: the distress caused by environmental change. *Australasian Psychiatry*. 2007;15(sup1):S95-S8.
62. Greenough G, McGeehin M, Bernard SM, Trtanj J, Riad J, et al. The potential impacts of climate variability and change on health impacts of extreme weather events in the United States. *Environmental Health Perspectives*. 2001;109(Suppl 2):191.
63. Speldewinde PC, Cook A, Davies P, Weinstein P. A relationship between environmental degradation and mental health in rural Western Australia. *Health & place*. 2009;15(3):880-7.
64. Barreau T, Conway D, Haught K, Jackson R, Kreutzer R, et al. Physical, Mental, and Financial Impacts From Drought in Two California Counties, 2015. *Journal of Public Health*. 2017;107(5):783-90.
65. Pearce M, Eagle L, Low D, Schurmann A. CUT FROM 'COUNTRY': THE IMPACT OF CLIMATE CHANGE ON THE MENTAL HEALTH OF ABORIGINAL PASTORALISTS. *Australasian Journal of Regional Studies*. 2015;21(1):50-79.
66. Carnie TL, Berry HL, Blinkhorn SA, Hart CR. In their own words: Young people's mental health in drought-affected rural and remote NSW. *Australian Journal of Rural Health*. 2011;19(5):244-8.
67. Morrow V, Tafere Y, Chuta N, Zharkevich I. "I started working because I was hungry": The consequences of food insecurity for children's well-being in rural Ethiopia. *Social Science and Medicine*. 2017;182:1-9.
68. Duclos P, Sanderson LM, Lipsett M. The 1987 forest fire disaster in California: Assessment of emergency room visits. *Archives of Environmental Health*. 1990;45(1):53-8.
69. Horton G, Hanna L, Kelly B. Drought, drying and climate change: emerging health issues for ageing Australians in rural areas. *Australasian Journal on Ageing*. 2010;29(1):2-7.
70. Senate Community Affairs and References Committee. Accessibility and quality of mental health services in rural and remote Australia. Parliament of Australia; 2018. Available from: https://http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Community_Affairs/MentalHealthServices/Report.
71. Stallones L, Beseler C. Safety practices and depression among farm residents. *Annals of Epidemiology*. 2004;14(8):571-8.
72. Syson-Nibbs L, Saul C, Cox P. Tideswell health survey: A population survey of the health needs and service utilization of a farming community. *Public Health*. 2006;120(3):221-8.
73. O'Brien L, Berry H, Hogan A. The structure of psychological life satisfaction: insights from farmers and a general community sample in Australia. *BMC Public Health*. 2012;12:976.
74. Jamal GA, Hansen S, Pilkington A, Buchanan D, Gillham RA, et al. A clinical neurological, neurophysiological, and neuropsychological study of sheep farmers and dippers exposed to organophosphate pesticides. *Occupational and Environmental Medicine*. 2002;59(7):434-41.
75. Friel S, Berry H, Dinh H, O'Brien L, Walls HL. The impact of drought on the association between food security and mental health in a nationally representative Australian sample. *BMC Public Health*. 2014;14:1102.
76. Brew B, Inder K, Allen J, Thomas M, Kelly B. The health and wellbeing of Australian farmers: a longitudinal cohort study. *BMC Public Health*. 2016;16(16):988.
77. Alpass F, Flett R, Humphries S, Massey C, Morriss S, et al. Stress in Dairy Farming and the Adoption of New Technology. *International Journal of Stress Management*. 2004;11(3):270.
78. Alston M, Kent J. Coping with a crisis: Human services in times of drought. *Rural Society*. 2004;14(3):214-27.
79. Hart CR, Berry HL, Tonna AM. Improving the mental health of rural New South Wales communities facing drought and other adversities. *Australian Journal of Rural Health*. 2011;19(5):231-8.
80. Bryant L, Garnham B. The fallen hero: masculinity, shame and farmer suicide in Australia. *Gender, Place and Culture*. 2015;22(1):67-82.
81. Caldwell K, Boyd C. Coping and resilience in farming families affected by drought. *Rural and Remote health*. 2009;9(2):1088.
82. Nicholls N, Butler CD, Hanigan I. Inter-annual rainfall variations and suicide in New South Wales, Australia, 1964–2001. *International Journal of Biometeorology*. 2006;50(3):139-43.
83. Kolassa I-T, Ertl V, Eckart C, Kolassa S, Onyut LP, et al. Spontaneous Remission From PTSD Depends on the Number of Traumatic Event Types Experienced. *Psychological Trauma: Theory, Research, Practice, and Policy*. 2010;2(3):169-74.
84. Firth HM, Williams SM, Herbison GP, McGee RO. Stress in New Zealand farmers. *Stress and Health*. 2007;23(1):51-8.
85. Gunn KM, Kettler LJ, Skaczkowski GL, Turnbull DA. Farmers' stress and coping in a time of drought. *Rural Remote Health*. 2012;12(4).
86. Polain JD, Berry HL, Hoskin JO. Rapid change, climate adversity and the next 'big dry': Older farmers' mental health. *The Australian Journal of Rural Health*. 2011;19(5):239-43.

87. Nelson DR, Finan TJ. Praying for drought: Persistent vulnerability and the politics of patronage in Ceará, Northeast Brazil. *American Anthropologist*. 2009;111(3):302-16.
88. Keshavarz M, Karami E, Vanclay F. The social experience of drought in rural Iran. *Land Use Policy*. 2013;30(1):120-9.
89. Dinh H, Daly A, Freyens B. Farm adjustment strategies to water-related challenges in the Murray-Darling Basin. *Policy Studies*. 2017;38(5):482-501.
90. Hossain D, Eley R, Coutts J, Gorman D. Mental health of farmers in Southern Queensland: Issues and support. *The Australian Journal of Rural Health*. 2008;16(6):343-8.
91. Hunter E. 'Radical hope' and rain: climate change and the mental health of Indigenous residents of northern Australia. *Australasian Psychiatry*. 2009;17(6):445-52.
92. McNamara KE, Westoby R. Solastalgia and the Gendered Nature of Climate Change: An Example from Erub Island, Torres Strait. *EcoHealth*. 2011;8(2):233-6.
93. Rigby CW, Rosen A, Berry HL, Hart CR. If the land's sick, we're sick: The impact of prolonged drought on the social and emotional well-being of Aboriginal communities in rural New South Wales. *Australian Journal of Rural Health*. 2011;19(5):249-54.
94. Staniford AK, Dollard MF, Guerin B. Stress and help - seeking for drought - stricken citrus growers in the Riverland of South Australia. *Australian Journal of Rural Health*. 2009;17(3):147-54.
95. Dean JG, Stain HJ. Mental health impact for adolescents living with prolonged drought. *The Australian Journal of Rural Health*. 2010;18(1):32-7.
96. Murray G, Judd F, Jackson H, Fraser C, Komiti A, et al. Big boys don't cry: An investigation of stoicism and its mental health outcomes. *Personality and Individual Differences*. 2008;44(6):1369-81.
97. Putnam R. Commentary: "Health by association": some comments. *International Journal of Epidemiology*. 2004;33(4):667-71.
98. Hogan A, Scarr E, Lockie S, Chant B, Alston S. Ruptured identity of male farmers: subjective crisis and the risk of suicide. *Journal of Rural Social Sciences*. 2012;27(3):118-40.
99. Yazd S, Wheeler S, Zuo A. Do alternative irrigators have less mental health distress than conventional irrigators? Working paper. Centre for Global Food and Resources; 2019 Jan 2019.
100. Wheeler SA, Marning A. Turning water into wine: Exploring water security perceptions and adaptation behaviour amongst conventional, organic and biodynamic grape growers. *Land Use Policy*. 2019;82:528-37.
101. Funk M, Minoletti A. Mental health policy, plans and programmes. Switzerland: World Health Organization; 2005. Available from: https://http://www.who.int/mental_health/policy/services/2_policy_plans_prog_WEB_07.pdf?ua=1.
102. Ridani R, Torok M, Shand F, Holland C, Murray S, et al. An evidence-based systems approach to suicide prevention: guidance on planning, commissioning and monitoring. Sydney: Black Dog Institute; 2016.
103. Dunbar JA, Hickie IB, Wakerman J, Reddy P. New money for mental health: will it make things better for rural and remote Australia? *Medical Journal of Australia*. 2007;186(11):587-9.
104. Cartmel J, Smith K, Miller D. Empowered with Wings: Professional Development for Supporting Children's Social and Emotional Wellbeing in South-West Queensland. *Children Australia*. 2016;41(4):292-6.
105. Fragar L, Kelly B, Peters M, Henderson A, Tonna A. Partnerships to promote mental health of NSW farmers: The New South Wales Farmers Blueprint for Mental Health. *The Australian Journal of Rural Health*. 2008;16(3):170-5.
106. Hossain D, Gorman D, Eley R, Coutts J. Value of mental health first aid training of advisory and extension agents in supporting farmers in rural Queensland. *Rural Remote Health*. 2010;10(4):1593.
107. Hunt W, Vanclay F, Birch C, Coutts J, Flittner N, et al. Agricultural extension: Building capacity and resilience in rural industries and communities. *Rural Society*. 2011;20(2):112-27.
108. Department of Primary Industry NSW. Rural Resilience Program Report Card 2017-2018 Department of Primary Industry NSW 2018.
109. Tonna A, Kelly B, Crockett J, Greig J, Buss R, et al. Improving the mental health of drought-affected communities: an Australian model. *Rural Society*. 2009;19(4):296-305.
110. Centre for Rural & Remote Mental Health. Rural adversity mental health program (RAMHP) process evaluation report. NSW; 2017.
111. Centre for Rural & Remote Mental Health. Rural adversity mental health program (RAMHP) outcome evaluation summary. NSW; 2018.
112. Bosch KR. Cooperative Extension responding to family needs in time of drought and water shortage. *The Journal of Extension*. 2004;42(4):1-10.
113. Purcell R, McGirr J. Rural health service managers' perspectives on preparing rural health services for climate change. *Australian Journal of Rural Health*. 2018;26(1):20-5.
114. Sartore G, Hoolahan B, Tonna A, Kelly B, Stain H. Wisdom from the drought: recommendations from a consultative conference. *Australian Journal of Rural Health*. 2005;13(5):315-20.
115. Arnautovska U, Kolves K, Ide N, De Leo D. Review of suicide-prevention programs in Queensland: state- and community-level activities. *Australian Health Review*. 2013;37(5):660-5.
116. McMichael AJ, Friel S, Nyong A, Corvalan C. Global environmental change and health: impacts, inequalities, and the health sector. *British Medical Journal*. 2008;336(7637):191-4.

117. Trombley J, Chalupka S, Anderko L. Climate Change and Mental Health. *The American Journal of Nursing* 2017;117(4):44-52.
118. Exner R, Jansen J, Stroud L, du Preez M. A Multidisciplinary Approach to University Engagement: Key Considerations for Dynamic Mental Health Teaching and Service Provision to a Disadvantaged Community. *Educational Research for Social Change*. 2017;6(2):60-75.
119. Sangalad PN, Huddar MG. Agrarian Distress and Farmers' Suicides in Karnataka: Strategy for Prevention. *International Multidisciplinary Research Journal*. 2011;1(3).
120. Department of Primary Industry NSW. Rural Resilience Program Team Report Card 2016-2017. 2017. Available from: https://http://www.dpi.nsw.gov.au/data/assets/pdf_file/0004/737653/2016-2017-RRP-Report-Card.pdf.
121. Crockett JA, Hart L, Greig J. Assessment of the efficacy and performance of the New South Wales Rural Mental Health Support line. *The Australian Journal of Rural Health*. 2009;17(5):282-3.
122. Hayes MJ, Wilhelmi OV, Knutson CL. Reducing drought risk: bridging theory and practice. *Natural Hazards Review*. 2004;5(2):106-13.
123. Ali T, Mogren I, Krantz G. Intimate Partner Violence and Mental Health Effects: A Population-Based Study among Married Women in Karachi, Pakistan. *International Journal of Behavioral Medicine*. 2013;20(1):131-9.
124. Graham AL, Julian J, Meadows G. Improving responses to depression and related disorders: evaluation of a innovative, general, mental health care workers training program. *International Journal of Mental Health Systems*. 2010;4(1):25.
125. Hayes K, Blashki G, Wiseman J, Burke S, Reifels L. Climate change and mental health: risks, impacts and priority actions. *International Journal of Mental Health Systems*. 2018;12:1-12.
126. Department of Primary Industry NSW. Rural Resilience Program Report Card. 2015. Available from: https://http://www.dpi.nsw.gov.au/data/assets/pdf_file/0009/654552/RRP-report-card.pdf.
127. Hirsch JK, Cukrowicz KC. Suicide in rural areas: An updated review of the literature. *Journal of Rural Mental Health*. 2014;38(2):65-78.
128. Morley B, Pirkis J, Naccarella L, Kohn F, Blashki G, et al. Improving access to and outcomes from mental health care in rural Australia. *Australian Journal of Rural Health*. 2007;15(5):304-12.
129. Flies EJ, Skelly C, Negi SS, Prabhakaran P, Liu Q, et al. Biodiverse green spaces: a prescription for global urban health. *Frontiers in Ecology and the Environment*. 2017;15(9):510-6.
130. Freebairn J. Drought is inevitable, Mr Joyce: The Conversation; 2018 [updated 28-Aug, 2018. Available from: <https://theconversation.com/drought-is-inevitable-mr-joyce-101444>.
131. Nauges C, Wheeler SA. The Complex Relationship Between Households' Climate Change Concerns and Their Water and Energy Mitigation Behaviour. *Ecological Economics*. 2017;141:87-94.
132. Brown K, Schirmer J. Growing resilience to drought: Natural resource management as a resilience intervention. Canberra: Health Research Institute, Institute for Applied Ecology & University of Canberra; 2018. Available from: <http://www.canberra.edu.au/research/faculty-research-centres/ceraph/regional-wellbeing/survey-results/Growing-resilience-to-drought-FINAL-23-Oct-2018-002.pdf>.
133. Francis K, Boyd M, Latham H, Anderson J, Bradley A, et al. A regional approach to the education of nurse practitioner candidates to meet the health needs of rural Australians. *Contemporary Nurse*. 2014;49(1):27-34.

Appendix 1: NHMRC Levels of Evidence

Table A1. NHMRC Levels of Evidence

Level of evidence	Study design
I	A systematic review of level II studies
II	A randomised controlled trial
III-1	A pseudo-randomised controlled trial (i.e. alternate allocation or some other method)
III-2	A comparative study with concurrent controls (i.e. non-randomised experimental trials, cohort studies, case-control studies, interrupted time series studies with a control group)
III-3	A comparative study without concurrent controls (i.e. historical control study, two or more single-arm studies, interrupted time series studies without a parallel control group)
IV	Case series with either post-test or pre-test/post-test outcomes

Table A2. NHMRC matrix to summarise the evidence base

Component	A	B	C	D
	Excellent	Good	Satisfactory	Poor
Evidence base^A	Several level I or II studies with low risk of bias	One or two level II studies with low risk of bias or a systematic review or multiple level III studies with low risk of bias	Level III studies with low risk of bias, or level I or II studies with moderate risk of bias	Level IV studies, or level I–III studies with high risk of bias
Consistency^B	All studies consistent	Most studies consistent and inconsistency may be explained	Some inconsistency reflecting genuine uncertainty about clinical question	Evidence is inconsistent
Clinical impact	Very large	Substantial	Moderate	Slight or restricted
Generalisability	Population/s studied in body of evidence are the same as the target population in question	Population/s studied in the body of evidence are similar to the target population in question	Population/s studied in body of evidence differ from the target population in question but it is clinically sensible to apply this evidence to the target population	Population/s studied in body of evidence differ from the target population and it is hard to judge whether it is sensible to generalise to the target population
Applicability	Directly applicable to the Australian context	Applicable to the Australian context with few caveats	Probably applicable to the Australian context with some caveats	Not applicable to the Australian context

^A Level of evidence determined from the NHMRC evidence hierarchy as in Table 1.

^B If there is only one study, rank this component as ‘not applicable’. National Health and Medical Research Council (2009) *NHMRC levels of evidence and grades for recommendations for guideline developers*. Canberra: National Health and Medical Research Council. Available from:

https://www.nhmrc.gov.au/files/nhmrc/file/guidelines/developers/nhmrc_levels_grades_evidence_120423.pdf

Appendix 2: Question 1 studies (excluding review studies)

1. Albrecht G, Sartore G-M, Connor L, Higginbotham N, Freeman S, et al. Solastalgia: the distress caused by environmental change. *Australasian Psychiatry*. 2007;15(sup1):S95-S8.
2. Alpass F, Flett R, Humphries S, Massey C, Morriss S, et al. Stress in Dairy Farming and the Adoption of New Technology. *International Journal of Stress Management*. 2004;11(3):270.
3. Alston M. 'I'd like to just walk out of here': Australian women's experience of drought. *Sociologia Ruralis*. 2006;46(2):154-70.
4. Alston M. "It's really not easy to get help": Services to drought-affected families. *Australian Social Work*. 2007;60(4):421-35.
5. Alston M, Clarke J, Whittenbury K. Contemporary Feminist Analysis of Australian Farm Women in the Context of Climate Changes. *Social Sciences*. 2018;7(2):16.
6. Alston M, Kent J. Coping with a crisis: Human services in times of drought. *Rural Society*. 2004;14(3):214-27.
7. Alston M, Kent J. The Big Dry: The link between rural masculinities and poor health outcomes for farming men. *Journal of Sociology*. 2008;44(2):133-47.
8. Anderson D. Enduring drought then coping with climate change: Lived experience and local resolve in rural mental health. *Rural Society*. 2009;19(4):340-52.
9. Austin EK, Handley T, Kiem AS, Rich JL, Lewin TJ, et al. Drought-related stress among farmers: findings from the Australian Rural Mental Health Study. *The Medical Journal of Australia*. 2018;209(4):159-65.
10. Barreau T, Conway D, Haught K, Jackson R, Kreutzer R, et al. Physical, Mental, and Financial Impacts From Drought in Two California Counties, 2015. *Journal of Public Health*. 2017;107(5):783-90.
11. Birhanu Z, Ambelu A, Berhanu N, Tesfaye A, Woldemichael K. Understanding Resilience Dimensions and Adaptive Strategies to the Impact of Recurrent Droughts in Borana Zone, Oromia Region, Ethiopia: A Grounded Theory Approach. *International Journal of Environmental Research and Public Health*. 2017;14(2):118.
12. Brew B, Inder K, Allen J, Thomas M, Kelly B. The health and wellbeing of Australian farmers: a longitudinal cohort study. *BMC Public Health*. 2016;16(16):988.
13. Bryant L, Gamham B. Beyond discourses of drought: The micro-politics of the wine industry and farmer distress. *Journal of Rural Studies*. 2013;32:1-9.
14. Bryant L, Garnham B. The fallen hero: masculinity, shame and farmer suicide in Australia. *Gender, Place and Culture*. 2015;22(1):67-82.
15. Caldwell K, Boyd C. Coping and resilience in farming families affected by drought. *Rural and Remote health*. 2009;9(2):1088.
16. Carleton TA. Crop-damaging temperatures increase suicide rates in India. *Proceedings of the National Academy of Sciences*. 2017;114(33):8746-51.
17. Carnie TL, Berry HL, Blinkhorn SA, Hart CRJAjorh. In their own words: Young people's mental health in drought-affected rural and remote NSW. *Australian Journal of Rural Health*. 2011;19(5):244-8.
18. Dean J, Stain HJ. The impact of drought on the emotional well-being of children and adolescents in rural and remote New South Wales. *The Journal of Rural Health*. 2007;23(4):356-64.
19. Dean JG, Stain HJ. Mental health impact for adolescents living with prolonged drought. *The Australian Journal of Rural Health*. 2010;18(1):32-7.
20. Dongre AR, Deshmukh PR. Farmers' suicides in the Vidarbha region of Maharashtra India: a qualitative exploration of their causes. *Journal of Injury and Violence Research*. 2012;4(1):2-6.
21. Edwards B, Gray M, Hunter B. The impact of drought on mental health and alcohol use. 2009. Available from: <https://apo.org.au/node/17737>.
22. Edwards B, Gray M, Hunter B. The Impact of Drought on Mental Health in Rural and Regional Australia. *Social Indicators Research*. 2015;121(1):177-94.

23. Edwards B, Gray M, Hunter B. The social and economic impacts of drought. *Australian Journal of Social Issues*. 2018;53(4):1–10
24. Ellis NR, Albrecht GA. Climate change threats to family farmers' sense of place and mental wellbeing: A case study from the Western Australian Wheatbelt. *Social Science & Medicine*. 2017;175:161-8.
25. Fennell KM, Jarrett CE, Kettler LJ, Dollman J, Turnbull DA. "Watching the bank balance build up then blow away and the rain clouds do the same": A thematic analysis of South Australian farmers' sources of stress during drought. *Journal of Rural Studies*. 2016;46:102-10.
26. Firth HM, Williams SM, Herbison GP, McGee RO. Stress in New Zealand farmers. *Stress and Health*. 2007;23(1):51-8.
27. Fragar L, Stain HJ, Perkins D, Kelly B, Fuller J, et al. Distress among rural residents: Does employment and occupation make a difference? *The Australian Journal of Rural Health*. 2010;18(1):25-31.
28. Friel S, Berry H, Dinh H, O'Brien L, Walls HL. The impact of drought on the association between food security and mental health in a nationally representative Australian sample. *BMC Public Health*. 2014;14:1102.
29. Goetz SJ, Davlasheridze M, Han Y. County-level determinants of mental health, 2002–2008. *Social Indicators Research*. 2015;124(2):657-70.
30. Greene C. Broadening understandings of drought – The climate vulnerability of farmworkers and rural communities in California (USA). *Environmental Science and Policy*. 2018;89:283-91.
31. Greenough G, McGeehin M, Bernard SM, Trtanj J, Riad J, et al. The potential impacts of climate variability and change on health impacts of extreme weather events in the United States. *Environmental Health Perspectives*. 2001;109(Suppl 2):191.
32. Guiney R. Farming suicides during the Victorian drought: 2001-2007. *The Australian Journal of Rural Health*. 2012;20(1):11-5.
33. Gunn KM, Kettler LJ, Skaczkowski GL, Turnbull DA. Farmers' stress and coping in a time of drought. *Rural Remote Health*. 2012;12(4).
34. Hanigan IC, Butler CD, Kocic PN, Hutchinson MF. Suicide and drought in New South Wales, Australia, 1970-2007. *Proceedings of the National Academy of Sciences*. 2012;109(35):13950-5.
35. Hanigan IC, Schirmer J, Niyonsenga T. Drought and Distress in Southeastern Australia. *Ecohealth*. 2018;15(3):642-55.
36. Hart CR, Berry HL, Tonna AM. Improving the mental health of rural New South Wales communities facing drought and other adversities. *Australian Journal of Rural Health*. 2011;19(5):231-8.
37. Heaney AK, Winter SJ. Climate-driven migration: An exploratory case study of Maasai health perceptions and help-seeking behaviors. *International Journal of Public Health*. 2016;61(6):641-9.
38. Hogan A, Scarr E, Lockie S, Chant B, Alston S. Ruptured identity of male farmers: subjective crisis and the risk of suicide. *Journal of Rural Social Sciences*. 2012;27(3):118-40.
39. Hossain D, Eley R, Coutts J, Gorman D. Mental health of farmers in Southern Queensland: Issues and support. *The Australian Journal of Rural Health*. 2008;16(6):343-8.
40. Hunter E. 'Radical hope' and rain: climate change and the mental health of Indigenous residents of northern Australia. *Australasian Psychiatry*. 2009;17(6):445-52.
41. Kearney GD, Rafferty AP, Hendricks LR, Allen DL, Tutor-Marcom R. A cross-sectional study of stressors among farmers in eastern North Carolina. *North Carolina medical journal*. 2014;75(6):384-92.
42. Keshavarz M, Karami E, Vanclay F. The social experience of drought in rural Iran. *Land Use Policy*. 2013;30(1):120-9.
43. King D, Lane A, MacDougall C, Greenhill J. The resilience and mental health and wellbeing of farm families experiencing climate variation in South Australia. Report for the National Institute of Labour Studies Incorporated, Adelaide, Australia. 2009.
44. Kunde L, Kölves K, Kelly B, Reddy P, De Leo D. Pathways to suicide in Australian farmers: a life chart analysis. *International journal of environmental research and public health*. 2017;14(4):352.
45. Kureshi JS, Somsundaram K. Assessment of occupational stress among farmers in Aurangabad district, Maharashtra. *International Journal Of Community Medicine and Public Health*. 2018;5(4):1434-40.
46. Lebel L, Lebel P. Emotions, attitudes, and appraisal in the management of climate-related risks by fish farmers in Northern Thailand. *Journal of Risk Research*. 2018;21(8):933-51.

47. McColl L. The influence of bush identity on attitudes to mental health in a Queensland community. *Rural Society*. 2007;17(2):107-24.
48. McNamara KE, Westoby R. Solastalgia and the Gendered Nature of Climate Change: An Example from Erub Island, Torres Strait. *EcoHealth*. 2011;8(2):233-6.
49. McShane CJ, Quirk F, Swinbourne A. Development and validation of a work stressor scale for Australian farming families. *Australian Journal of Rural Health*. 2016;24(4):238-45.
50. Morrow V, Tafere Y, Chuta N, Zharkevich I. "I started working because I was hungry": The consequences of food insecurity for children's well-being in rural Ethiopia. *Social Science and Medicine*. 2017;182:1-9.
51. Murray G, Judd F, Jackson H, Fraser C, Komiti A, et al. Big boys don't cry: An investigation of stoicism and its mental health outcomes. *Personality and Individual Differences*. 2008;44(6):1369-81.
52. Murti M, Yard E, Kramer R, Haselow D, Mettler M, et al. Impact of the 2012 extreme drought conditions on private well owners in the United States, a qualitative analysis. *BMC Public Health*. 2016;16(427):1-10.
53. Nelson DR, Finan TJ. Praying for drought: Persistent vulnerability and the politics of patronage in Cear , Northeast Brazil. *American Anthropologist*. 2009;111(3):302-16.
54. Ng FY, Wilson LA, Veitch C. Climate adversity and resilience: the voice of rural Australia. *Rural Remote Health*. 2015;15(4):3071.
55. Nicholls N, Butler CD, Hanigan I. Inter-annual rainfall variations and suicide in New South Wales, Australia, 1964–2001. *International Journal of Biometeorology*. 2006;50(3):139-43.
56. O'Brien L, Berry H, Coleman C, Hanigan I. Drought as a mental health exposure. *Environmental Research*. 2014;131:181-7.
57. O'Brien LV, Berry HL, Hogan A. The structure of psychological life satisfaction: insights from farmers and a general community sample in Australia. *BMC Public Health*. 2012;12:976.
58. Page A, Morrell S, Taylor R. Suicide and political regime in New South Wales and Australia during the 20th century. *Journal of Epidemiology and Community Health*. 2002;56(10):766-72.
59. Pearce M, Eagle L, Low D, Schurmann A. Cut from 'country': the impact of climate change on mental health of Aboriginal pastoralists. *Australasian Journal of Regional Studies*. 2015;21(1):50-79.
60. Peel D, Berry HL, Schirmer J. Perceived profitability and well-being in Australian dryland farmers and irrigators. *Australian Journal of Rural Health*. 2015;23(4):207-14.
61. Polain JD, Berry HL, Hoskin JO. Rapid change, climate adversity and the next 'big dry': Older farmers' mental health. *The Australian Journal of Rural Health*. 2011;19(5):239-43.
62. Powers JR, Dobson AJ, Berry HL, Graves AM, Hanigan IC, et al. Lack of association between drought and mental health in a cohort of 45–61 year old rural Australian women. *Australian and New Zealand Journal of Public Health*. 2015;39(6):518-23.
63. Qi X, Tong S, Hu W. Preliminary spatiotemporal analysis of the association between socio-environmental factors and suicide. *Environmental Health*. 2009;8:46.
64. Ramin BM, McMichael AJ. Climate change and health in sub-Saharan Africa: a case-based perspective. *EcoHealth*. 2009;6(1):52.
65. Rich JL, Wright SL, Loxton D. 'Patience, hormone replacement therapy and rain!' Women, ageing and drought in Australia: narratives from the mid-age cohort of the Australian Longitudinal Study on Women's Health. *Australian Journal of Rural Health*. 2012;20(6):324-8.
66. Rigby CW, Rosen A, Berry HL, Hart CR. If the land's sick, we're sick: The impact of prolonged drought on the social and emotional well-being of Aboriginal communities in rural New South Wales. *Australian Journal of Rural Health*. 2011;19(5):249-54.
67. Sartore GM, Kelly B, Stain H, Albrecht G, Higginbotham N. Control, uncertainty, and expectations for the future: a qualitative study of the impact of drought on a rural Australian community. *Rural and Remote Health*. 2008;8(3):950.
68. Sherval M, Askew LE. Experiencing 'drought and more': local responses from rural Victoria, Australia. *Population and Environment*. 2012;33(4):347-64.
69. Speldewinde PC, Cook A, Davies P, Weinstein P. A relationship between environmental degradation and mental health in rural Western Australia. *Health & place*. 2009;15(3):880-7.
70. Stain HJ, Kelly B, Carr VJ, Lewin TJ, Fitzgerald M, et al. The psychological impact of chronic environmental adversity: Responding to prolonged drought. *Social Science & Medicine*. 2011;73(11):1593-9.

71. Stain HJ, Kelly B, Lewin TJ, Higginbotham N, Beard JR, et al. Social networks and mental health among a farming population. *Social Psychiatry and Psychiatric Epidemiology*. 2008;43(10):843-9.
72. Staniford AK, Dollard MF, Guerin B. Stress and help-seeking for drought-stricken citrus growers in the Riverland of South Australia. *Australian Journal of Rural Health*. 2009;17(3):147-54.
73. D, Lawrence G, Gray I. Gender and drought: experiences of Australian women in the drought of the 1990s. *Disasters*. 2000;24(1):38-53.
74. Wheeler SA, Zuo A, Loch A. Water torture: Unravelling the psychological distress of irrigators in Australia. *Journal of Rural Studies*. 2018;62:183-94.

Appendix 3: Included papers for intervention evaluations

Source (author, year)	Study type	Level of evidence (NHMRC grade)	Population/ setting	n (sample size)	Intervention/ comparator	Outcomes	Outcome strength	Comment/ notes
1. Brown and Schirmer (2018) ⁽¹³²⁾	Quantitative, grey literature, report	III-2	Farmers/ participants in the Regional Wellbeing Survey; drought; wellbeing; natural resource management	Only farmers who worked more than 20 hours per week on farm were included in analysis, n = 2072 farmers across Australia	NRM practices	Following NRM practices found to improve drought resilience — wellbeing: <ul style="list-style-type: none"> • Farm drought planning • Farm risk planning • Farm NRM planning • Monitoring whether achieving environmental objectives • Prioritising groundcover (for graziers/mixed) • Increasing native pastures (graziers) • Working with others to reduce feral animals (graziers/mixed with a feral animal problem) • Increasing feed reserves (graziers/mixed) • Increasing financial reserves as drought preparation 	Moderate	

Source (author, year)	Study type	Level of evidence (NHMRC grade)	Population/ setting	n (sample size)	Intervention/ comparator	Outcomes	Outcome strength	Comment/ notes
2. Cartmel, Smith and Miller (2016) ⁽¹⁰⁴⁾	Qualitative, program/ policy analysis	N/A	Rural children between birth and 5 years of age; wellbeing; emotional development/drought-affected region	24	Wings: Social and emotional wellbeing in the early years	The Wings program successfully enhanced the confidence and knowledge of educator in supporting children's social and emotional wellbeing	Strong	
3. Centre for Rural & Remote Mental Health (2017) ⁽¹¹⁰⁾	Grey literature, report, mixed methods, program/ policy analysis	IV	People in rural and remote NSW in need of mental health/ process evaluation report using program-based and survey data	642 training participants completed the RAMHP Training 3-Minute Feedback Form; 24 stakeholders	Rural Adversity Mental Health Program (RAMHP)	RAMHP progressed well towards meeting the program objectives and there was substantial evidence that the program was being implemented as intended. Stakeholders observed improvements in the program and recognised many program strengths, such as the skills and abilities of the RAMHP coordinators. Several important risks to the program were identified, notably funding and recruitment issues	Moderate to strong	
4. Centre for Rural & Remote Mental Health (2018) ⁽¹¹¹⁾	Grey literature, report, mixed methods, program/ policy analysis	IV	People in rural and remote NSW who are in need of mental health/ outcome evaluation report using a range of data sources, including the RAMHP app	2053 training participants completed the RAMHP Training 3-Minute Feedback Form 215 for RAMHP Training Follow-Up Survey	Rural Adversity Mental Health Program (RAMHP)	Key stakeholders are highly satisfied with RAMHP. Considerable progress has been made towards achieving the program's objectives. RAMHP's strategies, activities and outputs appear appropriate to the needs of rural and remote communities in NSW. The main factor underpinning program sustainability is the quality of RAMHP's relationships with partner organisations, communities, key stakeholders and program staff.	Moderate to strong	2 months after training, approx. 2 out of 3 training participants reported at least one type of linking behaviour as a result of RAMHP training. That is either speaking with someone about their mental health or

Source (author, year)	Study type	Level of evidence (NHMRC grade)	Population/ setting	n (sample size)	Intervention/ comparator	Outcomes	Outcome strength	Comment/ notes
						The main unexpected impact of the program is the rapid increase in the RAMHP profile and consequent increase in demand for its services and resources. A key risk is the possibility of changes to funding structures beyond 2020.		providing them with information or service details.
5. Dept. of Primary Industry NSW (2015) ⁽¹²⁶⁾	Grey literature, report, qualitative, program/ policy analysis	N/A	Farmers/ rural resilience	Not available	Rural Resilience Program (RRP)	Increased farmers' access to opportunities to build knowledge, capabilities and skills in business and personal resilience: 231 workshops to build personal and business resilience; 17 rural support networks; 148 drought-specific activities in vulnerable farming communities; 11 news stories and information resources developed; coordinated 11 Minister and other VIP visits to regional farming communities.	Strong	
6. Dept. of Primary Industry NSW (2017) ⁽¹²⁰⁾	Grey literature, report, qualitative, program/ policy analysis	N/A	Farmers/ rural resilience	Not available	Rural Resilience Program (RRP)	Increased farmers' access to opportunities to build knowledge, capabilities and skills in business and personal resilience: engaged with 21 rural support networks; connected with 424 stakeholders and 9 industry groups; 150 workshops and events delivered to 6322 NSW farmers; 83% of respondents likely to change something as a result of attending an RRP activity.	Strong	

Source (author, year)	Study type	Level of evidence (NHMRC grade)	Population/ setting	n (sample size)	Intervention/ comparator	Outcomes	Outcome strength	Comment/ notes
7. Dept. of Primary Industry NSW (2018) ⁽¹⁰⁸⁾	Grey literature, report, qualitative, program/ policy analysis	N/A	Farmers/ rural resilience	Not available	Rural Resilience Program (RRP)	Increased farmers' access to opportunities to build knowledge, capabilities and skills in business and personal resilience: engaged with 35 rural support networks; connected with 437 stakeholders at 183 meetings; 145 workshops and events delivered to 7123 NSW farmers; 88% of respondents highly likely to change something as a result of attending an RRP activity.	Strong	
8. Francis et al. (2014) ⁽¹³³⁾	Original research, qualitative, program/ policy analysis	N/A	Rural and remote population/ healthcare/ educational program	N/A	Nurse practitioner (NP) program	NP program will improve rural populations' access to healthcare and has the potential to improve health outcomes through increasing the number of rural NPs.	Weak	
9. Hart, Berry and Tonna (2011) ⁽⁷⁹⁾	Original research, qualitative, program/ policy analysis	N/A	Rural NSW/ communities facing prolonged drought/ resilience	N/A	Rural Adversity Mental Health Program (RAMHP)	It is accepted and considered to be effective in helping communities build capacity and resilience in the face of prolonged drought. The mental health promotion components of RAMHP include: <ul style="list-style-type: none"> • Mental health first aid • Community mental health and drought information forums • Booklets for rural health and agricultural service 	Strong	

Source (author, year)	Study type	Level of evidence (NHMRC grade)	Population/ setting	n (sample size)	Intervention/ comparator	Outcomes	Outcome strength	Comment/ notes
10. Hossain et al. (2010) ⁽¹⁰⁶⁾	Original research, mixed methods, program/ policy analysis	N/A	Farmers in Queensland	32	Mental health first aid training of Advisory and Extension Agents (AEAs)	Mental health first aid training improved the participants' confidence levels and their knowledge of mental health issues and increased their empathy towards persons with mental health problems. Furthermore, providing training in mental health issues to AEAs was perceived by stakeholders to be beneficial to both farmers and AEAs.	Strong	Stakeholders and course participants see training as very much needed and highly beneficial. Providing training in mental health issues to rural service providers is beneficial to their farmer clients and their social network.
11. Hunt et al. (2011) ⁽¹⁰⁷⁾	Original research, qualitative, program/ policy analysis	N/A	Rural and regional communities/ resilience/ mental health services	83	Rural extension services: SheepConnect Tasmania as a case study	Almost all SheepConnect group members had effected changes in on-farm practices as a result of being involved in the program and gained benefits in the area of networking, group support and learning. The program helped farmers maintain morale and contributed to capacity building by maintaining cohesiveness in the face of drought.	Strong	

Source (author, year)	Study type	Level of evidence (NHMRC grade)	Population/ setting	n (sample size)	Intervention/ comparator	Outcomes	Outcome strength	Comment/ notes
12. Morley et al. (2007) ⁽¹²⁸⁾	Original research, quantitative, program/ policy analysis	IV	People in rural Australia/ service models survey, a minimum dataset and three case studies	29,244	Access to allied health services projects	Proportionally, uptake of the projects in rural areas has been higher than in urban areas: more GPs and allied health professionals are involved, and more consumers have received care. The projects are being delivered at no or low cost to consumers, and are achieving positive outcomes as assessed by standardised measures.	Strong	The rural projects have the potential to improve access to mental health care for rural residents with depression and anxiety by enabling GPs to refer them to allied health professionals.
13. Sartore et al. (2008) ⁽¹²⁾	Original research, quantitative, program/ policy analysis	IV	People in drought-affected rural and remote Australia/ survey of mental health first aid training participants	99	Mental health first aid (MHFA) training	Participants' ability to identify high-prevalence disorders and endorse evidence-based interventions for both high and low prevalence disorders increased following MHFA training, as did their confidence in their ability to provide appropriate help.	Strong	MHFA training can form an effective part of a strategy to improve systems of care and pathways to early intervention in rural communities by using local networks to provide mental health support.
14. Tonna et al. (2009) ⁽¹⁰⁹⁾	Original research, qualitative, program/ policy analysis	N/A	Rural community/ drought/ mental health service	N/A	Drought Mental Health Assistance Package' (DMHAP)	The mental health first aid training in DMHAP was effective in increasing mental health knowledge, reducing stigma, increasing participants' willingness to help those around them and suggesting increased confidence and capacity to provide early intervention for mental	Strong	

Source (author, year)	Study type	Level of evidence (NHMRC grade)	Population/ setting	n (sample size)	Intervention/ comparator	Outcomes	Outcome strength	Comment/ notes
						health problems. The program has successfully targeted mental disorders that may arise directly from the impact of drought and from pre-existing vulnerabilities that have been compounded by drought.		