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Brief assessment of male depression in clinical care: Validation of the Male Depression Risk Scale Short Form in a cross-sectional study of Australian men

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Abstract

Objectives: To develop and validate a short form of the Male Depression Risk Scale (MDRS-22) for use in primary care, examining sensitivity indices for psychological distress and suicidality.

Design: Cross-sectional study with 8-month follow-up.

Setting: Community-based recruited via an online survey.

Participants: A community sample of younger (*n* = 514; 18-64 years) and older (*n* = 444; 65-93 years) males residing in Australia (*M* age = 58.11 years, *SD* = 17.73) completed measures of externalising and prototypic depression symptoms. A subset of respondents (*n* = 167 younger males; *n* = 173 older males) provided follow-up data approximately eight months later.

Primary and secondary outcome measures: Participants completed the Male Depression Risk Scale (MDRS-22), Patient Health Questionnaire (PHQ-9), and Kessler Psychological Distress Scale (K10). Probable depression was determined according to PHQ-9 scores ≥ 10. Suicidality was determined based on a score ≥ 1 on item 9 of the PHQ-9. Probable mental illness was determined based on a K10 score ≥ 25.

Results: The short form MDRS-22 consisted of seven items (MDRS-7) and captured all of the domains in the original tool. Results demonstrated that externalising symptoms, either alone or in combination with prototypic symptoms were significantly more common than exclusively prototypic symptoms. Participants in the mixed symptom group had significantly higher risk of mental illness and current suicidality. Furthermore, the MDRS-7 was shown to be effective at predicting elevated symptoms of depression at follow-up, after controlling for previous depression diagnoses.

Conclusions: Findings provide preliminary evidence of the potential utility of the MDRS-7 as a screening tool for externalised symptoms associated with major depression in men. Use of the MDRS-7 in primary care settings may facilitate identification of men at-risk of suicide and psychological distress who do not meet cut-off scores for existing measures of major depression symptoms.

Key words: depression, externalising symptoms, short form, men, lifespan, help-seeking

Strengths and limitations of this study:

- This is the first study to explore the psychometric properties of the MDRS-7 as a screening tool for externalised symptoms associated with major depression in men.
- Use of the MDRS-7 in primary care settings may facilitate identification of men at-risk of suicide and psychological distress.
- Diagnosis of depression was not verified by clinical interview.
- Field trials of the MDRS-7 are needed to demonstrate the utility of the tool in primary care settings.

Introduction

Major depressive disorder (MDD) is a common psychiatric condition and the leading cause of disability worldwide [1, 2]. MDD is twice as prevalent in women than men [3] and severe depression is known to significantly increase the risk of suicide [4]. Although men are less likely to be diagnosed with a depressive disorder [5], they are three times more likely to die by suicide compared to women [6]. Current approaches to the diagnosis of depression (e.g., as per ICD-11 or DSM-5 diagnostic criteria) emphasise symptoms including persistent sadness, loss of interest or pleasure in previously enjoyable activities, as well as changes in affect, cognition, and neurovegetative functioning [7, 8]. However, a growing number of studies suggest that a significant proportion of men suffering from depression might experience a distinct phenotype [9-11]. Congruent with masculine role norms, this male-typical phenotype includes anger, substance misuse, emotion suppression, and risk-taking domains [10, 12]. However, these putative symptoms are not included in standard diagnostic criteria or screening measures, and it has been suggested that this might account in part for the under-diagnosis of male depression cases, and therefore under-recognition of (and treatment for) men at heightened risk of suicide [13].

Whilst men are often regarded as being less likely to seek help than women, recent statistics largely do not support this claim. In Australia, it has been estimated that in the general population, around 89% of men attend primary care annually [14]. Among men experiencing mental health difficulties, annual primary care attendance is similarly high with estimates of 80% up to 96% of men with symptoms of depression reporting a visit to

primary care within the previous 12 months [15, 16]. Similarly, findings from the UK demonstrate that whilst males are overall less likely to attend primary care compared to females, attendance rates in men and women with comparable underlying morbidities, including depression, are similar [17]. Furthermore, findings from a population study of health care contacts among Canadian suicide decedents in Toronto also demonstrated that over 60% (*n* = 1792) of men who died by suicide accessed professional mental health care in the year before their death [18]. These findings highlight the essential role of primary care physicians in identifying depression and suicide risk in men in order to facilitate effective treatment [19].

Growing interest in gender-sensitive assessment of men's depression has seen the development of male-specific screening tools to identify symptoms that align with men's socialisation and gender norm processes [e.g., 20, 21, 22]. One recently developed and widely validated measure for assessing externalising symptoms in men is the Male Depression Risk Scale (MDRS-22) [23]. The MDRS-22 consists of 22 items assessing six symptom domains including emotion suppression, drug use, alcohol use, anger and aggression, somatic symptoms, and risk-taking [23]. Recently, Zajac and colleagues [24] demonstrated that this tool, used in conjunction with a measure of prototypic major depression symptoms (PHQ-9), was able to stratify men into three distinct risk groups: (i) prototypic symptoms (consistent with current MDD diagnostic criteria), (ii) externalising symptoms consistent with masculine socialisation, and (iii) mixed depressive symptoms, reflecting both internalised and externalised symptomology. Further analyses showed that men in the externalising only group—men who are arguably missed when using measures of internalising symptoms—were at significantly increased risk of suicide compared to non-depressed men. Moreover, those with elevated externalised and prototypic symptomology were at highest risk of mental illness as well as suicide [24], highlighting the potential of early identification and intervention benefits of leveraging male-specific tools in primary care settings.

Two-stage screening methods are commonly used in primary care, and have been shown to be effective for increasing the recognition of depression [25]. However, many primary care physicians report that time is a limiting factor in their capacity to

comprehensively assess psychological issues, including depression [19, 26], despite management of common mental disorders rating as a top reason for general practice attendance [27]. To help address this issue, brief screening tools consisting of 15 items or less are often used, given their completion time is usually just a couple of minutes [28]. Examples include the Patient Health Questionnaire (PHQ-9) [29], the Kessler Psychological Distress Scale (K10) [30], and the Beck Depression Inventory for Primary Care (BDI-PC) [31].

To date, the MDRS-22 has demonstrated excellent psychometric properties as well as the ability to detect different groups of men who may be at increased risk of suicide and mental illness [e.g., 24, 32, 33]. However, given time constraints in primary care settings, the length of the current MDRS-22 is arguably impractical [12]. The purpose of the present study was to develop a short form of the MDRS-22 to facilitate its use as a screening tool in busy and time-pressured health care settings. We also aimed to establish an initial set of cut-off scores for interpretive purposes, as well as examine current and longitudinal risk of suicidality and mental illness in subgroups. Furthermore, as adherence to masculine gender norms has been found to decline as men get older [34], younger and older males were examined separately to examine the utility of the tool across age groups.

Method

Participants and procedure

This cross-sectional study included baseline data from a community sample of 514 younger males aged 18 to 64 years (M = 45.46, SD = 14.52) and 444 older males aged 65 to 93 years (M = 72.75, SD = 5.86). A subset of respondents (n = 167 younger males; n = 173 older males) participated in the follow-up component. On average, 35 weeks (M = 247.94 days, SD = 24.47 days) elapsed between the provision of T1 and T2. The mean age for the overall sample was 58.11 years (SD = 17.73). Eligible participants were Australian male residents over the age of 18 years who considered themselves fluent in English. Participants were recruited via paid advertisements displayed to Australian members of the Facebook social networking site (n = 609; 63.6%) and through promotion of the study to community organisations (e.g., Rotary, Men's Shed). Time 1 (T1) data were collected between August and November 2019 using an online questionnaire. However, participants from local

community organisations were provided with the option to complete a paper version of the survey to ensure inclusivity and accessibility of the sample and *n* = 5 participants completed a paper version. Ethics approval was obtained from the University of Adelaide Human Research Ethics Committee and the CSIRO Health and Medical Human Research Ethics Committee (approval number H-2019-109). All participants provided informed consent. Reporting adhered to the STROBE cross-sectional guidelines.

Public involvement

Participants were not involved in the design or conduct of this research; however, participants could nominate to receive updates on the results of the study.

Measures

Demographics

Participants reported their age, gender, relationship status, employment status, level of education, and household income.

Male Depression Risk Scale (MDRS-22)

Externalising depression symptoms were assessed by the Male Depression Risk Scale (MDRS-22) [23]. The MDRS-22 contains twenty-two self-report items designed to assess six broad domains of externalising and male-specific depression symptoms present in the last month including anger and aggression, drug use, alcohol use, emotion suppression, risk-taking, and somatic symptoms using the response format of 5-point Likert scale ranging from 0 (*none of the time*), 1 (*a little of the time*), 2 (*some of the time*), 3 (*most of the time*), and 4 (*all of the time*). Cronbach's alphas for the MDRS are reported in Table 3 for both age groups and for the overall sample and are considered adequate.

The Patient Health Questionnaire (PHQ-9)

The Patient Health Questionnaire (PHQ-9) [29] is a self-report depression screening tool for use in primary care that assesses nine symptoms consistent with the DSM-5 diagnostic

criteria for major depressive disorder [7]. Participants endorse how often they have experienced each symptom (e.g., "*Feeling down, depressed, or hopeless*") during the preceding two-week period using a 4-point Likert scale ranging from 0 (*not at all*) to 3 (*almost every day*). A score of 10 and above is indicative of clinically significant depressive symptoms [35]. In addition to utilising total PHQ-9 scores, we used item 9 as a measure of suicidality: "Over the past two weeks, how often have you been bothered by thoughts thar you would be better off dead, or of hurting yourself in some way?". We deemed those who scored 1 or more on this item to be currently experiencing suicidal ideation. Internal consistency of the PHQ-9 in the present study for the overall sample was high (α = .93).

Kessler Psychological Distress Scale (K10)

The Kessler Psychological Distress Scale (K10) [30] is a widely used measure in both research and primary care settings [36]. It comprises ten questions assessing a person's negative emotional state in the preceding 30 days (e.g., "*About how often did you feel so nervous that nothing could calm you down*"). Responses are based on a 5-point Likert scale ranging from 1 (*none of the time*) to 5 (*all of the time*). In addition to examining K10 total scores, we created a binary variable with scores ≥ 25 indicating probable mental illness, consistent with published cut-off scores for the K10 [37]. Internal consistency of the K10 in this study for the overall sample was high (α = .95).

Statistical analyses

Data for the present study was analysed using IBM SPSS Statistics (Version 26.0) except for the Confirmatory Factor Analysis undertaken in JASP [Version 0.13.1; 38]. A total of 1114 participants commenced the study. However, 156 participants were not included in the analyses due to substantial missing data. Thus, *N* = 958 participants who provided complete data for the items comprising the MDRS-22 were included in the item reduction process described below. Of this sample, *n* = 29 did not provide complete data for the PHQ-9 or K10 items. Thus, models using these variables comprised *n* = 929 participants.

Various recommendations exist for the selection of items for short-form surveys [39, 40]. Broadly speaking, the focus is on selecting items with maximum variability and which

retain the theorised underlying construct—as well as sub-domains—measured by the long-form scale. Therefore, we calculated descriptive (means, standard deviation (*SD*), and skewness) and relational statistics (correlations) for each item (see Table 2). Items were scored for each statistic (i.e., largest *SD*, strongest correlation etc) and summed across the statistical indices to derive a total score for each item. Best performing items were subject to Exploratory Factor Analysis with Maximum Likelihood Estimation performed within each age group, and in the combined sample. Parallel Analysis consisting of 1,000 permutations of the original raw data was used to determine thresholds for retaining factors. Stability of this solution was then established using Confirmatory Factor Analysis of Time 2 Data (n = 340). Fit indices reported include: comparative fit index (CFI); the Tucker-Lewis index (TLI); the root mean square error of approximation (RMSEA); and the standardized root mean residual (SRMR). Interpretation of these indices were guided by the recommendations of Hu & Bentler [41].

In order to demonstrate clinical utility of the reduced item scale, cut-off scores were determined for Low (0 – 5), Moderate (6 – 7), Severe (8 – 12) and Extremely severe (13+) symptom severity groups. These scores corresponded to cut-off percentiles representing differing degrees of increased risk of recent suicide attempt previously identified for the MDRS-22 [33]. Individuals were then classified into depression groups using the MDRS-7 in combination with the PHQ-9 as follows: not depressed (PHQ-9 < 10 and MDRS-7 ≤ 5), prototypical depression features (PHQ-9 ≥ 10 and MDRS-7 ≤ 5), mixed features (PHQ-9 ≥ 10 and MDRS-7 > 5) and externalising features (PHQ-9 < 10 and MDRS-7 > 5). In addition, the K10 was used to determine those individuals suffering a moderate mental illness (K10 ≥ 25) from those without a mental illness (K10 < 25), and current suicidality was ascribed based on scores ≥ 1 on PHQ-9 item 9: “Over the past two weeks, how often have you been bothered by thoughts that you would be better off dead, or of hurting yourself in some way?”. Finally, Generalised linear models (GLMs) were used to examine differences in K10 and PHQ-9 scores across the MDRS-7 categories to determine risk of mental illness and current suicidality and to examine risk of Depression at Time 2 (PHQ-9 ≥ 10). Assumptions of GLMs were considered through inspection of scatter plots and histograms of residuals and predicted values, with model results reported as standardised betas.

Results

Sample characteristics

Table 1 presents the characteristics of the study participants at T1. As expected, there was a higher proportion of older participants who reported themselves as married/de-facto or widowed/divorced/separated, in comparison to younger men. Regarding education, the majority of older participants completed year 11 or below, whilst the proportion of participants completing a Bachelor's degree was higher in the younger sample. In addition, household income appeared to be higher in younger compared to older men, consistent with the majority of the older sample reporting themselves as being retired.

Insert Table 1 about here

Item reduction

Descriptive and relational statistics for each of the MDRS-22 items across younger and older age groups are displayed in Supplementary Table 1. For the emotion suppression, alcohol use, somatic symptoms, and drug use domains, a single highest scoring item emerged congruent across age groups. For the anger and aggression domain, two different items were retained because of their performance across the age groups. Finally, although two risk-taking items scored equally well in the younger group, only one of those showed sensitivity within the older age group and only this item was retained, resulting in a total selection of seven items for the short form scale covering all of the original MDRS-22 domains.

Factor analysis of these seven items revealed the presence of a single underlying domain that satisfied criteria determined by the parallel analysis; eigenvalues were required to exceed 1.16. As shown in Table 2, all items demonstrated a moderate-to-strong loading on the underlying component except for those measuring alcohol and drug use, which loaded weakly. When modelling these 7-items using CFA at Time 2, the initial solution

specifying all items loading on a single latent MDRS-7 factor was not quite adequate [$\chi^2(14) = 62.23$ $p < .001$, CFI = 0.96, TLI = .94, RMSEA = 0.10 (.077-.128), SRMR = .10]. However, allowing the errors of the two items assessing anger and physical aggression to covary resulted in excellent model fit [$\chi^2(13) = 28.08$ $p = .04$, CFI = 0.99, TLI = .98, RMSEA = .059 (.028-.089), SRMR = .085].

Insert Table 2 about here

Cut-off scores for the short scale

The proportion of men in each of the different MDRS-7 symptom severity categories are shown in Supplementary Figure 1 for the total sample, and by age group. As can be seen, older men appear more likely to be in the 'low' category of symptoms, and less likely to be in the 'severe' or 'extremely severe' categories compared to younger males. Figure 1 shows the effect of age and MDRS-7 categories on prototypic depression (PHQ-9) and psychological distress (K10). For PHQ-9, there were significant differences between all MDRS-7 groups [$f(3, 921) = 208.04$, $p < .001$] and between age groups [$f(1, 921) = 28.45$, $p < .001$], with no significant interaction between MDRS-7 and age [$f(3, 921) = 0.45$, $p = .71$]. For the K10, results were similar: significant differences between all MDRS-7 groups [$f(3,921) = 190.93$, $p < .001$] and between younger and older men [$f(1,921) = 34.77$, $p < .001$], but no interaction between MDRS-7 and age [$f(3, 921) = 0.43$, $p = .73$].

Insert Figure 1 about here

Clinical utility of the MDRS-7

The proportion of males according to depressive classification type is shown in Supplementary Figure 2. Externalised-only depression affected approximately 10% of

younger and older males, whilst prototypical and mixed depressive symptoms were more common in younger males. Table 3 shows the risk of mental illness and suicidality compared to non-depressed participants within each age group after controlling for a previous diagnosis of depression. All classifications were associated with both outcome measures. Individuals with mixed symptoms undoubtedly have the highest risk of suicidality and mental illness.

Insert Table 3 about here

A final GLM considered the likelihood of being classified as depressed at follow-up based on responses to the PHQ-9 (i.e., score ≥ 10). MDRS-7 category was entered as a predictor controlling for PHQ-9 scores at time 1, previous diagnosis of depression and age. As shown in Table 4, PHQ scores at time 1 were significantly associated with increased risk of depression at time 2 although age and prior diagnoses were not significantly associated. Those classified as having moderate MDRS-7 symptoms at time 1 were significantly more likely than those in the low symptom category to be classified as depressed at Time 2, whilst the severe and extremely severe categories were not associated with increased risk.

Insert Table 4 about here

Discussion

Clinical reports and emergent empirical work suggest that men's depression may be under-detected as a result of prototypic screening tools that may be insensitive to men's gender role socialisation [11, 13, 42]. The Male Depression Risk Scale (MDRS-22) assesses male-specific, externalised symptoms of depression, such as substance misuse, risk-taking, and anger. However, in its current 22-item form, it is impractical for rapid use in primary care, particularly when used alongside traditional depression screening tools [12]. The

present research aimed to derive a short form of the MDRS-22, examine its psychometric properties and relationship with psychological distress and depression in order to demonstrate its utility as a potential screening tool in primary and other health care settings.

The short form derived herein comprises seven items, representing 1 item for each of the original MDRS domains including emotion suppression, risk-taking, substance use, drug use, somatic symptoms, and two items for the anger and aggression domain, based on criteria including variability within items, the item's relationship to its original MDRS domain but also with the overall MDRS score. Five of the seven items demonstrated moderate-to-strong loadings on a single underlying construct presumed to reflect the male depression phenotype, whilst two items assessing alcohol and drug use loaded weakly. This likely reflects the reduced variability of participant responses on these items, with most participants reporting that these items applied to them none, or a little of the time. However, despite these lower loadings, items that tap these behaviours are important to retain given that substance use is an important marker of depression and suicidality in men and particularly those who adhere to masculine norms [42, 43].

In the present study, externalising symptoms, either alone or in combination with prototypic symptoms, were found to be significantly more common than exclusively prototypic symptoms. Approximately 10% of younger and older males were found to present with uniquely eternalising symptoms, whilst approximately 40% of younger males and 10% of older males presented with mixed symptoms. These findings are consistent with previous research using the MDRS-22 [24] and highlights the potential utility of the MDRS-7 for detecting additional cases of men at risk. These men are a subset who score below threshold on traditional prototypic measures, but whose degree of externalised behaviours may be problematic. Furthermore, despite the absence of clinically elevated prototypic symptoms, both younger and older males in the mixed symptom group had a significantly higher risk of a mental illness after controlling for a previous diagnosis of depression, demonstrating unequivocally that this represents a unique group of at-risk men experiencing psychological distress. Similarly, both younger and older males in the mixed symptom group had a significantly elevated risk of suicidality. These findings are consistent

with research by Zajac and colleagues [24] and highlight the clinical importance of considering a broad range of potential presentations of depression in men, all of which are associated with increased risk of poor outcomes.

The MDRS-7 was also shown to be effective at predicting depression at a later time point, suggesting a possible prodromal effect. These findings are consistent with those by [44] who demonstrated that externalising symptoms predicted a future depressive episode in men. Hence, our findings may reflect early symptom expression, or even attempts of men to cope with what has the potential to develop into a threshold depressive disorder. This further highlights the potential value of screening for externalising symptoms to facilitate early intervention and prevention of further mental health issues [45]. In addition, given the externalised nature of male-typical symptoms of depression, it is important to note that these symptoms not only affect men's health and wellbeing but also the health wellbeing of their families, friends, and communities [13, 46, 47]. Hence the better identification and management of male depression is likely to have substantial public health implications.

Clinical implications

There is an urgent need for health services and providers to utilise more sensitive diagnostic tools as a means of improving the detection of depression and psychological distress in males and addressing the high rates of male suicide [13]. The use of brief tools such as the MDRS-7 may assist with detecting unique cases of men who would score below threshold on measures such as the PHQ-9. However, an added benefit of using this scale alongside prototypic measures, is the ability to detect men presenting with mixed symptomology whose risk of suicide and poor mental health outcomes is significantly elevated. Therefore, the clinical utility of this measure may extend beyond screening and detection and into the therapy setting where it is necessary to determine, monitor, and manage differing degrees of suicidality.

Limitations and future research

The methodology adopted in this study is not without limitations. The use of an online community sample of Australian males limits the generalisability of the findings to

other populations. Future research should examine the psychometric properties of the MDRS-7 with additional populations, including clinical samples of men presenting to primary care. In addition, as data was self-report, diagnosis of depression could not be verified at clinical interview. The results of this study would be strengthened by a more rigorous assessment of psychopathology and comorbidity. It is also important to acknowledge that this study used a single item from the PHQ-9 to examine current suicidal ideation. Therefore, there is a need for additional research to examine the relationship between the MDRS-7 and other measures of suicidality, including recent suicide attempt.

Conclusion

The present study provides important information on the development and validation of the MDRS-7. Specifically, this study demonstrates that the MDRS-7 is a valid and reliable measure of externalising and male-typical depression symptoms in both younger and older men in terms of its psychometric properties as well as its sensitivity to prototypic depression symptoms, psychological distress, and suicidality. Use of male-specific measures of depression such as the MDRS-7 may improve the detection of depression and suicide risk in men, and adjunctive use (alongside established prototypical scales such as the PHQ-9) may contribute to improved public health outcomes.

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Author contributions

D.H., S.R., and I.Z. developed the study concept. D.H. and I.Z. performed the data analyses. D.H. drafted the paper and S.R. and I.Z. provided critical revisions. All authors approved the final version of the paper for submission.

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Table 1. Sociodemographic characteristics of participants at Time 1

Variable	Younger men (< 65)	Older men (≥ 65)
n	514	444
Age range	18-64	65-93
Age, *M* (*SD*)	45.5 (14.5)	72.8 (5.9)
Relationship status, *n* (%)		
Single (never married)	119 (23.2)	12 (2.7)
Widowed/divorced/separated	70 (13.6)	95 (21.4)
Married/de-facto	323 (62.8)	334 (75.2)
Prefer not to say	2 (0.4)	3 (0.7)
Employment status, *n* (%)		
Employed full-time	227 (44.2)	22 (5.0)
Employed part-time	38 (7.4)	18 (4.1)
Employed casually	67 (13.0)	14 (3.2)
Not employed or unpaid work	97 (18.9)	13 (2.9)
Retired	73 (14.2)	375 (84.5)

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Ethics approval

Ethics approval was obtained from the University of Adelaide Human Research Ethics Committee and the CSIRO Health and Medical Human Research Ethics Committee (approval number H-2019-109). All participants provided informed consent.

Competing interests

The authors declare that they have no competing interests.

Data sharing statement

Data is available upon reasonable request.

Prefer not to say	12 (2.3)	2 (0.5)
Household income, *n* (%)		
<$35,000	139 (27.0)	143 (32.2)
$35,000-$65,000	92 (17.9)	159 (35.8)
$65,000-$105,000	100 (19.5)	80 (18.0)
$105,000-$160,000	97 (18.9)	31 (7.0)
>$160,000	65 (12.6)	12 (2.7)
Prefer not to say	21 (4.1)	19 (4.3)
Highest level of education, *n* (%)		
Year 11 or below	50 (9.7)	83 (18.7)
Year 12	52 (10.1)	49 (11.0)
Certificate/diploma	156 (30.4)	133 (30.0)
Bachelor's degree	139 (27.0)	76 (17.1)
Graduate certificate/diploma	44 (8.6)	39 (8.8)
Postgraduate degree	72 (14.0)	56 (12.6)
Prefer not to say	1 (0.2)	8 (1.8)

Note. Time 2 n's (younger men = 167; older men = 173).

% may not equal 100% due to rounding.

446

447

Table 2. Item loadings derived from Principal Components Analysis, and Cronbach's Reliability Alpha

Domains	Items	18-64	65+	Overall	Time 2
Emotion Suppression	I bottled up my negative feelings	0.53	0.61	0.60	0.65
Alcohol Use	I needed alcohol to help me unwind	0.29	0.30	0.34	0.38
Somatic Symptoms	I had unexplained aches and pains	0.42	0.44	0.46	0.64
Aggression	I overreacted to situations with aggressive behaviour	0.68	0.74	0.69	0.30
Anger	It was difficult to manage my anger	0.76	0.73	0.74	0.65
Drug Use	Using drugs provided temporary relief	0.22	0.31	0.28	0.47
Risk-Taking	I stopped caring about the consequences of my actions	0.47	0.50	0.52	0.77
	Eigenvalue	2.52	2.73	2.71	
	Variance explained (%)	36.00	38.90	38.80	
	Cronbach's alpha	.69	.73	.73	
	Correlation with MDRS-22	.94	.94	.94	
	Short form re-test reliability	.70	.69	.70	
	M (SD)	5.9 (4.0)	3.5 (3.4)	4.8 (3.9)	

Note. Time 2 loadings derived using Confirmatory Factor Analysis (CFA) in the combined sample.

Table 3. Odds of mental illness and current suicidality controlling for previous diagnosis of depression

		Not depressed	Prototypical depression	Externalised depression	Mixed depression
18-64	Depressed group, *n*	193	71	49	187
	Moderate mental illness, *n* (%)	11 (6%)	56 (79%)	10 (20%)	163 (87%)
	OR (95% CI)	1	54.77 (23.5 - 127.9)	4.24 (1.7 - 10.9)	95.23 (44.8 - 202.2)
	Suicidality, *n* (%)	13 (7%)	43 (61%)	9 (18%)	137 (73%)
	OR (95% CI)	1	19.01 (9.0 - 40.0)	3.1 (1.2 - 7.7)	33.2 (17.2 - 64.2)
65+	Depressed group, *n*	310	20	45	54
	Moderate mental illness, *n* (%)	5 (2%)	8 (40%)	6 (13%)	36 (67%)
	OR (95% CI)	1	30.24 (8.3 - 109.6)	8.0 (2.3 - 27.7)	106.01 (36.8 - 305.1)
	Suicidality, *n* (%)	19 (6%)	8 (40%)	11 (24%)	41 (76%)
	OR (95% CI)	1	8.3 (3.0 -23.5)	4.5 (1.9 - 10.3)	43.2 (19.7 - 94.8)

Note. OR for previous depression diagnosis not shown.
Mental illness defined as K10 ≥ 25.
Suicidality defined as ≥ 1 on PHQ-9 item 9.

Table 4. Odds of being classified as depressed at follow up

Outcome: Depressed (PHQ-9 ≥ 10) at Time 2 (*n* = 340)	OR	CI	
Age (older)	1.39	0.671	2.875
Previous depression diagnosis (yes)	1.97	0.945	4.119
PHQ-9 T1	1.25**	1.158	1.342
Moderate (MDRS-7)	2.76**	1.185	6.437
Severe (MDRS-7)	1.74	0.679	4.458
Extremely severe (MDRS-7)	1.44	0.258	8.051

Note. Reference category = low symptoms.
**$p < .01$.

Figure 1. Effect of age and MDRS-7 category on prototypic depression symptoms (PHQ-9) and psychological distress (K10)

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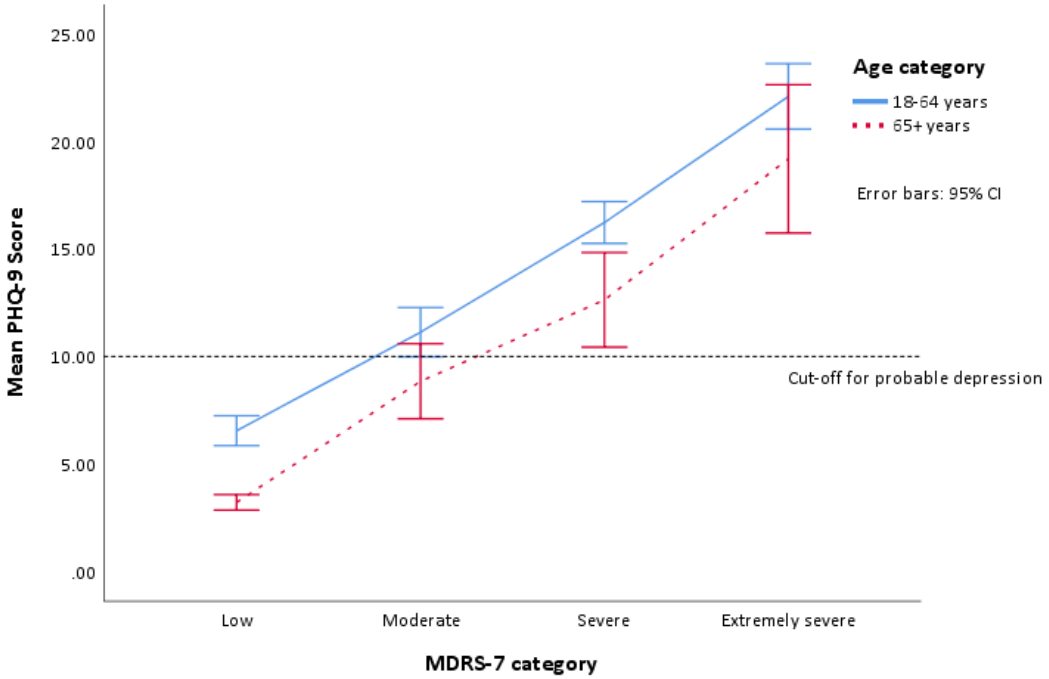


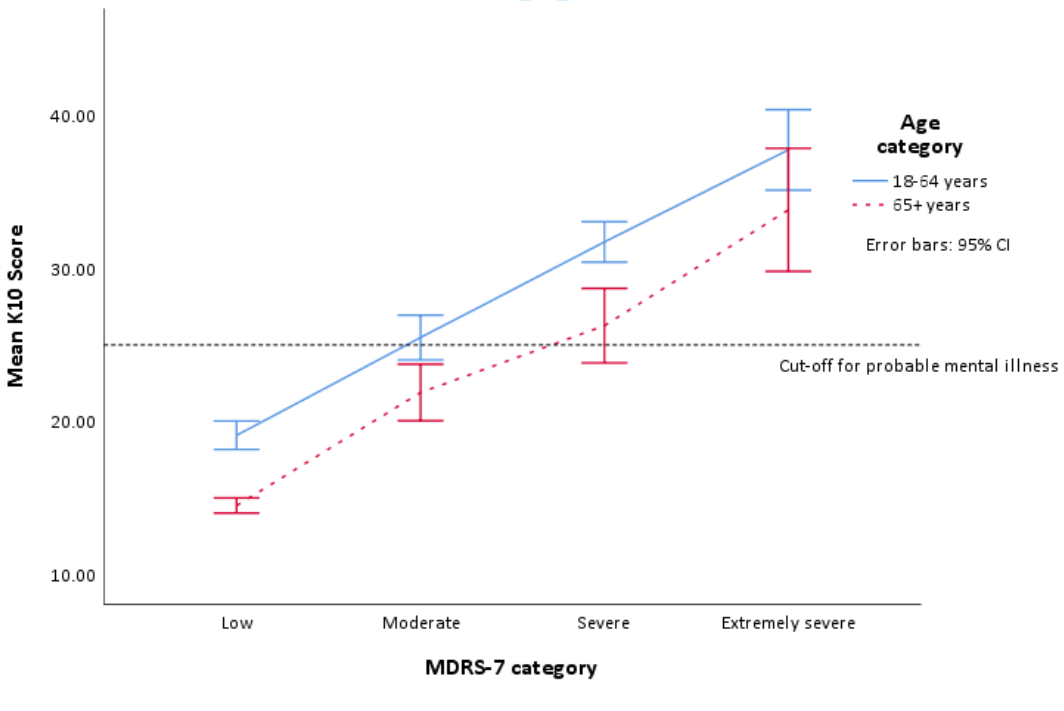
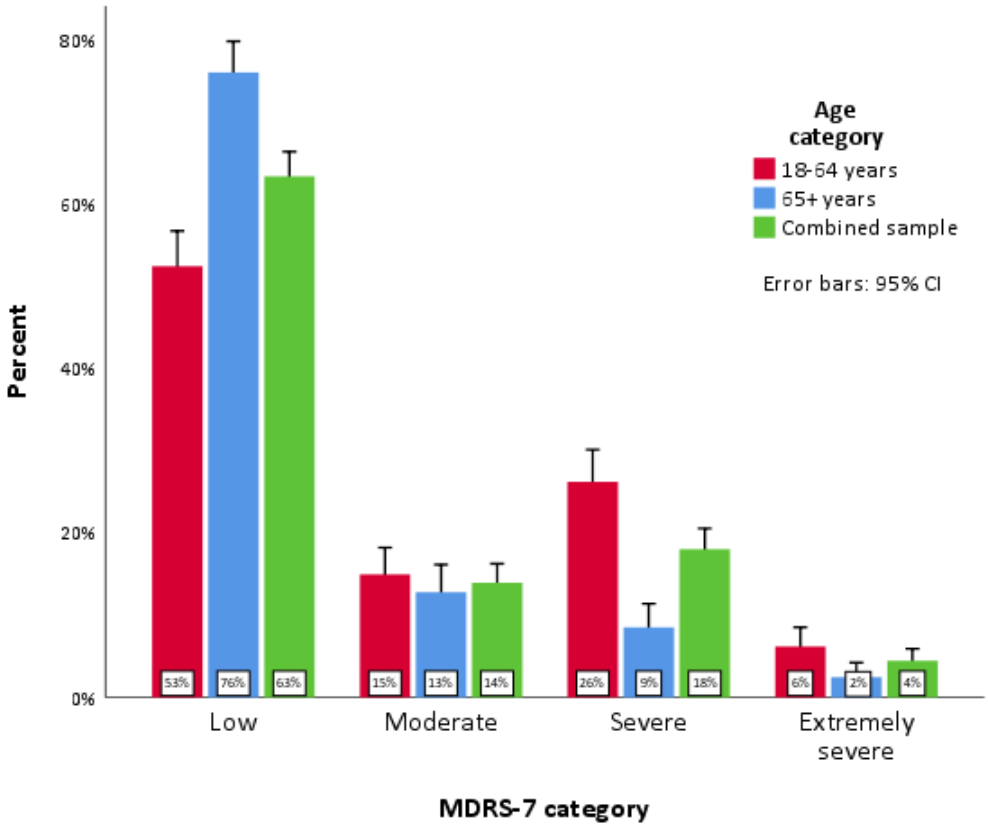


Figure 1. Effect of age and MDRS-7 category on prototypic depression symptoms (PHQ-9) and psychological distress (K10)

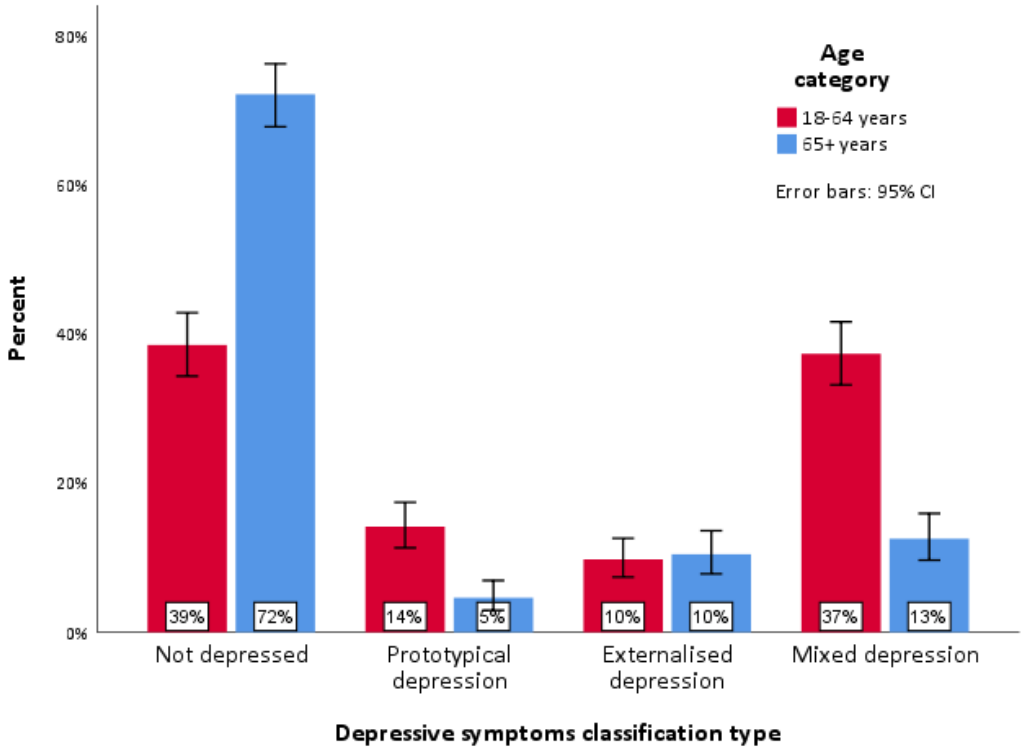
Supplementary Table 1. Descriptive and relational statistics for MDRS-22 items across younger and older age groups

		Younger males							Older males						
Domain	Item	*M*	*SD*	Skew	Total(*r*)	Domain(*r*)	Other domains(*r*)	Item score	*M*	*SD*	Skew	Total(*r*)	Domain(*r*)	Other domains(*r*)	Item score
Emotion Suppression	I tried to ignore feeling down	1.77	1.12	0.08	0.61	0.76	0.49	0	1.34	1.26	0.51	0.57	0.77	0.42	0
	I bottled up my negative feelings	1.93	1.16	0.00	0.64	0.86	0.54	4	1.28	1.15	0.58	0.73	0.86	0.58	3
	I covered up my difficulties	1.90	1.18	-0.04	0.64	0.85	0.50	1	1.21	1.21	0.64	0.71	0.84	0.55	0
	I had to work things out by myself	2.39	1.19	-0.32	0.46	0.68	0.36	1	1.96	1.36	-0.04	0.58	0.72	0.40	3
Alcohol Use	I drank more alcohol than usual	0.80	1.09	1.23	0.60	0.89	0.37	1	0.48	0.88	2.10	0.59	0.91	0.38	0
	I stopped feeling so bad while drinking	0.81	1.14	1.22	0.57	0.86	0.37	0	0.39	0.93	2.51	0.58	0.88	0.41	1
	I needed alcohol to help me unwind	0.92	1.16	1.10	0.60	0.94	0.37	4	0.52	0.93	2.01	0.61	0.94	0.37	5
	I needed to have easy access to alcohol	0.54	0.99	1.92	0.59	0.87	0.38	1	0.44	0.91	2.16	0.59	0.91	0.39	0
Somatic Symptoms	I had more heartburn than usual	0.60	0.91	1.48	0.39	0.65	0.33	0	0.38	0.71	1.88	0.50	0.70	0.41	0
	I had regular headaches	0.90	1.04	1.05	0.50	0.75	0.43	0	0.40	0.79	2.24	0.54	0.77	0.43	0
	I had stomach pains	0.72	0.90	1.06	0.54	0.75	0.44	1	0.38	0.76	2.32	0.57	0.77	0.46	1
	I had unexplained aches and pains	1.05	1.13	0.79	0.52	0.78	0.47	4	0.74	0.93	1.16	0.57	0.78	0.48	6
Anger & Aggression	I overreacted to situations with aggressive behaviour	0.59	0.82	1.42	0.51	0.83	0.46	2	0.41	0.70	1.79	0.56	0.85	0.50	4
	I verbally lashed out at others without being provoked	0.28	0.61	2.53	0.41	0.77	0.38	0	0.16	0.45	3.42	0.44	0.74	0.36	0
	I was verbally aggressive to others	0.34	0.64	2.14	0.45	0.83	0.38	0	0.20	0.49	2.82	0.41	0.80	0.33	0
	It was difficult to manage my anger	0.58	0.84	1.49	0.56	0.84	0.50	3	0.31	0.64	2.33	0.57	0.81	0.53	2
Drug Use	I sought out drugs	0.32	0.79	2.63	0.47	0.94	0.36	2	0.11	0.43	4.85	0.33	0.89	0.25	1
	I used drugs to cope	0.32	0.80	2.78	0.47	0.94	0.34	2	0.07	0.35	5.59	0.31	0.82	0.24	0
	Using drugs provided temporary relief	0.33	0.84	2.70	0.47	0.95	0.34	4	0.11	0.44	4.76	0.39	0.90	0.31	6
Risk-Taking	I drove dangerously or aggressively	0.33	0.66	2.04	0.32	0.67	0.35	0	0.12	0.37	3.12	0.32	0.61	0.29	1
	I stopped caring about the consequences of my actions	0.54	0.87	1.69	0.55	0.82	0.48	3	0.21	0.59	3.24	0.54	0.83	0.49	5
	I took unnecessary risks	0.38	0.70	1.94	0.55	0.84	0.52	3	0.15	0.45	3.19	0.47	0.82	0.43	0



Supplementary Figure 1. Proportion of participants within MDRS-7 categories

Note. Low (0 – 5), Moderate (6 – 7), Severe (8 – 12), Extremely severe (13+).



Supplementary Figure 2. Proportion of participants according to depressive symptoms classification type

Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

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In your methods section, say that you used the STROBE cross sectionalreporting guidelines, and cite them as:

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		Reporting Item	Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	4-6
Objectives	#3	State specific objectives, including any prespecified hypotheses	6
Methods			

Study design	#4	Present key elements of study design early in the paper	6
Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	6
	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-9
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	6-9
Bias	#9	Describe any efforts to address potential sources of bias	6
Study size	#10	Explain how the study size was arrived at	8-9
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	8-9
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	8-9
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	8-9
Statistical methods	#12c	Explain how missing data were addressed	8-9
Statistical methods	#12d	If applicable, describe analytical methods taking account of sampling strategy	N/A
Statistical methods	#12e	Describe any sensitivity analyses	N/A

Results			
Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	8-9
Participants	#13b	Give reasons for non-participation at each stage	N/A
Participants	#13c	Consider use of a flow diagram	N/A
Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	9-10
Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	8-9
Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	N/A
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included all estimates are reported in tables	All estimates are reported in Tables
Main results	#16b	Report category boundaries when continuous variables were categorized	8-9
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	N/A
Discussion			

Key results	#18	Summarise key results with reference to study objectives	12-15
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	14
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	12-15
Generalisability	#21	Discuss the generalisability (external validity) of the study results	14
Other Information			
Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	N/A

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Brief assessment of male depression in clinical care: Validation of the Male Depression Risk Scale Short Form in a cross-sectional study of Australian men

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Brief assessment of male depression in clinical care: Validation of the Male Depression Risk Scale Short Form in a cross-sectional study of Australian men

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Word Count: 4170

Abstract

Objectives: To develop and validate a short form of the Male Depression Risk Scale (MDRS-22) for use in primary care, examining associations with prototypic depression symptoms, psychological distress, and suicidality.

Design: Cross-sectional study with 8-month follow-up.

Setting: Community-based.

Participants: A community sample of younger (*n* = 510; 18-64 years) and older (*n* = 439; 65-93 years) males residing in Australia (*M* age = 58.09 years, *SD* = 17.77) participated in the study. A subset of respondents (*n* = 159 younger males; *n* = 169 older males) provided follow-up data approximately eight months later.

Primary and secondary outcome measures: Quantitative data were obtained through a survey comprising a range of validated measures, including the Male Depression Risk Scale (MDRS-22), the Patient Health Questionnaire (PHQ-9), and the Kessler Psychological Distress Scale (K10). The MDRS-22 was refined using exploratory and confirmatory factor analysis in line with best practice guidelines. ANOVAs and generalised linear models were conducted to explore relationships between variables.

Results: The short form MDRS-22 consisted of seven items (MDRS-7) and captured all of the domains in the original tool. Participants with mixed symptoms (PHQ-9 ≥ 10 and MDRS-7 > 5) had significantly higher risk of mental illness (K10 ≥ 25) and current suicidality (PHQ-9 item 9 ≥ 1) than those with exclusively prototypic symptoms. Furthermore, the MDRS-7 was shown to be effective at predicting elevated symptoms of depression at follow-up, after controlling for previous depression diagnoses.

Conclusions: Findings provide preliminary evidence of the potential utility of the MDRS-7 as a screening tool for externalised and male-type symptoms associated with major depression in men. Field trials of the MDRS-7 in primary care settings may facilitate identification of men at risk of suicide and psychological distress who do not meet cut-off scores for existing measures of major depression symptoms.

Key words: depression, externalising symptoms, short form, men, lifespan, help-seeking

Strengths and limitations of this study:

- This is the first study to explore the psychometric properties of the MDRS-7 as a screening tool for externalised and male-type symptoms associated with major depression in men.
- Use of the MDRS-7 in primary care settings may facilitate identification of men at risk of suicide and psychological distress.
- Diagnosis of depression was not verified by clinical interview.
- Field trials of the MDRS-7 are needed to demonstrate the utility of the tool in primary care settings.

Introduction

Major depressive disorder (MDD) is a common psychiatric condition and the leading cause of disability worldwide [1, 2]. MDD is twice as prevalent in women than men [3] and severe depression is known to significantly increase the risk of suicide [4]. Although men are less likely to be diagnosed with a depressive disorder [5], they are three times more likely to die by suicide compared to women [6]. Current approaches to the diagnosis of depression (e.g., as per ICD-11 or DSM-5 diagnostic criteria) emphasise symptoms including persistent sadness, loss of interest or pleasure in previously enjoyable activities, as well as changes in affect, cognition, and neurovegetative functioning [7, 8]. However, a growing number of studies suggest that a significant proportion of men suffering from depression might experience a distinct phenotype [9-11]. Congruent with masculine role norms, this male-typical phenotype includes anger, substance misuse, emotion suppression, and risk-taking domains [10, 12]. However, these putative symptoms are not included in standard diagnostic criteria or screening measures, and it has been suggested that this might account in part for the under-diagnosis of male depression cases, and therefore under-recognition of (and treatment for) men at heightened risk of suicide [13].

Whilst men are often regarded as being less likely to seek help than women, recent statistics largely do not support this claim. In Australia, around 89% of men attend primary care annually [14]. Among men experiencing mental health difficulties, annual primary care attendance is similarly high with estimates of 80% to 96% of men with symptoms of

depression reporting a visit to primary care within the previous 12 months [15, 16]. Similarly, findings from the UK demonstrate that whilst males are overall less likely to attend primary care compared to females, attendance rates in men and women with comparable underlying morbidities, including depression, are similar [17]. Furthermore, findings from a population study of healthcare contacts among Canadian suicide decedents in Toronto demonstrated that over 60% (*n* = 1792) of men who died by suicide accessed professional mental health care in the year before their death [18]. These findings highlight the essential role of primary care physicians in identifying depression and suicide risk in men in order to facilitate effective treatment [19].

Growing interest in gender-sensitive assessment of men's depression has seen the development of male-specific screening tools to identify symptoms that align with men's socialisation and gender norm processes [e.g., 20, 21, 22]. One recently developed and widely validated measure for assessing externalising and male-type symptoms in men is the Male Depression Risk Scale (MDRS-22) [23]. The MDRS-22 consists of 22 items assessing six symptom domains including emotion suppression, drug use, alcohol use, anger and aggression, somatic symptoms, and risk-taking [23]. Recently, Zajac and colleagues [24] demonstrated that this tool, used in conjunction with a measure of prototypic depression symptoms (PHQ-9), was able to stratify men into three distinct risk groups: (i) prototypic symptoms (consistent with current MDD diagnostic criteria), (ii) externalising symptoms consistent with masculine socialisation, and (iii) mixed depressive symptoms, reflecting both internalised and externalised symptomology. Further analyses showed that men in the externalising only group—men who are arguably missed when using measures of internalising symptoms—were at significantly increased risk of suicide compared to non-depressed men. Moreover, those with elevated externalised and prototypic symptomology were at highest risk of mental illness as well as suicide [24], highlighting the potential early identification and intervention benefits of leveraging male-specific tools in primary care settings.

Two-stage screening methods are commonly used in primary care, and have been shown to be effective for increasing the recognition of depression [25]. However, many primary care physicians report that time is a limiting factor in their capacity to

comprehensively assess psychological issues, including depression [19, 26], despite management of common mental disorders rating as a top reason for general practice attendance [27]. To help address this issue, brief screening tools consisting of 15 items or less are often used, given their completion time is usually just a couple of minutes [28]. Examples include the Patient Health Questionnaire (PHQ-9) [29], the Kessler Psychological Distress Scale (K10) [30], and the Beck Depression Inventory for Primary Care (BDI-PC) [31].

To date, the MDRS-22 has demonstrated excellent psychometric properties as well as the ability to detect different groups of men who may be at increased risk of suicide and mental illness [e.g., 24, 32, 33]. However, given time constraints in primary care settings, the length of the current MDRS-22 is arguably impractical [12]. The purpose of the present study was to develop a short form of the MDRS-22 to facilitate its use as a screening tool in busy and time-pressured health care settings. We also aimed to establish an initial set of cut-off scores for interpretive purposes. If the MDRS short form is to have clinical utility, it needs to be able to identify broader aspects of psychopathology. Thus, a secondary aim was to explore current and longitudinal risk of suicidality and mental illness by adopting a previously utilised categorisation according to cut-off scores on the MDRS and the widely used PHQ-9, which assesses prototypic depression symptoms [24]. Furthermore, as adherence to masculine gender norms has been found to decline as men get older [34], younger and older males were examined separately to examine the utility of the tool across age groups.

Method

Participants and procedure

This cross-sectional study included baseline data from a community sample of 510 younger males aged 18 to 64 years (M = 45.43, SD = 14.56) and 439 older males aged 65 to 93 years (M = 72.79, SD = 5.88). A subset of respondents (n = 159 younger males; n = 169 older males) participated in the follow-up component. On average, 35 weeks (M = 248.56 days, SD = 24.59 days) elapsed between the provision of Time 1 and Time 2. The mean age for the overall sample was 58.09 years (SD = 17.77). Eligible participants were Australian male residents over the age of 18 years who considered themselves fluent in English.

Participants were recruited via paid advertisements displayed to Australian members of the Facebook social networking site (*n* = 601; 63.3%) and through promotion of the study to community organisations (e.g., Rotary, Men's Shed). Time 1 data were collected between August and November 2019 using an online questionnaire. However, participants from local community organisations were provided with the option to complete a paper version of the survey to ensure inclusivity and accessibility of the sample and *n* = 5 participants completed a paper version. Ethics approval was obtained from the University of Adelaide Human Research Ethics Committee and the CSIRO Health and Medical Human Research Ethics Committee (approval number H-2019-109). All participants provided informed consent. Reporting adhered to the STROBE cross-sectional guidelines. Table 1 presents a summary of the characteristics of the study participants at Time 1 and Time 2.

Public involvement

Participants were not involved in the design or conduct of this research; however, participants could nominate to receive updates on the results of the study.

Measures

Demographics

Participants reported their age, gender, relationship status, employment status, level of education, and household income. They also reported whether they had previously been diagnosed with depression.

Male Depression Risk Scale (MDRS-22)

Externalising and male-type depression symptoms were assessed by the Male Depression Risk Scale (MDRS-22) [23]. The MDRS-22 contains twenty-two self-report items designed to assess six broad domains of externalising and male-type depression symptoms present in the last month including anger and aggression, drug use, alcohol use, emotion suppression, risk-taking, and somatic symptoms using the response format of 5-point Likert scale ranging from 0 (*none of the time*), 1 (*a little of the time*), 2 (*some of the time*), 3 (*most*

of the time), and 4 (*all of the time*). Cronbach's alphas for the MDRS are reported in Table 2 for both age groups and for the overall sample and are considered adequate.

The Patient Health Questionnaire (PHQ-9)

The Patient Health Questionnaire (PHQ-9) [29] is a self-report depression screening tool for use in primary care that assesses nine symptoms consistent with the DSM-5 diagnostic criteria for major depressive disorder [7]. Participants endorse how often they have experienced each symptom (e.g., "*Feeling down, depressed, or hopeless*") during the preceding two-week period using a 4-point Likert scale ranging from 0 (*not at all*) to 3 (*almost every day*). A score of 10 and above is indicative of clinically significant depressive symptoms [35]. In addition to utilising total PHQ-9 scores, we used item 9 as a measure of suicidality: "Over the past two weeks, how often have you been bothered by thoughts that you would be better off dead, or of hurting yourself in some way?". We deemed those who scored 1 or more on this item to be currently experiencing suicidal ideation. Internal consistency of the PHQ-9 in the present study for the overall sample was high (α = .93).

Kessler Psychological Distress Scale (K10)

The Kessler Psychological Distress Scale (K10) [30] is a widely used measure in both research and primary care settings [36]. It comprises ten questions assessing a person's negative emotional state in the preceding 30 days (e.g., "*About how often did you feel so nervous that nothing could calm you down*"). Responses are based on a 5-point Likert scale ranging from 1 (*none of the time*) to 5 (*all of the time*). In addition to examining K10 total scores, we created a binary variable with scores ≥ 25 indicating probable mental illness, consistent with published cut-off scores for the K10 [37]. Internal consistency of the K10 in this study for the overall sample was high (α = .95).

Analytic sample

A total of 1114 participants commenced the study. However, 156 participants were not included in the analyses due to substantial missing data. Thus, *N* = 949 participants who provided complete data for the items comprising the MDRS-22 were included in the item

reduction process described below. Of this sample, *n* = 29 did not provide complete data for the PHQ-9 or K10 items. Thus, models using these variables comprised *n* = 920 participants.

Statistical analyses

Data for the present study were analysed using IBM SPSS Statistics (Version 26.0) except for the confirmatory factor analysis (CFA) undertaken in JASP [Version 0.13.1; 38]. Various recommendations exist for the selection of items for short-form surveys including both Rasch analysis [39] and descriptive approaches [40, 41]. Broadly speaking, the focus is on selecting items with maximum variability and which retain the theorised underlying construct—as well as sub-domains—measured by the long-form scale. Therefore, we calculated descriptive (means, standard deviation (*SD*), and skewness) and relational statistics (correlations) for each item (see Supplementary Table 1). Items were then scored based on each statistic within its corresponding domain (i.e., largest *SD*, strongest correlation etc) and summed across the different descriptive indices to derive a total performance score for each item. Parallel Analysis consisting of 1,000 permutations of the original raw data was used to determine thresholds for retaining factors. Exploratory factor analysis (EFA) of the best performing items was performed with maximum likelihood estimation within each age group, and in the combined sample. Stability of this solution was then established using CFA of Time 2 Data (*n* = 328). Fit indices reported include: comparative fit index (CFI); the Tucker-Lewis index (TLI); the root mean square error of approximation (RMSEA); and the standardised root mean residual (SRMR). Interpretation of these indices were guided by the recommendations of Hu & Bentler [42].

In order to investigate the clinical utility of the reduced item scale, cut-off scores were determined for Low (0 – 5), Moderate (6 – 7), Severee (8 – 12) and Extremely severe (13+) symptom severity groups. The corresponding cumulative percentiles (cum$^{\%}$) at the upper boundaries of these categories were: Low (cum$^{\%}$ = 63.5), Moderate (cum$^{\%}$ = 77.5%), Severe (cum$^{\%}$ = 95.5), Extremely severe (cum$^{\%}$ = 100.0). These category scores were determined using previously reported cumulative percentiles that represented differing degrees of increased risk of recent suicide attempt for the MDRS-22 [33]. A 2x2 ANOVA was conducted to explore the effect of age group differences and MDRS-7 symptom categories

on prototypic depression (PHQ-9) and psychological distress (K10). We classified individuals into depression groups using the MDRS-7 in combination with the PHQ-9 based on previous research [24] with groups referred to as: not depressed (PHQ-9 < 10 and MDRS-7 ≤ 5), prototypic depression features (PHQ-9 ≥ 10 and MDRS-7 ≤ 5), mixed features (PHQ-9 ≥ 10 and MDRS-7 > 5), and externalising and male-type features (PHQ-9 < 10 and MDRS-7 > 5). In addition, we used the K10 to determine those individuals suffering a moderate mental illness (K10 ≥ 25) from those without a mental illness (K10 < 25), and current suicidality was ascribed based on scores ≥ 1 on PHQ-9 item 9: "Over the past two weeks, how often have you been bothered by thoughts that you would be better off dead, or of hurting yourself in some way?". Based on these classifications, generalised linear models (GLMs) were used to determine risk of mental illness and suicidality based on depressive symptom groupings whilst controlling for previous diagnosis of depression. An additional GLM examined risk of depression at Time 2 (PHQ-9 ≥ 10) as a function of MDRS-7 categories at Time 1. Assumptions of GLMs were considered through inspection of scatter plots and histograms of residuals and predicted values, with model results reported as standardised betas.

Results

Sample characteristics

Table 1 presents the characteristics of the participants at Time 1 and Time 2. As expected, there was a higher proportion of older participants who reported themselves as married/de-facto or widowed/divorced/separated, in comparison to younger men. Regarding education, the majority of older participants completed year 11 or below, whilst the proportion of participants completing a Bachelor's degree was higher in the younger sample. In addition, household income appeared to be higher in younger compared to older men, consistent with the majority of the older sample reporting themselves as being retired. Comparisons with 2016 Australian Census data indicate that participants in the current study were more likely to be married or in a de-facto relationship (63.1% vs 58.1%), more likely to have completed a Bachelor Degree level or above (49.8% vs 22.0%), and less likely to be employed full-time (44.5% vs 57.7%) compared to the Australian population [43]. This likely reflects the trend towards older males in the current study. Sample characteristics at

Time 1 and Time 2 were mostly comparable, with a higher proportion of participants at Time 2 retired.

Insert Table 1 about here

Item reduction

Descriptive and relational statistics for each of the MDRS-22 items across younger and older age groups are displayed in Supplementary Table 1. For the emotion suppression, alcohol use, somatic symptoms, and drug use domains, a single highest scoring item emerged congruent across age groups. For the anger and aggression domain, two different items were retained because of their performance across the age groups. Finally, although two risk-taking items scored equally well in the younger group, only one of these loaded within the older age group, and only this item was retained. This resulted in a total selection of seven items for the short form scale covering all of the original MDRS-22 domains.

Factor analysis of these seven items revealed the presence of a single underlying domain that satisfied criteria determined by the parallel analysis; eigenvalues were required to exceed 1.16. As shown in Table 2, all items demonstrated a moderate-to-strong loading on a single underlying factor except for those measuring alcohol and drug use, which loaded moderately. When modelling these 7-items using CFA at Time 2, the initial solution specifying all items loading on a single latent MDRS-7 factor was not quite adequate [$\chi^2(14) = 65.85$ $p < .001$, CFI = 0.96, TLI = 0.94, RMSEA = 0.11 (0.08, 0.13), SRMR = 0.10]. However, allowing the errors of the two items assessing anger and physical aggression to covary resulted in acceptable model fit [$\chi^2(13) = 29.04$ $p \leq .01$, CFI = 0.99, TLI = .98, RMSEA = 0.06 (0.03, 0.09), SRMR = 0.09].

Insert Table 2 about here

Cut-off scores for the short scale

The proportion of men in each of the different MDRS-7 symptom severity categories are shown in Supplementary Figure 1 for the total sample, and by age group. As can be seen, older men appear more likely to be in the 'low' category of symptoms, and less likely to be in the 'severe' or 'extremely severe' categories compared to younger males. Figure 1 shows the effect of age and MDRS-7 categories on prototypic depression (PHQ-9) and psychological distress (K10). For PHQ-9, there were significant differences between all MDRS-7 groups [$F(3, 912) = 208.05$, $p < .001$] and between age groups [$F(1, 912) = 26.76$, $p < .001$], with no significant interaction between MDRS-7 and age [$F(3, 912) = 0.59$, $p = .625$]. For the K10, results were similar: significant differences between all MDRS-7 groups [$F(3, 912) = 188.95$, $p < .001$] and between younger and older men [$F(3, 912) = 33.05$, $p < .001$], but no interaction between MDRS-7 and age [$F(3, 912) = 0.44$, $p = .719$].

Insert Figure 1 about here

Clinical utility of the MDRS-7

The proportion of males according to depressive classification type is shown in Supplementary Figure 2. Externalised and male-type depression affected approximately 10% of younger and older males, whilst prototypic and mixed depressive symptoms were more common in younger males. Table 3 shows the risk of mental illness and suicidality compared to non-depressed participants within each age group after controlling for a previous diagnosis of depression. All classifications were associated with both outcome measures. Individuals with mixed symptoms have the highest risk of suicidality and mental illness.

Insert Table 3 about here

A final GLM considered the likelihood of being classified as depressed at follow-up based on responses to the PHQ-9 at Time 2 (i.e., score ≥ 10). MDRS-7 category was entered as a predictor controlling for PHQ-9 scores at Time 1, previous diagnosis of depression and age. As shown in Table 4, PHQ scores at Time 1 were significantly associated with increased risk of depression at Time 2 although age and prior diagnoses were not significantly associated. Those classified as having moderate MDRS-7 symptoms at Time 1 were significantly more likely than those in the low symptom category to be classified as depressed at Time 2, whilst the severe and extremely severe categories were not associated with increased risk.

Insert Table 4 about here

Discussion

Clinical reports and emergent empirical work suggest that men's depression may be under-detected as a result of prototypic screening tools that may be insensitive to men's gender role socialisation [11, 13, 44]. The Male Depression Risk Scale (MDRS-22) assesses externalised and male-type symptoms of depression, such as substance misuse, risk-taking, and anger. However, in its current 22-item form, it is impractical for rapid use in primary care, particularly when used alongside traditional depression screening tools [12]. The present research aimed to derive a short form of the MDRS-22, examine its psychometric properties and relationships with psychological distress, depression, and suicidal ideation in order to demonstrate its utility as a potential screening tool in primary and other health care settings.

The short form derived herein comprises seven items, representing 1 item for each of the original MDRS domains including emotion suppression, risk-taking, substance use, drug use, somatic symptoms, and two items for the anger and aggression domain, based on criteria including variability within items, the item's relationship to its original MDRS domain but also with the overall MDRS score. Of particular importance is our finding that the correlation between the MDRS-7 and the original MDRS-22 was near perfect (r = .94). Five

of the seven items demonstrated moderate-to-strong loadings on a single underlying construct presumed to reflect the male depression phenotype, whilst two items assessing alcohol and drug use loaded moderately. This likely reflects the reduced variability of participant responses on these items, with most participants reporting that these items applied to them none, or a little of the time. However, these loadings still exceeded the minimum recommended factor loading of .32 [45]. In addition, items that tap these behaviours are important to retain given that substance use is an important marker of depression and suicidality in men and particularly those who adhere to masculine norms [44, 46]. It is nonetheless important to note that substance use may reflect a comorbidity [47] or maladaptive coping [48]. These are important questions for future research to explore.

In the present study, externalising and male-type symptoms, either alone or in combination with prototypic symptoms, were found to be more common than exclusively prototypic symptoms. Approximately 10% of younger and older males were found to present with uniquely externalising and male-type symptoms, whilst 38% of younger males and 13% of older males presented with mixed symptoms. These findings are consistent with previous research using the MDRS-22 [24] and highlight the potential utility of the MDRS-7 for detecting additional cases of men at risk. Men with exclusively externalised and male-type depression are a subset who score below threshold on traditional prototypic measures but whom report a degree of externalised behaviours that might be problematic. Furthermore, both younger and older males in the mixed symptom group had increased risk of a mental illness—after controlling for a previous diagnosis of depression—demonstrating unequivocally that this represents a unique group of psychologically distressed, at-risk men. Similarly, both younger and older males in the mixed symptom group had a significantly elevated risk of suicidality. These findings are consistent with research by Zajac and colleagues [24] and highlight the clinical importance of considering a broad range of potential presentations of depression in men, all of which are associated with increased risk of poor outcomes.

The MDRS-7 was also shown to be effective at predicting depression at a later time point, suggesting a possible prodromal effect. These findings are consistent with those by

Kendler and colleagues [49] who demonstrated that externalising and male-type symptoms predicted a future depressive episode in men. Hence, our findings may reflect early symptom expression, or even attempts of men to cope with what has the potential to develop into a threshold depressive disorder. This further highlights the potential value of screening for externalising and male-type symptoms to facilitate early intervention and prevention of further mental health issues [50]. In addition, given the externalised nature of male-typical symptoms of depression, it is important to note that these symptoms not only affect men's health and wellbeing but also the health wellbeing of their families, friends, and communities [13, 51, 52]. Hence the better identification and management of male depression is likely to have substantial public health implications.

Clinical implications

There is an urgent need for health services and providers to utilise more sensitive diagnostic tools as a means of improving the detection of depression and psychological distress in males and addressing the high rates of male suicide [13]. The use of brief tools such as the MDRS-7 may assist with detecting unique cases of men who would score below threshold on measures such as the PHQ-9. However, an added benefit of using this scale alongside prototypic measures, is the ability to detect men presenting with mixed symptomology whose risk of suicide and poor mental health outcomes is significantly elevated. Therefore, the clinical utility of this measure may extend beyond screening and detection and into the therapy setting where it is necessary to determine, monitor, and manage differing degrees of suicidality.

Limitations and suggestions for future research

The methodology adopted in this study is not without limitations. The majority of participants were recruited online, which may limit the generalisability of the findings to other populations [53]. Future research should examine measurement invariance according to factors such as education level, income, and cultural background. There was also a trend towards older males in the current sample. However, items retained in the MDRS-7 were those that performed best in both younger and older males to ensure the measure was

appropriate across the lifespan. Future research should examine the psychometric properties of the MDRS-7 with additional populations, including clinical samples of men across the lifespan presenting to primary care. In addition, as data was self-report, diagnosis of depression could not be verified at clinical interview. The results of this study would be strengthened by a more rigorous assessment of psychopathology and comorbidity. It is also important to acknowledge that this study used a single item from the PHQ-9 to examine current suicidal ideation. Therefore, there is a need for additional research to examine the relationship between the MDRS-7 and other measures of suicidality, including recent suicide attempt.

Conclusion

The present study provides important preliminary information on the development and validation of the MDRS-7. Specifically, this study provides emerging support for the validity and reliability of the MDRS-7 as a measure of externalising and male-type depression symptoms in both younger and older men in terms of its psychometric properties as well as its relationship to prototypic depression symptoms, psychological distress, and suicidality. Use of male-specific measures of depression such as the MDRS-7 may improve the detection of depression and suicide risk in men, and adjunctive use (alongside established prototypic scales such as the PHQ-9) may contribute to improved public health outcomes.

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Author contributions

D.H., S.R., and I.Z. developed the study concept. D.H. and I.Z. performed the data analyses. D.H. drafted the paper and S.R. and I.Z. provided critical revisions. All authors approved the final version of the paper for submission.

Table 1. Sociodemographic characteristics of participants

Variable	Younger men (< 65)		Older men (≥ 65)	
	Time 1 (*n* = 510)	Time 2 (*n* = 159)	Time 1 (*n* = 439)	Time 2 (*n* = 169)
Age range	18-64		65-93	
Age, *M* (*SD*)	45.43 (14.56)		72.79 (5.88)	
Relationship status, *n* (%)				
Single (never married)	118 (23.1)	27 (17.0)	12 (2.7)	6 (3.6)
Widowed/divorced/separated	68 (13.3)	19 (11.9)	92 (21.0)	44 (26.0)
Married/de-facto	322 (63.1)	113 (71.1)	332 (75.6)	119 (70.4)
Prefer not to say	2 (0.4)	0 (0.0)	3 (0.7)	0 (0.0)
Employment status, *n* (%)				

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Ethics approval

Ethics approval was obtained from the University of Adelaide Human Research Ethics Committee and the CSIRO Health and Medical Human Research Ethics Committee (approval number H-2019-109). All participants provided informed consent.

Competing interests

The authors declare that they have no competing interests.

Data sharing statement

Data is available upon reasonable request.

Employed full-time	227 (44.5)	66 (41.5)	22 (5.0)	5 (3.0)
Employed part-time	37 (7.3)	11 (6.9)	18 (4.1)	4 (2.4)
Employed casually	67 (13.1)	19 (11.9)	14 (3.2)	5 (3.0)
Not employed or unpaid work	94 (18.4)	24 (15.1)	13 (3.0)	7 (4.1)
Retired	73 (14.3)	39 (24.5)	370 (84.3)	148 (87.6)
Prefer not to say	12 (2.4)	0 (0.0)	2 (0.5)	0 (0.0)
Household income, *n* (%)				
<$35,000	136 (26.7)	28 (17.6)	141 (32.1)	51 (30.2)
$35,000-$65,000	91 (17.8)	32 (20.1)	156 (35.5)	55 (32.5)
$65,000-$105,000	100 (19.6)	44 (27.7)	80 (18.2)	29 (17.2)
$105,000-$160,000	97 (19.0)	26 (16.4)	31 (7.1)	15 (8.9)
>$160,000	65 (12.7)	20 (12.6)	12 (2.7)	4 (2.4)
Prefer not to say	21 (4.1)	9 (5.7)	19 (4.3)	15 (8.9)
Highest level of education, *n* (%)				
Year 11 or below	49 (9.6)	11 (6.9)	81 (18.5)	23 (13.6)
Year 12	52 (10.2)	10 (6.3)	48 (10.9)	17 (10.1)
Certificate/diploma	154 (30.2)	55 (34.6)	133 (30.3)	50 (29.6)
Bachelor's degree	139 (27.3)	44 (27.7)	74 (16.9)	34 (20.1)
Graduate certificate/diploma	43 (8.4)	15 (9.4)	39 (8.9)	20 (11.8)
Postgraduate degree	72 (14.1)	23 (14.5)	56 (12.8)	22 (13.0)
Prefer not to say	1 (0.2)	1 (0.6)	8 (1.8)	3 (1.8)

Note. % may not equal 100% due to rounding.

Table 2. Item loadings derived from exploratory factor analysis (maximum likelihood estimation)

Domains	Items	18-64	65+	Overall	Time 2
Emotion Suppression	I bottled up my negative feelings	.67	.72	.71	.68
Alcohol Use	I needed alcohol to help me unwind	.44	.45	.48	.37
Somatic Symptoms	I had unexplained aches and pains	.56	.59	.58	.63
Aggression	I overreacted to situations with aggressive behaviour	.69	.74	.71	.30
Anger	It was difficult to manage my anger	.75	.74	.75	.65
Drug Use	Using drugs provided temporary relief	.36	.44	.42	.44
Risk-Taking	I stopped caring about the consequences of my actions	.63	.62	.65	.80
	Eigenvalue	2.52	2.74	2.72	
	Variance explained (%)	36.04	39.08	38.82	
	Cronbach's alpha	.68	.71	.72	
	Correlation with MDRS-22	.94	.94	.94	
	Short form re-test reliability	.72	.69	.71	
	M (SD)	5.93 (4.04)	3.57 (3.39)	4.84 (3.93)	

Note. Time 2 loadings derived using confirmatory factor analysis (CFA) in the combined sample. All correlations were significant at $p < .001$

Table 3. Odds of mental illness and current suicidality controlling for previous diagnosis of depression

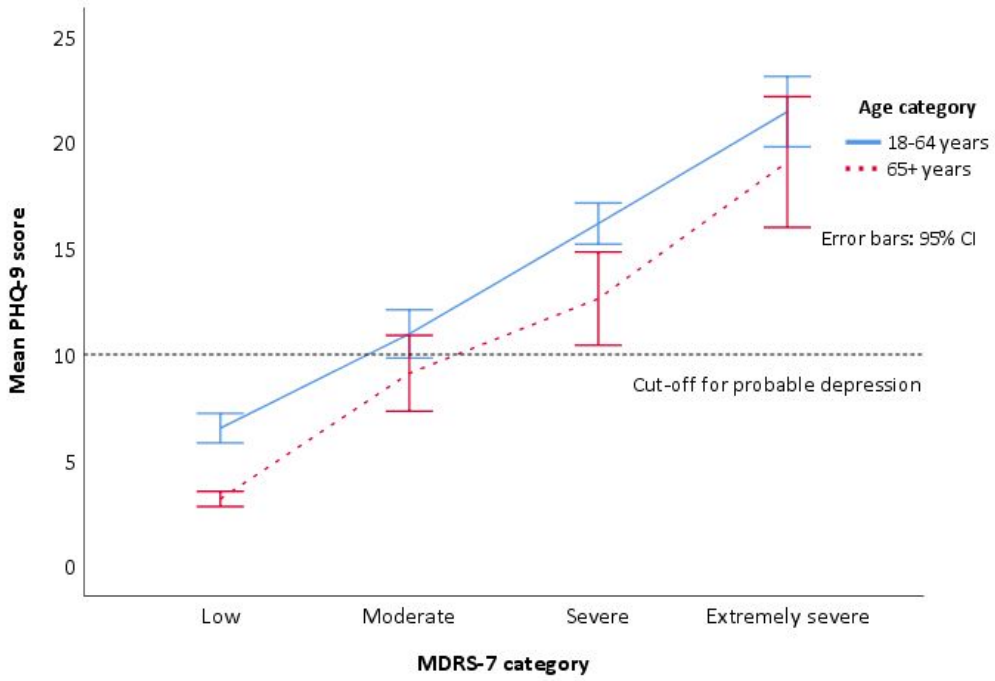
	Depressed group, *n*	Moderate mental illness, *n* (%)	Moderate mental illness, AOR [95% CI]	Suicidality, *n* (%)	Suicidality, AOR [95% CI]
18-64					
Not depressed	189	11 (6)	1	13 (7)	1
Prototypic depression	69	54 (78)	51.35*** [21.94, 120.18]	42 (61)	18.76*** [8.86, 39.72]
Externalised depression	69	10 (20)	4.09** [1.60, 10.47]	9 (18)	2.99 * [1.19, 7.50]
Mixed depression	186	162 (87)	91.35*** [43.00, 194.06]	136 (73)	31.97*** [16.51, 61.90]
65+					
Not depressed	308	5 (2)	1	19 (6)	1
Prototypic depression	20	8 (40)	29.66*** [8.17, 107.670]	8 (40)	8.14*** [2.89, 22.97]
Externalised depression	41	4 (10)	5.37* [1.36, 21.26]	10 (24)	4.34*** [1.83, 10.29]
Mixed depression	54	36 (67)	105.05*** [36.48, 302.50]	41 (76)	42.69*** [19.47, 93.61]

Note. Total *N* = 916 due to 4 respondents not reporting previous depression diagnosis. AOR = adjusted odds ratio. OR for previous depression diagnosis not shown. Moderate mental illness defined as K10 ≥ 25. Suicidality defined as ≥ 1 on PHQ-9 item 9. Not depressed = PHQ-9 < 10 and MDRS-7 ≤ 5; Prototypic depression = PHQ-9 ≥ 10 and MDRS-7 ≤ 5; Externalised depression = PHQ-9 < 10 and MDRS-7 > 5; Mixed depression = PHQ-9 ≥ 10 and MDRS-7 > 5.
***$p < .001$, ** $p < .01$, * $p < .05$.

Table 4. Odds of being classified as depressed at follow up

Outcome: Depressed (PHQ-9 ≥ 10) at Time 2 (*n* = 328)	OR	95% CI
Age (older)	1.46	[0.69, 3.09]
Previous depression diagnosis (yes)	1.87	[0.88, 3.99]
PHQ-9 (Time 1)	1.24***	[1.15, 1.34]
Moderate (MDRS-7)	3.30**	[1.38, 7.90]
Severe (MDRS-7)	2.00	[0.76, 5.28]
Extremely severe (MDRS-7)	1.64	[0.28, 9.54]

Note. Reference category = low symptoms. ***$p < .001$, ** $p < .01$.



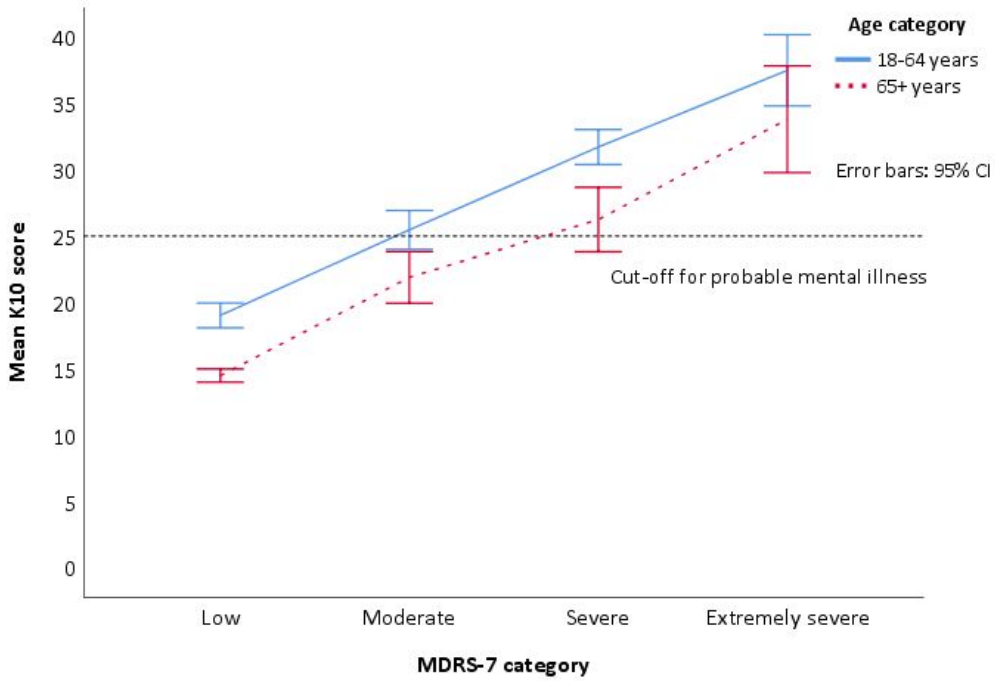


Figure 1. Effect of age and MDRS-7 category on prototypic depression symptoms (PHQ-9) and psychological distress (K10)

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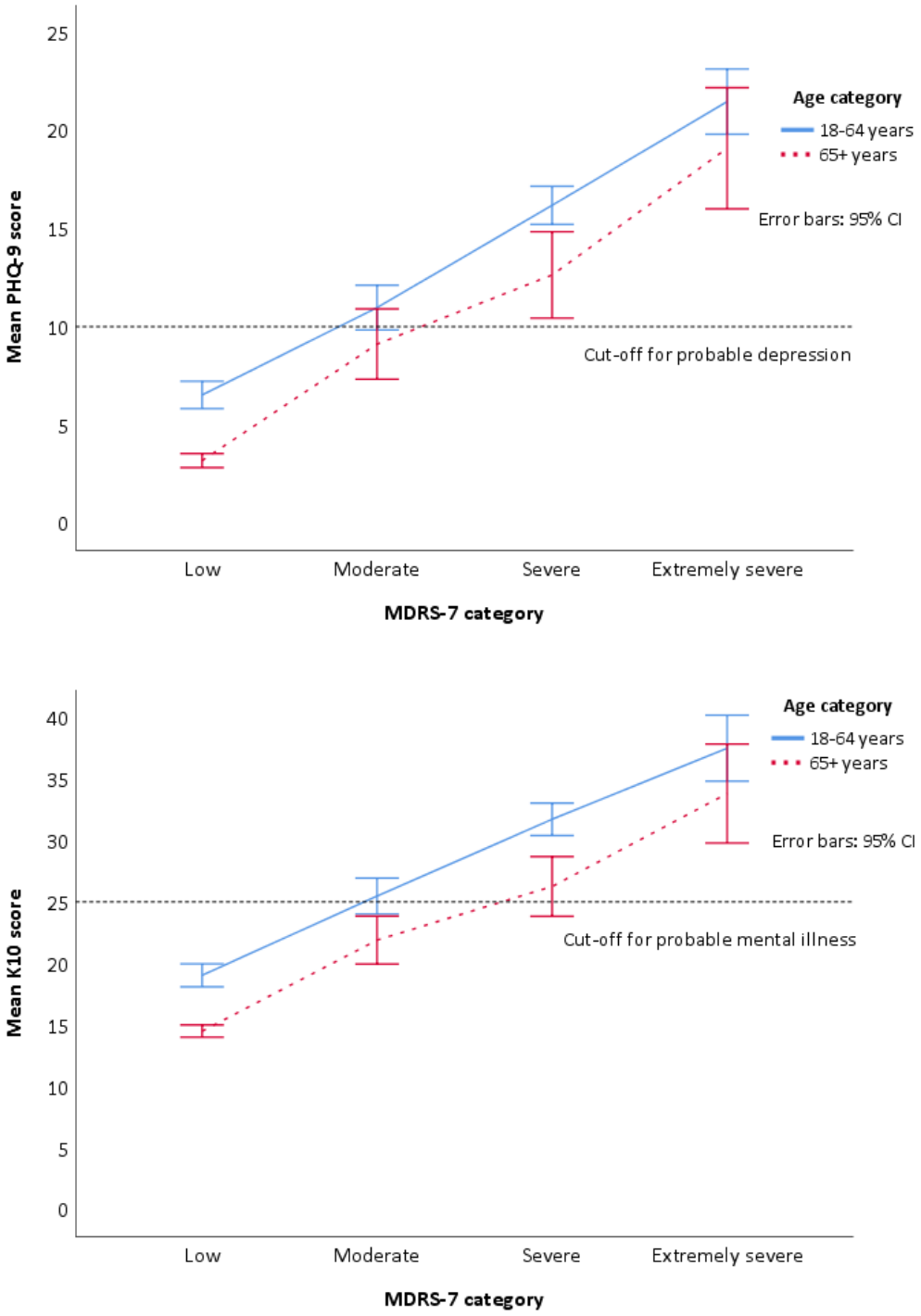
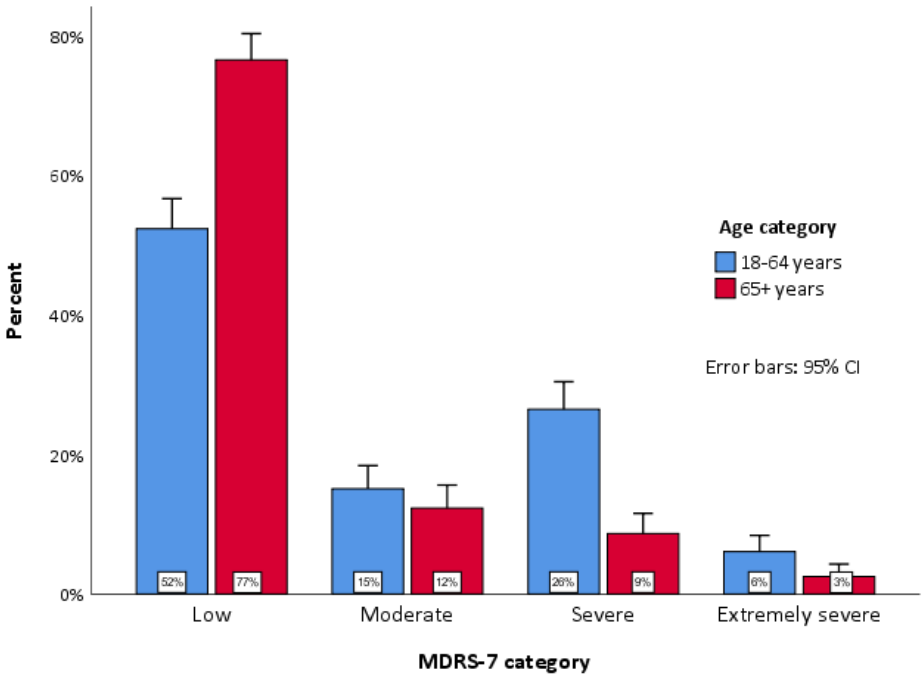


Figure 1. Effect of age and MDRS-7 category on prototypic depression symptoms (PHQ-9) and psychological distress (K10)

Supplementary Table 1. Descriptive and relational statistics for MDRS-22 items across younger and older age groups

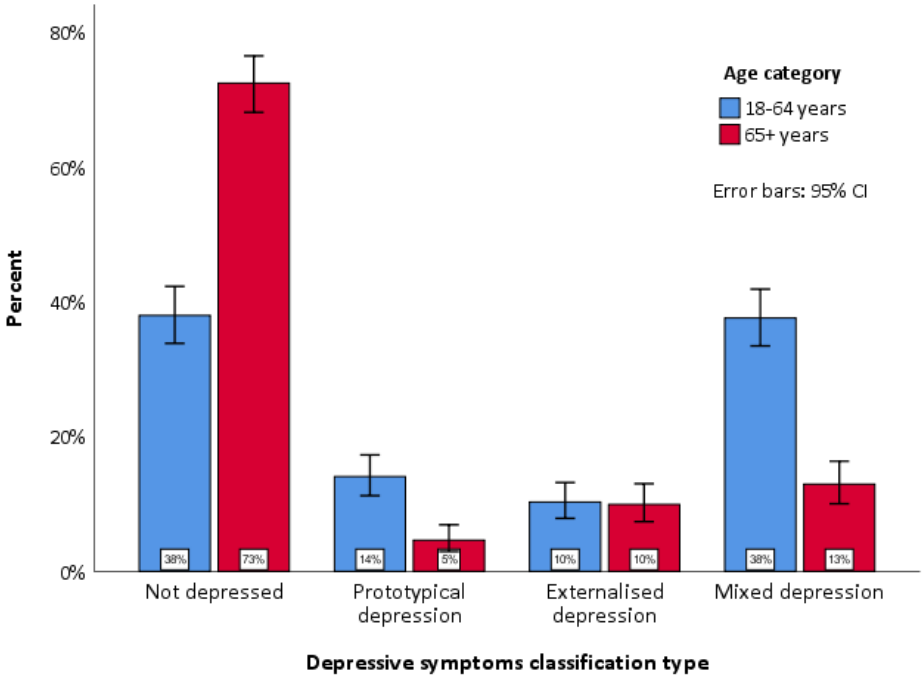
		Younger males							Older males						
Domain	Item	*M*	*SD*	Skew	Total(*r*)	Domain(*r*)	Other domains(*r*)	Item score[a]	*M*	*SD*	Skew	Total(*r*)	Domain(*r*)	Other domains(*r*)	Item score
Emotion Suppression	I tried to ignore feeling down	1.77	1.12	0.08	.62	.77	.46	1	1.34	1.26	0.51	.57	.77	.35	0
	I bottled up my negative feelings	1.93	1.16	0.01	.64	.86	.45	3	1.28	1.15	0.58	.73	.86	.52	3
	I covered up my difficulties	1.90	1.18	-0.04	.64	.85	.45	2	1.21	1.21	0.63	.72	.84	.51	0
	I had to work things out by myself	2.38	1.18	-0.31	.46	.68	.29	2	1.95	1.36	0.04	.58	.72	.39	3
Alcohol Use	I drank more alcohol than usual	0.80	1.09	1.24	.60	.89	.34	2	0.47	0.89	2.11	.59	.91	.33	0
	I stopped feeling so bad while drinking	0.80	1.14	1.22	.57	.86	.32	0	0.38	0.92	2.51	.58	.88	.33	0
	I needed alcohol to help me unwind	0.92	1.16	1.10	.60	.94	.32	5	0.52	0.94	2.02	.61	.94	.34	6
	I needed to have easy access to alcohol	0.53	0.98	1.93	.58	.87	.34	1	0.44	0.91	2.17	.59	.91	.33	0
Somatic Symptoms	I had more heartburn than usual	0.60	0.91	1.48	.39	.65	.26	0	0.38	0.71	1.87	.50	.70	.38	0
	I had regular headaches	0.89	1.04	1.07	.49	.74	.35	0	0.41	0.79	2.23	.54	.77	.42	0
	I had stomach pains	0.72	0.90	1.06	.53	.74	.40	2	0.38	0.76	2.33	.57	.77	.45	2
	I had unexplained aches and pains	1.05	1.13	0.80	.52	.78	.37	4	0.74	0.93	1.19	.57	.78	.44	5
Anger & Aggression	I overreacted to situations with aggressive behaviour	0.59	0.83	1.41	.52	.83	.38	2	0.41	0.70	1.80	.56	.85	.45	4
	I verbally lashed out at others without being provoked	0.28	0.61	2.54	.42	.77	.28	0	0.15	0.45	3.44	.45	.75	.34	0
	I was verbally aggressive to others	0.34	0.65	2.13	.46	.83	.31	0	0.20	0.49	2.85	.41	.80	.28	0
	It was difficult to manage my anger	0.58	0.84	1.48	.56	.84	.42	4	0.31	0.64	1.35	.58	.81	.47	2
Drug Use	I sought out drugs	0.32	0.79	2.64	.47	.94	.30	3	0.11	0.43	3.82	.33	.90	.23	4
	I used drugs to cope	0.32	0.81	2.79	.47	.94	.30	2	0.07	0.36	3.55	.31	.83	.23	0
	Using drugs provided temporary relief	0.33	0.84	2.73	.47	.95	.29	4	0.10	0.43	3.89	.40	.90	.31	4
Risk-Taking	I drove dangerously or aggressively	0.33	0.66	2.04	.33	.67	.24	0	0.12	0.37	3.14	.32	.60	.27	1
	I stopped caring about the consequences of my actions	0.54	0.87	1.69	.55	.82	.46	4	0.21	0.59	2.26	.54	.83	.47	5
	I took unnecessary risks	0.39	0.70	1.93	.56	.84	.46	3	0.15	0.46	3.21	.47	.82	.40	0

[a] Items received a score of 0 or 1 (which was summed) for each statistic within its corresponding domain as follows: highest mean; largest *SD*; skew closest to zero; strongest correlation with total score; strongest correlation with domain score; and strongest correlation with other domains.



Supplementary Figure 1. Proportion of participants within MDRS-7 categories

Note. Low (0 – 5), Moderate (6 – 7), Severe (8 – 12), Extremely severe (13+).



Supplementary Figure 2. Proportion of participants according to depressive symptoms classification type

Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the STROBE cross sectionalreporting guidelines, and cite them as:

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		Reporting Item	Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	4-6
Objectives	#3	State specific objectives, including any prespecified hypotheses	6
Methods			

Study design	#4	Present key elements of study design early in the paper	6
Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	6
	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-9
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	6-9
Bias	#9	Describe any efforts to address potential sources of bias	6
Study size	#10	Explain how the study size was arrived at	8-9
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	8-9
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	8-9
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	8-9
Statistical methods	#12c	Explain how missing data were addressed	8-9
Statistical methods	#12d	If applicable, describe analytical methods taking account of sampling strategy	N/A
Statistical methods	#12e	Describe any sensitivity analyses	N/A

Results			
Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	8-9
Participants	#13b	Give reasons for non-participation at each stage	N/A
Participants	#13c	Consider use of a flow diagram	N/A
Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	9-10
Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	8-9
Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	N/A
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included all estimates are reported in tables	All estimates are reported in Tables
Main results	#16b	Report category boundaries when continuous variables were categorized	8-9
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	N/A
Discussion			

Key results	#18	Summarise key results with reference to study objectives	12-15
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	14
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	12-15
Generalisability	#21	Discuss the generalisability (external validity) of the study results	14
Other Information			
Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	N/A