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Title:

A comparison of two measures to screen for mental health symptoms in pregnancy and early postpartum: the Matthey Generic Mood Questionnaire and the Depression, Anxiety, Stress Scales short-form

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## INTRODUCTION

Screening for possible depression during pregnancy and the early postpartum years is commonplace due to the well-established negative impacts that poor mental health has on a woman's ongoing emotional and physical wellbeing, her relationship with her partner, and her children's health and development (Buist 2002, Prince et al. 2007, Kurtz et al. 2017). Various mental health measures are used to screen for symptoms of depression, such as the Edinburgh Postnatal Depression Scale (EPDS) (Cox et al. 1987), the Primary Health Questionnaire (PHQ-9 (Kroenke et al. 2001) or -2 (Kroenke et al. 2003)), and a derivative of these, the Whooley questions (Whooley et al. 1997). The EPDS and Whooley questions are recommended in various perinatal guidelines including those from the US, Canada, the UK and Australia.

In recent years, clinicians and researchers have recognized the importance of screening for possible anxiety (Grant et al. 2008, Hirsch et al. 2017), as this too has similar negative consequences as for depression (Misri et al. 2010). In Australia, the national antenatal guidelines recommend screening for psychosocial wellbeing that includes depression and anxiety (Australian Government Department of Health and Ageing, 2018). To this end, various self-report anxiety measures have been developed or used in the perinatal period, including the Pregnancy-Related Anxiety Questionnaire (PRAQ) (Huizink et al. 2002) and the State-Trait Anxiety Inventory (STAI) (Spielberger et al. 1970). The UK guidelines recommend using the Generalized Anxiety Disorder 2-item (GAD-2) (Spitzer et al. 2006), while guidelines from countries such as Australia, Canada and the US are yet to choose a measure.

Notably, most screening measures are designed to assess for only one type of emotional difficulty. To screen for possible depression and anxiety typically requires two measures, which may be too time consuming for many clinical services. Another consideration is the continuous scoring format of many measures (e.g. the EPDS has a score ranging from 0-30), which means that screen-positive scores (those indicating the likely presence of the mood disorder) need to be defined for women with different cultural backgrounds and at different times in the antenatal and postpartum periods. These screen-positive scores can vary widely, e.g. validated screen positive scores on the EPDS for women across different cultures has been reported to range from 4 or more (Vietnamese women: see Shrestha et al. 2016) to 19 or more (South African women: Van der Westhuizen et al. 2018) Thus, clinical services that use

a measure with a continuous scoring format and serve women with a variety of cultural backgrounds may incorrectly identify the optimal screen-positive score for each woman. This can make the correct use of such measures impractical within clinical settings with women with diverse cultural backgrounds.

A more recent screening measure that attempts to overcome these single mood, time and screen-positive limitations is the Matthey Generic Mood Questionnaire (MGMQ) (Matthey et al. 2013). It is brief, with between two and four questions, asks about a variety of negative moods, and uses a categorical response format. The MGMQ has performed well for women in antenatal clinical settings against diagnostic criteria for depression and anxiety, and against various self-report measures of anxiety (both general and pregnancy-specific) and depression (Matthey et al. 2013; 2019, Matthey and Bilbao 2018, Matthey and Della Vedova 2020). It has also performed well for men when comparing it to the EPDS, in both Australia and Italy (Matthey and Della Vedova 2020).

The need for rapid screening of emotional difficulties is also relevant for research that prioritizes women who are at risk of, or experiencing, poor mental health. This is the context of the current paper, which sought a very brief screen for emotional difficulties to help identify eligible participants for a larger randomized controlled trial (RCT, “right@home”) of nurse home visiting. Eligible women who enrolled in the trial completed the Depression, Anxiety, Stress Scales short-form (DASS-21) (Lovibond and Lovibond 1995, Henry and Crawford 2005). While the DASS is not a diagnostic tool, it is one of the only broad-spectrum self-report measures of mental health and frequently used in research with clinical and population-level cohorts (Henry and Crawford 2005). However, it is less frequently used with perinatal populations. This is possibly due to its length and lack of suitability of some items for the perinatal period, which describe symptoms that can be due to normal physical changes, resulting in false positives. In contrast, the MGMQ was designed to screen for broad-ranging emotional difficulties and is well-tested in the perinatal period. As the MGMQ is yet to be compared with a broad-spectrum self-report measure of mental health such as the DASS-21, or for English-speaking postpartum women, data collected for the right@home trial offered the opportunity to contribute this new knowledge.

Therefore, the objective of this research was to compare the MGMQ with the DASS-21 using an existing research cohort of Australian women recruited during pregnancy and followed as

their children turned 1 and 2 years old. The specific aims were to investigate (1) the association between the MGMQ and DASS-21, and (2) how well the MGMQ detected women scoring high on the DASS-21, while also noting how well a high DASS-21 score detected women reporting on the MGMQ that they were substantially bothered by how they were feeling.

## **METHODS**

**Design:** This cross-sectional comparison of the MGMQ and DASS-21 was nested within the “right@home” randomized controlled trial (RCT) of nurse home visiting (details in the trial protocol (Goldfeld et al. 2017)). The current study was developed in response to the larger trial’s need to include a short measure of significant emotional difficulties in a brief survey of psychosocial and sociodemographic risk factors (termed ‘adversity’ throughout) known to impact children’s development. Assessing risk factors in a way that is acceptable to women and feasible in the public setting of antenatal waiting rooms can be challenging, and the process was thoroughly piloted (published in (Price et al. 2017, Price et al. 2018)). The resulting 10-item brief risk factor (BRF) survey included the MGMQ and was used to identify women who were experiencing adversity and thus eligible to participate in the trial. Given how few omnibus measures of mental health exist, the trial data provided an opportunity to compare the short MGMQ with the longer DASS-21, to evaluate how well the MGMQ approximates the DASS-21 measurement of mental health symptomatology during pregnancy and the first postpartum years.

**Setting and participants:** Participants were pregnant women attending antenatal clinics at 10 public maternity hospitals across Victoria and Tasmania between 30 April 2013 and 29 August 2014 who completed (a) the BRF (which included the 2-item MGMQ and identified eligibility for the trial and the current nested study), and (b) a subsequent home-based interview (which included the DASS-21, and provided baseline data prior to the trial allocation process (Goldfeld et al. 2017, Goldfeld et al. 2018)). Women were eligible for the right@home trial (and thus the current nested study) if they met the following criteria: (i) birth due dates before 1 Oct 2014, (ii) up to but not more than 36 weeks gestation, (iii) sufficient English for interviews, (iv) 2 or more of 10 risk factors on the BRF survey (details in Supplementary Table 1), and (v) home addresses within nurse travel boundaries. Women were excluded if (i) enrolled in an existing Tasmanian NHV program, (ii) did not comprehend the recruitment invitation (e.g. had insufficient English or intellectual disability),

(iii) had no mechanism for contact (e.g. telephone/email), or (iv) experienced a critical event (e.g. termination of pregnancy, stillbirth, or participant or child death) (Goldfeld et al. 2017).

**Procedure:** Women were invited to complete the MGMQ as part of the BRF survey collected at antenatal clinics. A median of 9 days later (interquartile range 6-17, range 0-167 days), women who were eligible for the trial were invited to complete the DASS-21 as part of the right@home enrollment interview. At 1 and 2 years postpartum, researchers collected the MGMQ followed by the DASS-21 as part of the direct follow-up assessments. This order reflects a convention in screening, which involves administering a broad initial screen followed by a more detailed follow-up assessment. While it is possible that the administration of one measure could influence a person's response to the follow-up measure, we felt that this order (MGMQ first) was less likely to sensitize a person to the more detailed DASS-21, than if the measures were administered the other way around. This paper reports data from the 729 women who provided both the MGMQ and DASS-21 for at least one time-point (pregnancy, or child ages 1 or 2 years). In pregnancy, only data for the 296 women who completed the two measures within 7 days of each other were analyzed because the DASS-21 asks respondents about the past week and, otherwise, the timeframes for the two measures did not overlap (see *Measures*, below).

### **Measures:**

Matthey General Mood Questionnaire: The trial and hence the current study collected the first two (of a possible four) MGMQ items with wording slightly changed from the original version (Matthey et al. 2013). The first (Distress) question asked, "*In the last 2 weeks, have you felt any of the following for some of that time: very stressed, anxious or unhappy, or found it difficult to cope?*" Responses options were "yes", "possibly" or "no". Answering "yes" or "possibly" are grouped together because some respondents may be reluctant to openly say "yes" for various reasons other than the severity of their distress (e.g. stigma, uncertainty of how they feel, reduced emotional expressiveness). Respondents who answered "yes" or "possibly" were asked the second (Bother Impact) question, "*How bothered have you been by these feelings?*" Responses options were "not at all", "a little bit", "moderately" or "a lot". In a clinical setting, a third 'Reason for Distress' question (if the Bother Impact question was endorsed) and fourth 'Wish for Referral' question can be collected; however, the focus of the current study was on women's experience of adversity broadly rather than

clinical-level mental health problems, using questions that could be asked by non-clinician researchers.

The MGMQ produces dichotomous, screen-positive responses depending on women's answers (Matthey and Bilbao 2018, Matthey and Della Vedova 2018). The larger right@home trial used the "*moderately bothered (or more)*" screen-positive threshold, whereby women were categorized as having significant emotional difficulties if they reported being "moderately" or "a lot" bothered to the Bother Impact question. Otherwise, women were classified as not having significant emotional difficulties. The "*moderately bothered (or more)*" screen-positive threshold has been endorsed by clinicians in Australia and Italy as the threshold to use within screening contexts (Matthey et al. 2013, Matthey and Della Vedova 2018). Other MGMQ screen-positive thresholds derived from the Bother Impact question are "*a little bit bothered (or more)*" for those who respond "a little bit", "moderately" or "a lot" to the Bother Impact question. In addition, "*a lot bothered*" (responding "a lot" to the Bother Impact question) can be examined, although it is not recommended in clinical settings given that it would miss too many people with significant emotional difficulties.

Administered in Australian antenatal clinical samples, the "*moderately bothered (or more)*" MGMQ screen-positive threshold has identified 84% and 87% of women scoring high or in the clinical range of the EPDS and HADS anxiety subscales, respectively, and 61% of women who score high on the PHQ-2 (Matthey et al. 2013, Matthey and Bilbao 2018). It has detected lower proportions of Australian women meeting diagnostic criteria for a depressive or anxiety disorder (51-56%), screening positive on the EPDS for depression only (48-69%) or either depression or anxiety (39-42%) (Matthey et al. 2019), or scoring high on pregnancy-specific anxiety measures including the PRAQ-revised (58%) and Pregnancy-Related Thoughts (67%) (Matthey et al. 2013).

The MGMQ "*a little bit bothered (or more)*" screen-positive threshold has naturally demonstrated higher sensitivity than the higher "*moderately bothered (or more)*" threshold: identifying 72%-75% pregnant Australian women meeting diagnostic criteria for a depressive or anxiety disorder (major or minor), and around two-thirds of women screening positive for EPDS depression only (68%-88%) or either depression or anxiety (61-64%) (Matthey et al. 2019). Similarly, in a sample of pregnant Italian women, the "*moderately bothered (or more)*" screen positive threshold identified fewer women responding high to EPDS

depression or anxiety (32%-37%) compared with the “*a little bit bothered (or more)*” screen positive response (63%-70%) (Matthey and Della Vedova 2018).

Depression, Anxiety, Stress Scales: The DASS-21 is the short version of the full-length DASS-42 (Lovibond and Lovibond 1995, Lovibond and Lovibond 1995). The short-form comprises 21 items rated on a 4-point scale ("not at all" to "most of the time") assessing three negative emotional states (comprising 7 items each) of Depression, Anxiety and Stress experienced during the past week. Scores are summed to produce a total score and scores for three subscales. Scores are doubled to represent the full-length DASS-42 (where the possible range for the Total score is 0-126 and for the three subscales is 0-42). Higher scores indicate increased risk. While the DASS is not a diagnostic tool nor validated against a gold standard instrument, the DASS-21 subscales have strongly correlated with other self-report mental health measures in Australian postpartum women, such as the EPDS ( $r=0.84$ ), and the anxiety and depression subscales of Beck Depression Inventory (BDI-II;  $r=0.82$  and  $0.86$ , respectively) (Cunningham et al. 2013), and is frequently used in Australian research with large community- and population-level cohorts (examples of published research in (Lovibond and Lovibond 1995)).

This paper dichotomized the DASS-21 in two ways. The first followed the categorization employed by the larger right@home trial, which dichotomized the DASS-21 total and subscale scores into high (top 15%) versus low (up to and including the 84<sup>th</sup> percentile) scores to identify women with poorer mental health, using normative data from 1794 UK adults (mean age 41 years (SD 15.9), range 18-91 years) (Henry and Crawford 2005). The cut-points are 12 or more for Depression; 8 or more for Anxiety; 18 or more for Stress and 18 or more for the Total scores. This is termed the “research” cut-point for high mental health symptomatology in this paper.

In addition to this “research” screen-positive cut-point, the DASS authors provide clinical categories (normal, mild, moderate, severe, extremely severe) for the DASS-42 to characterize clinical symptom severity for Australian adults. The DASS-42 scores that correspond to ‘moderate’ or higher clinical severity (termed “clinical” cut-points in this paper) are 14 or more for Depression, 10 or more for Anxiety, and 19 or more for Stress. No clinical cut-points exist for the DASS Total score or for the shorter DASS-21 (Lovibond and Lovibond 1995). In providing the DASS-42 clinical cut-points, the DASS authors emphasize

the dimensional nature of mental health symptoms, and state that the “labels are used to characterize the full range of scores in the population, so ‘mild’ for example means that the person is above the population mean but still well below the typical severity of people seeking help, i.e. it does not mean a mild level of a ‘disorder’” (see FAQ 5 in (Lovibond and Lovibond 1995)).

**Analyses:** For each participant, we calculated a count of the adverse BRF survey items and assigned data from the Socio-Economic Indexes for Areas (SEIFA) Index of Relative Disadvantage, a national area level index derived from census data for all individuals living in a postcode, with higher scores indicating greater advantage (Australian Bureau of Statistics Census of Population and Housing 2011). Demographic characteristics were described using means (SDs) for continuous data and frequencies (%) for categorical data. For Aim 1, associations between the MGMQ and “high” DASS-21 Total and subscale scores were calculated at each time-point using the Phi coefficient, a measure of the strength between two dichotomous variables (Matthey et al. 2013). Coefficients of 0.4 and above are considered strong; 0.3 to 0.39 are considered moderate; and 0.29 or less are considered weak.

For Aim 2, sensitivity, specificity, correct classification and positive predictive value were calculated using the percentage of “high” DASS Total and subscale scores that were captured by the MGMQ as being screen-positive (for both the “research” and “clinical” DASS cut-points). For comparison, these analyses were repeated for four different MGMQ screen-positive thresholds: (i) “*moderately bothered (or more)*”, (ii) “*a little bit bothered (or more)*”, (iii) “*a lot bothered (or more)*” and (iv) responses to the *Distress* question only. The latter categorized women as having significant emotional difficulties if they reported “possibly”/“yes” versus “no” to the first *Distress* question, regardless of any response to the *Bother Impact* question. While the *Distress* question was not intended for clinical use as a single question, this comparison was conducted to inform research studies such as the *right@home* trial that seek single screening items. Data were analyzed using Stata 13.1 (StataCorp, College Station, TX).

**Ethical approval:** This study was approved by the Human Research Ethics Committees of: The Royal Children’s Hospital (HREC 32296); Peninsula Health (HREC/13/PH/14); Ballarat Health Services (HREC/13/BHSSJOG/9); Southern Health (HREC 13084X); Northern

Health (HREC P03/13) in Victoria, Australia; and The University of Tasmania (HREC H0013113), Tasmania, Australia.

## RESULTS

Figure 1 shows that 5586 women were surveyed for the larger trial, comprising 1427 eligible and 4159 ineligible women (who reported only one (n=1658) or zero (n=1753) risk factors or met other exclusion criteria (n=748)). Of the 1427 eligible women, 729 completed the enrollment interview, 348 declined, and 350 were excluded because they were not contactable (n=348) or experienced a critical event (n=2). At enrollment, 296/729 (41%) women completed the MGMQ and DASS-21 within 7 days. At 1 and 2 years, 625 (86%) and 573 (79%) women, respectively, completed both measures. Visual inspection of participant characteristics (Table 1) suggests they were similar across the three time-points, with minor loss to follow-up of women experiencing greater adversity according to SEIFA quintile, education level, and number of BRF items.

Table 2 describes how women responded to the MGMQ at each time point. Similar proportions of women said they were “yes” or “possibly” distressed at each time point (approximately 30% for either response option). In pregnancy, 31% of all women were bothered “moderately” or “a lot” while the proportions were lower at 1 and 2 years (23% and 20%, respectively). Women reporting “yes” to the Distress question were around 2-3 times more likely to say it bothered them “moderately” or “a lot” compared with women who said they were “possibly” distressed. The proportion of women who said “possibly” to the Distress question and that this bothered them “moderately” or “a lot” was 31% in pregnancy and 17% at 1 and 2 years postpartum. Between 7-9% of all women said they were bothered “a lot” at each time point.

Table 3 describes women's responses to the DASS-21 at the three time points. The proportions of women identified as scoring high using the "research" cut-points were higher than the 15% normed at the populations level for the Anxiety scale at all time points (42% in pregnancy, and 21% at 1 and 2 years), and for Depression and Stress in pregnancy (19% and 21%, respectively). The proportions were similar or less than the 15% population norms for the Depression and Stress subscale scores at 1 and 2 years (ranging 11% to 16%). Almost half of the cohort scored high on one or more of the DASS-21 scales in pregnancy, and just over a quarter at 1 and 2 years. The proportions of women scoring high according to the

DASS "clinical" cut-point ('moderate' or more according to the DASS manual) were more similar to the MGMQ proportions, with 36% scoring high on one or more scale in pregnancy, and 20% at 1 or 2 years (compared with 31%, 23%, 22%, respectively, responding to the *moderately bothered (or more)* threshold of the MGMQ).

Table 4 presents associations (Aim 1) between the MGMQ "*moderately bothered (or more)*" threshold option and "high" DASS scores for both "research" and "clinical" categorizations. Neither categorization outperformed the other. Associations were weak-to-moderate during pregnancy (values ranged from 0.16 to 0.37), and moderate-to-strong during the postpartum years (values ranged from 0.34 to 0.49).

Tables 5 and 6 present how well the MGMQ detected women scoring high on the DASS-21 (Aim 2) for the "research" and "clinical" categorizations of the DASS-21, respectively. For both DASS categorizations, the MGMQ "*moderately bothered (or more)*" threshold captured between half and three-quarters of women scoring high on the DASS-21 Depression and Stress scores (and Total for the "research" categorization only). Sensitivity for the Anxiety subscale was lower, ranging from 39-48% for high DASS scores according to the "research" categorization, and 45-60% for the "clinical" categorization. Sensitivity for all DASS scores was higher during the postpartum years than in pregnancy. The MGMQ "*moderately bothered (or more)*" threshold demonstrated better specificity for all DASS scores and across the two high score definitions than sensitivity.

When comparing the MGMQ screen-positive response options, Tables 5 and 6 shows similar patterns between the DASS-21 subscales and time points: sensitivity was greatest for the "*Distress only*" option, similar but slightly lower for "*a little bit bothered*" response option, and overall lower during pregnancy than the postpartum years. Correct classification and PPV were highest for the "*a lot bothered*" MGMQ response threshold, though again it should be noted that this is not a recommended screen-positive threshold for clinical settings.

Analyses of women screening positive on the MGMQ Bother Impact question shows that the DASS, using the varying clinical thresholds for the three subscales, detects only around half of the women saying that they are "*moderately bothered*" by how they are feeling at all three time points (pregnancy: 49%; 1-year postpartum: 44%; 2-years postpartum: 45%), and just over two-thirds of those saying that they are "*a lot bothered*" by how they are feeling (68%,

72%, 70%, respectively). Combining these figures shows that screening positive on one or more DASS subscale detects around half of the women saying they are either “*moderately bothered*” or “*a lot bothered*” on the MGMQ at each time point (54%, 54%, 56% respectively).

## DISCUSSION

In this large cohort of Australian women, associations between the MGMQ “*moderately bothered (or more)*” threshold and DASS-21 were weak-to-moderate during pregnancy and moderate-to-strong at 1 and 2 years postpartum. The MGMQ “*moderately bothered (or more)*” threshold detected upwards of 40% of women scoring high on the DASS Total and subscale scores according to “research” (top 15% based on population norms) and “clinical” (moderate or more) cut-points. Sensitivity was higher for Depression and Stress subscales than the Anxiety subscale, and for postpartum rather than antenatal measurement.

In the context of screening – as for this paper – sensitivity should be prioritized, as the need to capture all women experiencing any clinically significant emotional difficulty outweighs the need for accurate, initial categorization. The sensitivity of the MGMQ in detecting “high” DASS-21 scores increased considerably when the MGMQ threshold included the broader “*a little bit bothered*” option and was highest when based on the Distress question alone, capturing over 90% of women across timepoints for the DASS-21 Total, Depression and Stress scores, and over 80% of women across timepoints for the DASS-21 Anxiety subscale score. This finding may be because the DASS-21 asks about “frequency” of symptoms, which is different to “impact”, and thus aligns better with the Distress rather than the Impact question.

Compared with previous MGMQ analyses, the current study found that the MGMQ “*moderately bothered (or more)*” screen-positive threshold demonstrated greater sensitivity in detecting “high” DASS-21 Depression scores (“research” or “clinical” categorizations) than the EPDS collected from pregnant Italian women (EPDS sensitivity: 32%-43% and PPV: 12%-40%), and was comparable to the PHQ-2 (61%) collected from pregnant Australian women (Matthey and Bilbao 2018, Matthey and Della Vedova 2018). Similarly, responding to the Distress question alone (“yes” or “possibly”) demonstrated greater sensitivity and comparable PPV for the DASS-21 Depression subscale than the EPDS during pregnancy (sensitivity: 63%-88%, PPV: 5%-28%) (Matthey and Della Vedova 2018).

In contrast, the MGMQ “*moderately bothered (or more)*” threshold demonstrated lower sensitivity for the DASS-21 Anxiety subscale (“research” or “clinical” categorizations) than anxiety measures such as the Pregnancy Related Anxiety Questionnaire-Revised (PRAQ-R, 58%) and HADS Anxiety Scale (HADS-A, 87%) (Matthey et al. 2013). This may be because

the DASS-21 does not exclude symptoms commonly associated with pregnancy. For example, four of the seven DASS-21 Anxiety items ask about symptoms that can be commonly associated with physical or hormonal changes in pregnancy (dry mouth, difficulty breathing, trembling hands, awareness of the heart), rather than a requirement for a perinatal mood measure. The lower sensitivity of the MGMQ in detecting “high” DASS-21 scores during pregnancy than postpartum may also be due to the gap between administering the two measures (up to 7 days in the current analyses), during which time the woman’s mood may have changed.

The DASS ‘moderate’ or more threshold missed a substantial proportion (~50%) of women saying on the MGMQ, that they were “*moderately bothered*” or “*a lot bothered*” by how they were feeling. This proportion is similar to the rates of missed detection by the EPDS, PHQ-2, and Diagnostic interview (Matthey and Bilbao 2018, Matthey and Della Vedova 2018, Matthey and Della Vedova 2020, Matthey et al. 2019). In a clinical setting it is difficult to imagine dismissing a woman’s expressed concern about how she feels emotionally, simply because she has not endorsed sufficient symptoms on other measures. Thus, including the other two MGMQ clinical questions (‘Reasons for Distress’ and ‘Wish for Referral’) can help clinical services understand with more precision a woman’s individual situation, and whether further assessment and possible intervention should be considered.

Strengths of this study include it being the first to investigate the association and agreement between the MGMQ and a broad-spectrum mental health measure, the first to examine the agreement between the measures during pregnancy and the early postpartum years, and sampling a large cohort of Australian women drawn from multiple sites and states. There were also limitations. Women invited into the larger trial were prioritized for their experience of adversity during pregnancy (reporting two or more of 10 risk factors, which included significant emotional difficulties), making it difficult to say whether the MGMQ and DASS-21 would compare differently for women reporting zero or one risk factor. The order of postpartum administration (collecting the MGMQ before the DASS-21) may have influenced women’s responses in a way that may have been different had the order been reversed, or only one measure collected.

The DASS “research” and “clinical” cut-points used in this paper are based on adult populations that differ to the cohort of pregnant Australian women participating in the current

study. As mentioned, the DASS-21 is a non-perinatal specific measure and thus contains items that overlap with common pregnancy and postpartum symptoms that may not indicate an increased level of mental distress outside of common motherhood experiences. Given that the larger right@home trial was longitudinal, the DASS-21 was chosen for use as a repeated, broad-spectrum mental health measure, instead of selecting different pregnancy and postpartum measures. The difference between emotional states experienced by women in the antenatal and postpartum years is evident in the proportions of women reporting high scores on the MGMQ and DASS during those periods. Furthermore, the self-report scales are not diagnostic. Even though the MGMQ and DASS-21 demonstrated some overlap, it is unclear to what extent the overlap identifies mental health diagnoses. However, the aim of screening with these scales is to detect women who probably have a high level of distress, rather than to only detect those who probably meet diagnostic criteria for a mood disorder. Indeed, such criteria are considered by some to lack empirical support (Tyrrer 2014; Zimmerman et al. 2006) and be of questionable validity during the perinatal period (Kammerer et al. 2009, Matthey and Ross-Hamid 2011).

Of note is that the DASS response options include both frequency of symptoms and the extent of them (e.g. “Applied to me to a considerable degree or a good part of time”), though it is unclear which domain any respondent is using when they answer each question. The MGMQ differs in that it asks about the level of impact the domain is having on the person (e.g. “How bothered are you by these feelings? (response) – Moderately”), or in the full MGMQ whether or not the respondent wishes to talk with a health professional. Thus, the MGMQ’s approach is consistent with DSM-5’s necessary diagnostic criterion of the symptoms causing a substantial impact on the individual’s daily life (American Psychiatric Association, 2013). Whether enquiring about frequency of symptoms is thus a good proxy for severity or impact seems questionable (e.g. having a small worry frequently would not necessarily indicate that it is having a large impact on the individual).

In the context of research that screens or selects women at risk of poor mental health, the findings of this study can help researchers decide whether to use a short screen like the MGMQ and, if so, which balance of sensitivity, specificity and correct classification will best suit their needs. For example, the current findings suggest that a substantial proportion of women who may have been experiencing clinically significant levels of emotional difficulty as defined by a “high” DASS (bearing in mind that some of its items are normal physical

sequelae of the perinatal period) would not be referred for further assessment if their mental health was measured using the MGMQ “*moderately bothered (or more)*” screen-positive threshold. However, they would be referred if screening positive to the MGMQ “*a little bit bothered (or more)*” threshold or Distress item only. This paper also found that although agreement between the MGMQ and Anxiety subscale was consistently lower than the other DASS-21 scores, a higher proportion of true positives on the Anxiety scale were captured by the MGMQ. Using the DASS “clinical” (‘moderate’ or more) threshold; however, would miss a substantial number of women saying on the MGMQ that they were bothered “*moderately*” or “*a lot*” by how they were feeling.

For the purposes of screening in research studies, simply collecting the Distress question may provide the most efficient option for identifying women experiencing any clinically significant emotional difficulty. However, this would result in a large proportion of ‘false positives’ that would be greatly reduced by including the second Bother Impact question (as in the right@home trial). With regards to clinical use, the current findings suggest that while there is overlap between the MGMQ and DASS-21, they may measure somewhat different constructs of mental health. This could be because the DASS-21 asks about the frequency of symptoms, which is different to the distress or impact they cause, as measured by the MGMQ.

## **CONCLUSION**

In a large cohort of Australian women, the MGMQ and DASS-21 appeared to assess overlapping but distinct constructs of mental health. Associations between the two measures were stronger in the postpartum years than in pregnancy. In the context of clinical or population-level research that relies on rapid screening to identify women at risk of poor mental health, a majority of women scoring “high” on the DASS-21 could be identified with various thresholds of the 2-item MGMQ, further supporting its feasibility for use in busy settings. In clinical contexts, using the full MGMQ (4 questions), which includes questions about the respondent’s reasons for feeling distressed (if the Bother Impact question was endorsed), and whether or not they would like to speak with a health professional about how they are feeling (the ‘Wish for Referral’ question), may be helpful, building on the usefulness of the rapid 2-question screen. In the context of identifying women with perinatal mental health concerns for research, these findings can help researchers decide whether to use a short

screening questionnaire like the MGMQ and, if so, which balance of sensitivity, specificity and correct classification will best suit their needs.

## **ABBREVIATIONS**

BDI: Beck Depression Inventory

BRF: Brief risk factor

CFH: Child and Family Health

DASS-21: Depression, Anxiety, Stress Scales short-form

DASS-42: Depression, Anxiety, Stress Scales long-form

EPDS: Edinburgh Postnatal Depression Scale

GAD-2: Generalized Anxiety Disorder 2-item

HADS: Hospital Anxiety and Depression Scale

MGMQ: Matthey General Mood Questionnaire

NHV: Nurse home visiting

PHQ: Primary Health Questionnaire

PPV: Positive predictive value

PRAQ: Pregnancy-Related Anxiety Questionnaire

RCT: Randomized controlled trial

STAI: State-Trait Anxiety Inventory

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**Table 1:** Participant characteristics at pregnancy and child ages 1 and 2 years

<b>Participant Characteristics</b>	<i>Pregnancy</i>	<i>1 year</i>	<i>2 years</i>
	N = 296	N = 625	N = 573
	n (%)	n (%)	n (%)
Maternal age at baseline (years), mean (SD), [range]	27.4 (6.1), [15-49]	27.7 (6.3), [14-49]	27.8 (6.3), [14-49]
State			
Victoria	208 (70.5)	423 (67.7)	405 (70.7)
Tasmania	87 (29.5)	202 (32.3)	168 (29.6)
Area socioeconomic disadvantage (SEIFA quintile)			
1 (greatest disadvantage)	115 (39.7)	254 (41.9)	223 (40.2)
2	28 (9.7)	48 (7.9)	43 (7.7)
3	112 (38.6)	238 (39.3)	225 (40.5)
4	26 (9)	48 (7.9)	48 (8.6)
5 (least disadvantage)	9 (3.1)	18 (3.0)	16 (2.9)
Education			
Did not complete high school	67 (24.8)	137 (24.5)	126 (24.2)
Completed high school	25 (9.3)	42 (7.5)	42 (8.1)
Completed vocational training	150 (55.6)	318 (56.9)	293 (56.3)
Completed university degree or higher	28 (10.4)	62 (11.1)	59 (11.3)
First child	107 (36.1)	233 (37.4)	216 (37.7)
Number of BRF survey items			
2	115 (38.9)	247 (39.5)	231 (40.3)
3	88 (29.7)	192 (30.7)	179 (31.2)
4	46 (15.5)	93 (14.9)	84 (14.7)
5 or more	47 (15.9)	93 (14.9)	79 (13.8)

BRF: Brief risk factor; SD: Standard deviation; SEIFA: Socio-Economic Indexes for Areas

**Table 2:** Frequency and percentage (n (%)) of women within each MGMQ response category at pregnancy and child ages 1 and 2 years

<b>Bother Impact</b>	<b>Distress</b>			<b>Total</b>
	Yes	Possibly	No	
<i>Pregnancy</i>				
N/A	-	-	100 (100.0%)	100 (33.8%)
Not at All	4 (3.8%)	12 (13.3%)	-	16 (5.4%)
A Little Bit	39 (36.8%)	50 (55.6%)	-	89 (30.1%)
Moderately	42 (39.6%)	27 (30%)	-	69 (23.3%)
A Lot	21 (19.8%)	1 (1.1%)	-	22 (7.4%)
<b>Total</b>	106 (35.8%*)	90 (30.4%*)	100 (33.8%*)	<b>296</b>
<i>Child age 1 year</i>				
N/A	-	-	231 (100.0%)	230 (36.8%)
Not at All	6 (3.1%)	27 (13.6%)	-	33 (5.3%)
A Little Bit	80 (40.8%)	138 (69.7%)	-	218 (34.9%)
Moderately	69 (35.2%)	24 (12.1%)	-	93 (14.9%)
A Lot	41 (20.9%)	9 (4.5%)	-	50 (8.0%)
<b>Total</b>	196 (31.4%*)	198 (31.7%*)	231 (37.0%*)	<b>625</b>
<i>Child age 2 years</i>				
N/A	-	-	241 (100.0%)	241 (42.1%)
Not at All	4 (2.7%)	21 (11.5%)	-	25 (4.4%)
A Little Bit	61 (40.7%)	130 (71.4%)	-	191 (33.3%)
Moderately	42 (28.0%)	23 (12.6%)	-	65 (11.3%)
A Lot	43 (28.7%)	8 (4.4%)	-	51 (8.9%)
<b>Total</b>	150 (26.2%*)	182 (31.8%*)	241 (42.1%*)	<b>573</b>

N/A: Answered “no” to the first Distress question.

\*proportion is of the row total; all other proportions are calculated for the column totals.

**Table 3:** Summary of women’s DASS scores at pregnancy and child ages 1 and 2 years

<b>DASS scores</b>	<i>Pregnancy</i> N = 296	<i>1 year</i> N = 625	<i>2 years</i> <sup>d</sup> N = 573
DASS-21 Mean (standard deviation) <sup>a</sup>			
Depression	6.3 (7.0)	4.5 (6.1)	4.5 (6.1)
Anxiety	7.2 (6.6)	4.1 (5.6)	4.0 (5.5)
Stress	11.5 (8.3)	9.0 (7.5)	8.8 (7.3)
Total score	25.0 (19.5)	17.6 (16.9)	17.3 (16.9)
High according to DASS-21 “Research” cut-point, n (%) <sup>b</sup>			
Depression	56 (18.9)	66 (10.6)	66 (11.6)
Anxiety	125 (42.2)	130 (20.8)	118 (20.7)
Stress	63 (21.3)	85 (13.6)	72 (12.7)
Total score	76 (25.7)	97 (15.5)	78 (13.7)
On any 1 or more of the 3 subscales	142 (48.0)	167 (26.7)	155 (27.3)
High according to DASS-42 “Clinical” cut-point, n (%) <sup>c</sup>			
Depression	45 (15.2)	51 (8.2)	49 (8.6)
Anxiety	92 (31.1)	93 (14.9)	88 (15.4)
Stress	51 (17.2)	62 (9.9)	59 (10.4)
On any 1 or more of the 3 subscales	107 (36.2)	122 (19.5)	115 (20.3)

<sup>a</sup> Higher scores represent increasing mental health symptoms.

<sup>b</sup> High “Research” cut-point refers to the top 15% according to normed UK adult data (Henry and Crawford 2005).

<sup>c</sup> High “Clinical” cut-point refers to the ‘moderate’ or more thresholds in the DASS manual (Lovibond and Lovibond 1995).

<sup>d</sup> N=569 for DASS Depression and Stress scales, and 568 for Anxiety and Total scales.

**Table 4:** Phi coefficients estimating associations between the MGMQ “moderately bothered (or more)” screen-positive threshold and “high” DASS scores at pregnancy and child ages 1 and 2 years

Phi coefficients	“High” DASS Score <sup>a</sup>			
	Total	Depression	Anxiety	Stress
“Research” categorization <sup>b</sup>				
<i>Pregnancy</i> (N=296)	0.25	0.37	0.16	0.26
<i>Child age 1 year</i> (N=625)	0.44	0.37	0.35	0.44
<i>Child age 2 years</i> (N=569) <sup>c</sup>	0.49	0.46	0.36	0.39
“Clinical” categorization <sup>d</sup>				
<i>Pregnancy</i> (N=296)		0.30	0.21	0.27
<i>Child age 1 year</i> (N=625)	N/A	0.34	0.37	0.44
<i>Child age 2 years</i> (N=569) <sup>c</sup>		0.44	0.35	0.42

<sup>a</sup> Higher scores represent increasing mental health symptoms

<sup>b</sup> High “Research” cut-point refers to the top 15% according to normed UK adult data (Henry and Crawford 2005).

<sup>c</sup> N=569 for DASS Depression and Stress scales, and 568 for Anxiety and Total scales.

<sup>d</sup> High “Clinical” cut-point refers to the ‘moderate’ or more thresholds in the DASS manual (Lovibond and Lovibond 1995).

**Table 5:** Sensitivity, specificity, correctly classified (class.) and positive predictive value (PPV) (all %) for four MGMQ screen-positive thresholds, using the DASS-21 total and subscale “research” scores (top 15% of normed data)

	MGMQ Screen-positive thresholds															
	Moderately (or more)	A lot	A little bit (or more)	Distress only	Moderately (or more)	A lot	A little bit (or more)	Distress only	Moderately (or more)	A lot	A little bit (or more)	Distress only	Moderately (or more)	A lot	A little bit (or more)	Distress only
	DASS-21 Total				DASS-21 Depression				DASS-21 Anxiety				DASS-21 Stress			
<i>Pregnancy</i>																
Sensitivity	<b>50.0</b>	19.7	90.8	94.7	<b>66.1</b>	21.4	96.4	98.2	<b>39.2</b>	11.2	77.6	82.4	<b>54.0</b>	19.0	92.1	95.2
Specificity	<b>75.9</b>	96.8	49.5	43.6	<b>77.5</b>	95.8	47.5	41.3	<b>75.4</b>	95.3	51.5	45.6	<b>75.5</b>	95.7	47.6	41.6
Correctly class.	<b>69.3</b>	77.0	60.1	56.8	<b>75.3</b>	81.8	56.8	52.0	<b>60.1</b>	59.8	62.5	61.1	<b>70.9</b>	79.4	57.1	53.0
PPV	<b>41.8</b>	68.2	38.3	36.7	<b>40.7</b>	54.5	30	28.1	<b>53.8</b>	63.6	53.9	52.6	<b>37.4</b>	54.5	32.2	30.6
<i>Child age 1 year</i>																
Sensitivity	<b>66.0</b>	30.9	91.8	93.8	<b>68.2</b>	37.9	92.4	95.5	<b>51.5</b>	22.3	84.6	86.9	<b>69.4</b>	34.1	92.9	94.1
Specificity	<b>85.0</b>	96.2	48.5	42.6	<b>82.5</b>	95.5	46.3	40.8	<b>84.6</b>	95.8	49.3	43.2	<b>84.4</b>	96.1	47.8	41.9
Correctly class.	<b>82.1</b>	86.1	55.2	50.6	<b>81.0</b>	89.4	51.2	46.6	<b>77.8</b>	80.5	56.6	52.3	<b>82.4</b>	87.7	53.9	49.0
PPV	<b>44.8</b>	60.0	24.7	23.1	<b>31.5</b>	50.0	16.9	16.0	<b>46.9</b>	58.0	30.5	28.7	<b>41.3</b>	58.0	21.9	20.3
<i>Child age 2 years</i>																
Sensitivity	<b>69.2</b>	43.6	97.4	98.7	<b>71.2</b>	47.0	95.5	97.0	<b>48.3</b>	27.1	89.0	90.7	<b>61.1</b>	38.9	95.8	98.6
Specificity	<b>87.6</b>	96.7	53.3	48.4	<b>86.5</b>	96.2	51.9	47.1	<b>87.2</b>	96.0	55.8	50.7	<b>85.7</b>	95.6	52.5	47.9
Correctly class.	<b>85.0</b>	89.4	59.3	55.3	<b>84.7</b>	90.5	56.9	52.9	<b>79.1</b>	81.8	62.6	58.9	<b>82.6</b>	88.4	58.0	54.3
PPV	<b>47.0</b>	68.0	24.9	23.3	<b>40.9</b>	62.0	20.7	19.4	<b>49.6</b>	64.0	34.4	32.4	<b>38.3</b>	56.0	22.6	21.5

MGMQ screen-positive response options:

- “moderately bothered (or more)”: responding “moderately” or “a lot” bothered to the Bother Impact question.
- “a lot bothered (or more)”: responding “a lot” to the Bother Impact question (note: this is not intended to be used as a screen positive threshold in the clinical setting).
- “a little bit bothered (or more)”: responding “a little bit”, “moderately” or “a lot” to the Bother Impact question; and
- *Distress question only*: categorizing women as having significant emotional difficulties if they reported “possibly”/“yes” to the first Distress question, without considering second Bother Impact response. (Note, the Distress question alone is not intended to be used as a screen-positive threshold in the clinical setting.)

**Table 6:** Sensitivity, specificity, correctly classified (class.) and positive predictive value (PPV) (all %) for four MGMQ screen-positive thresholds, using the DASS-21 “clinical” subscale scores (moderate and above)

	MGMQ Screen-positive thresholds															
	Moderately (or more)	A lot	A little bit (or more)	Distress only	Moderately (or more)	A lot	A little bit (or more)	Distress only	Moderately (or more)	A lot	A little bit (or more)	Distress only	Moderately (or more)	A lot	A little bit (or more)	Distress only
	DASS-21 Total				DASS-21 Depression				DASS-21 Anxiety				DASS-21 Stress			
<i>Pregnancy</i>																
Sensitivity					<b>65</b>	24	92	94	<b>44.7</b>	12.4	81	85.8	<b>59.8</b>	22.4	89.7	91.6
Specificity		N/A			<b>75.3</b>	96.2	46.4	41.4	<b>76.2</b>	96	51.1	46.5	<b>74.8</b>	96.2	46.5	41.3
Correctly class.					<b>73.9</b>	86.3	52.7	48.6	<b>66.5</b>	70.2	60.3	58.7	<b>72.6</b>	85.4	52.8	48.7
PPV					<b>29.4</b>	50	21.4	20.3	<b>45.7</b>	58.3	42.6	41.8	<b>29</b>	50	22.3	21.1
<i>Child age 1 year</i>																
Sensitivity					<b>70.6</b>	43.1	92.2	96.1	<b>60.2</b>	28	86	87.1	<b>79</b>	40.3	95.2	96.8
Specificity		N/A			<b>81.4</b>	95.1	45.3	39.9	<b>83.6</b>	95.5	47.2	41.2	<b>83.3</b>	95.6	46.4	40.7
Correctly class.					<b>80.5</b>	90.9	49.1	44.5	<b>80.2</b>	85.4	53	48	<b>82.9</b>	90.1	51.2	46.2
PPV					<b>25.2</b>	44	13	12.4	<b>39.2</b>	52	22.2	20.6	<b>34.3</b>	50	16.3	15.2
<i>Child age 2 years</i>																
Sensitivity					<b>77.6</b>	51	98	100	<b>53.4</b>	30.7	89.8	90.9	<b>69.5</b>	45.8	94.9	98.3
Specificity		N/A			<b>85.2</b>	95.2	50.6	46	<b>85.9</b>	95.2	53.1	48.1	<b>85.5</b>	95.5	51.2	46.7
Correctly class.					<b>84.5</b>	91.4	54.7	50.6	<b>80.9</b>	85.3	58.8	54.7	<b>83.8</b>	90.3	55.7	52
PPV					<b>33</b>	50	15.7	14.8	<b>40.9</b>	54	25.9	24.2	<b>35.7</b>	54	18.4	17.6

MGMQ screen-positive response options:

- “moderately bothered (or more)”: responding “moderately” or “a lot” bothered to the Bother Impact question.
- “a lot bothered (or more)”: responding “a lot” to the Bother Impact question (note: this is not intended to be used as a screen positive threshold in the clinical setting).
- “a little bit bothered (or more)”: responding “a little bit”, “moderately” or “a lot” to the Bother Impact question; and
- *Distress question only*: categorizing women as having significant emotional difficulties if they reported “possibly”/“yes” to the first Distress question, without considering second Bother Impact response. (Note, the Distress question alone is not intended to be used as a screen-positive threshold in the clinical setting.)

