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A randomised controlled trial of 'MUMentum postnatal': Internet-delivered cognitive behavioural therapy for anxiety and depression in postpartum women

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1. Introduction

Maternal anxiety and depression is common during the first 12 months after childbirth (i.e., postpartum period), with 10–15% of mothers likely to meet diagnostic criteria for an anxiety disorder or Major Depressive Disorder (MDD; Dennis, Falah-Hassani, & Shiri, 2017; Woody, Ferrari, Siskind, Whiteford, & Harris, 2017). If left untreated, anxiety and depression adversely affect both the mother and infant (e.g., reduced maternal self-care, poor childhood emotional and behavioural development; Stein et al., 2014). Despite the deleterious effects of postpartum mental health problems, effective treatments exist.

Cognitive behavioural therapy (CBT) is recommended for the treatment of mild to moderate anxiety and/or depression in postpartum women (Austin, Highet, & Expert Working Group, 2017). Yet, due to an absence of routine screening in primary care, postpartum anxiety and depression remain under-detected and undertreated (Biaggi, Conroy, Pawlby, & Pariante, 2016). Indeed, less than half of the women who are anxious or depressed seek help or receive evidence-based treatment such as CBT (Austin et al., 2008; Goodman & Tyer-Viola, 2010). This is due to a range of barriers that limit mothers' access and engagement with traditional face-to-face treatment services, including long waiting lists, out-of-pocket costs, geographical distance to services, logistical issues (e.g., childcare), and perceived stigma associated with seeking help (Woolhouse, Brown, Krastev, Perlen, & Gunn, 2009).

Delivering CBT via the Internet (iCBT) is one solution to overcoming known barriers to accessing treatment and improving treatment coverage. ICBT is private and convenient, affordable, and has high treatment fidelity (Andrews et al., 2018). In the general adult population, iCBT is well-established in the treatment of anxiety and depressive disorders and has been shown to be as effective as face-to-face CBT for some disorders (Carlbring, Andersson, Cuijpers, Riper, & Hedman-Lagerlöf, 2018). In postpartum populations, therapist-guided iCBT has been demonstrated to be effective in treating depression with moderate to large reductions in symptoms (pooled between-group effect size, Cohen's $d = 0.63$, Lau, Htun, Wong, Tam, & Klainin-Yobas, 2017). ICBT supported by low-intensity telephone coaching has been shown to be effective in six sessions (Milgrom et al., 2016). Of the women that received iCBT, 79% no longer met diagnostic criteria for depression compared to 18% in the TAU condition. Milgrom et al. (2016) showed a large effect favouring iCBT in reducing depression symptom severity

Abbreviations: iCBT, internet-delivered cognitive behavioural therapy; TAU, treatment as usual control; TAU, treatment as usual waitlist control; RCT, randomised controlled trial; CRUfAD, Clinical research unit for anxiety and depression; GAD-7, Generalized anxiety disorder; 7-item scale, PHQ-9; Patient health questionnaire, 9-item; BDI-II, Beck depression inventory; 2nd edition, K-10; Kessler-10 psychological distress scale, DSM-IV; Diagnostic Statistical Manual, 4th edition; MDD, major depressive disorder; EPDS, Edinburgh postnatal depression scale; MPAS, Maternal postnatal attachment scale; KPCS, Karitane Parenting Confidence Scale; WHOQOL-BREF, World health organisation quality of life scale

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(d = 0.83) and small to medium effects for anxiety and stress. However, the number of studies of iCBT for postpartum depression is small, and almost non-existent for the specific treatment of postpartum anxiety, resulting in several gaps in our understanding about treating postpartum anxiety and depression using iCBT.

Firstly, no studies have investigated the effects of iCBT on generalized anxiety disorder (GAD), or comorbid GAD and MDD in postpartum women. This is despite postpartum anxiety affecting a comparable number of women as depression, and resulting in similar adverse outcomes (Goodman, Watson, & Stubbs, 2016). Comorbid anxiety and depression is also common, and associated with greater symptom severity, poorer short- and long-term outcomes, and increased suicidality (Field et al., 2010; Ross, Evans, Sellers, & Romach, 2003). One recent study (Ashford, Olander, Rowe, Fisher, & Ayers, 2018) investigated the potential efficacy of delivering a self-help psychoeducational booklet online to women experiencing postpartum anxiety. No group differences were evident between the treatment and control group at post-treatment, with the study suffering from high rates of dropout and non-usage attrition. Greater clinical attention to postpartum anxiety, including comorbidity with depression, is therefore warranted, particularly given depression-specific iCBT interventions appear to have only a small to moderate impact on anxiety symptom improvements compared to control conditions (d = 0.36; Lau et al., 2017).

Secondly, no studies have investigated the effects of unguided (i.e., no supervision or coaching) or very brief (i.e., less than six lessons) iCBT in treating postpartum anxiety or depression. In general adult populations, studies have demonstrated that unguided iCBT is comparable to guided iCBT in improving anxiety and depression (e.g., Titov et al., 2013), although in some studies, adherence is lower in unguided iCBT (Morgan et al., 2017). Brief unguided iCBT programs that can be accessed without reliance on specialist mental health clinicians for guidance may offer a more scalable, cost-effective way to teach new mothers how to manage anxiety and depression. In addition, very brief unguided programs may be more appealing to busy mothers who are time-poor and unable to commit to longer treatment, and for mothers residing in rural and remote geographical regions in which access to a supervising therapist may be limited. Lastly, few studies have investigated the impact of symptom change on maternal factors such as bonding (e.g., O'Mahen et al., 2014) and quality of life (QOL; Pugh, Hadjistavropoulos, & Dirkse, 2016). As a result, little is known about the effects of postpartum anxiety and depression on these outcomes and whether iCBT can offer additional benefits to the mother, infant, and family.

To address these limitations in the literature, we developed a brief unguided iCBT intervention, '*MUMentum Postnatal*', to target symptoms of anxiety and depression in postpartum women (Loughnan, Newby et al., 2018). This program was created alongside our iCBT intervention for antenatal anxiety and depression, '*MUMentum Pregnancy*' (Loughnan, Sie et al., 2018). The *MUMentum Pregnancy* program was previously evaluated in depressed and anxious pregnant women, producing large and superior reductions in anxiety (between groups, Hedges g = 0.76) and psychological distress (g = 0.88) relative to treatment as usual (TAU). Adherence to iCBT was high (71%), as was patient satisfaction.

The current study aimed to evaluate the efficacy and acceptability of the three-lesson unguided *MUMentum Postnatal* program in postpartum women with elevated symptoms of depression and/or generalized anxiety compared to TAU. We hypothesized that the *MUMentum Postnatal* program would: (1) significantly reduce symptoms of anxiety, depression, and general psychological distress; (2) be significantly more effective at reducing these symptoms than TAU; (3) improve maternal feelings of emotional bonding to the infant, parenting confidence, and QOL; and (4) be acceptable to participants.

2. Method

2.1. Design

A CONSORT-revised 2010 compliant (Schulz, Altman, & Moher, 2010) randomised, controlled superiority trial (RCT) design was used to compare iCBT to TAU control. The trial protocol has been published (Loughnan, Newby et al., 2018), was approved by the Human Research Ethics Committee of St. Vincent's Hospital, Sydney (HREC/16/SVH/63) and is registered with the Australian New Zealand Clinical Trials Registry (ACTRN12616000559415).

2.2. Participants

Participants were women recruited in Australia by advertisements posted on social media websites, online forums and flyers distributed in maternity hospitals in Sydney, Australia. All participants voluntarily applied and provided informed consent online.

2.2.1. Inclusion criteria

All participants met the following eligibility criteria: (i) within 12 months postpartum; (ii) aged over 18 years; (iii) fluent in written and spoken English; (iv) Australian resident; (v) computer and internet access; (vi) self-report symptoms of anxiety and/or depression above clinical threshold (e.g., GAD-7 and/or PHQ-9 total score ≥ 10); (vii) and willing to provide personal contact details and details of their general practitioner (GP).

2.2.2. Exclusion criteria

Applicants were excluded if they reported any of the following: (i) current substance abuse or dependence; (ii) current use of benzodiazepines; (iii) self-reported diagnosis of schizophrenia or bipolar disorder; (iv) started psychological therapy < 4 weeks ago or medication < 8 weeks ago for anxiety/depression. Applicants that reported severe depression (PHQ-9 total score ≥ 23) or current suicidality at screening were excluded and directed to appropriate services.

2.3. Procedure

All women applied online at www.virtualclinic.org.au, provided online informed consent, and completed the aforementioned screening questions to determine if they were eligible for the study.[1] Successful applicants were automatically randomised to either the iCBT or TAU arm of the RCT and notified on-screen and via email of their allocation. Our randomisation sequence (i.e., 1:1 ratio within blocks of 20) was uploaded to our server by personnel not involved in the study. Participants' general practitioners (GPs) received a written letter advising that their patient was participating in a research study for postpartum anxiety and depression.

After randomisation, participants were required to log in to their Virtual Clinic account within two weeks to complete baseline questionnaires. Those allocated to iCBT then started Lesson 1. All three lessons were required to be completed within the active treatment period of six weeks. Participants in both groups were withdrawn if they did not complete baseline questionnaires within two weeks of screening, or if they requested to be withdrawn. Post-treatment questionnaires were completed one week after the active treatment period ended (i.e., Week 7), with follow-up questionnaires completed four weeks post-treatment (i.e., Week 11). Clinical contact only occurred when a participant's distress score or suicidal ideation[2] was

[1] Applicants meeting criteria yet reporting occasional suicidal ideation were contacted by the study clinician by phone to determine suitability.

[2] For the purposes of trial risk monitoring only, Item 9 of the *Beck Depression Inventory, second edition* (BDI-II; Beck, Steer, & Brown, 1996) was administered

significantly elevated (see Loughnan, Newby et al., 2018 for safety protocol). Automated notifications and reminders (i.e., to complete lessons and questionnaires) were sent via email and SMS.

2.4. Measures

2.4.1. Primary outcomes

Anxiety and depression were assessed according to the *Generalized Anxiety Disorder 7-item scale* (GAD-7; Spitzer, Kroenke, Williams, & Löwe, 2006) and *Patient Health Questionnaire 9-item scale (*PHQ-9; Kroenke, Spitzer, & Williams, 2001). Both scales are validated self-report measures of GAD and MDD symptoms experienced over the past two weeks, with symptom frequency rated on a 4-point scale. Total scores over nine on the GAD-7 (R = 0–21) and PHQ-9 (R = 0–27) are indicative an increased likelihood of diagnosis of GAD or MDD. Both measures have been validated in adult (e.g., Löwe et al., 2008) and postpartum samples (e.g., Sidebottom, Harrison, Godecker, & Kim, 2012). Internal reliabilities for the current sample were acceptable (Cronbach's α: GAD-7 = 0.85; PHQ-9 = 0.75). The *Edinburgh Postnatal Depression Scale* (EPDS; Cox, Holden, & Sagovsky, 1987) was also administered to assess postpartum-specific depressive symptoms. Participants rated the intensity of symptoms over the past seven days, with total scores (R = 0–30) over 12 indicative of probable depression. The EPDS is well validated as a screening tool in postpartum samples (Bergink et al., 2011; current sample α = .77).

2.4.2. Secondary outcomes

The *Kessler 10-item Psychological Distress scale* (K-10; Kessler et al., 2002) measured non-specific psychological distress over the past two weeks. Total scores ranged from 10 to 50, with scores over 20 indicative of a mild mental disorder. The K-10 demonstrates strong psychometric properties in non-perinatal samples (Furukawa, Kessler, Slade, & Andrews, 2003), acceptable validity in antenatal samples (e.g., Spies et al., 2009; current sample α = 0.83). The *Maternal Postnatal Attachment Scale* (MPAS; Condon, 1993) assessed maternal feelings of emotional bonding to the infant with higher total scores indicative of more adaptive mother-infant bonding style (Condon & Corkindale, 1998). The MPAS has demonstrated acceptable psychometric properties (Condon & Corkindale, 1997; current sample α = .85). The *Karitane Parenting Confidence Scale* (KPCS; Črnčec, Barnett, & Matthey, 2008) assessed perceived parental self-efficacy with higher scores indicating higher parenting confidence. Total scores below 40 are indicative of lower than average parenting confidence. The KPCS has been validated in postpartum samples (current sample α = .84). The *World Health Organisation Quality of Life scale* (WHOQOL-BREF; Skevington, Lotfy, & O'Connell, 2004) assessed QOL over the past four weeks and is measured across four domains: physical health, psychological health, social relationships and environment. Higher scores are indicative of higher QOL. The WHOQOL-BREF has been validated in postpartum samples (e.g., Webster, Nicholas, Velacott, Cridland, & Fawcett, 2010; current sample α's = 0.71, 0.72, 0.46, 0.72).

In the iCBT group, expectancy of treatment benefit was assessed before Lesson 1 and Lesson 2 according to the Treatment Credibility and Expectancy questionnaire (CEQ; Devilly & Borkovec, 2000); treatment adherence was reflected in the mean number of CBT sessions completed; and treatment satisfaction was measured at post-treatment using items derived from the Treatment Satisfaction Questionnaire (TSQ; Cox, Fergus, & Swinson, 1994).

(*footnote continued*)
to assess the presence and severity of suicidal ideation and suicide risk.

Table 1
MUMentum Postnatal lesson plans.

Lesson	Title	Skills
1	Learning about postpartum anxiety and depression, and tackling physical symptoms	✓ Psychoeducation: - About postpartum anxiety and depression - Identifying symptoms - Cognitive behavioural model - Prioritising self-care - Physical symptoms ✓ Controlled breathing ✓ Progressive muscle relaxation ✓ Extra resources: Sleep hygiene, medications, fight-or-flight response, pleasant activities, partners and supporters, FAQs
2	Identifying unhelpful thoughts and dealing with uncertainty	✓ Psychoeducation: - About thoughts - Identifying unhelpful thoughts - Shifting unhelpful thoughts - Accepting uncertainty ✓ Thought challenging ✓ Coping cards ✓ Structured problem-solving ✓ Extra resources: Understanding intrusive thoughts, further examples, FAQs
3	Tackling unhelpful behaviours and building confidence	✓ Psychoeducation: - Unhelpful behaviours (low activity; avoidance) - Facing your fears ✓ Activity planning and monitoring ✓ Graded exposure ✓ Assertive communication ✓ Relapse prevention ✓ Extra resources: further examples, self-care plan, FAQs

2.5. Treatment conditions

2.5.1. Internet-based CBT

The *MUMentum Postnatal* program is a three lesson, unguided iCBT intervention for postpartum anxiety and depression. The program was adapted from our validated, six-lesson, clinician-guided transdiagnostic iCBT program for anxiety and depression in adults (Newby et al., 2013; 2014), and tailored specifically to the unique challenges and concerns of mothers in the postpartum period. Given the barriers to treatment uptake in this population (e.g., time-poor), course content was condensed and presented over three rather than six lessons. Content focused on psychoeducation and key cognitive behavioural skills such as thought challenging, problem-solving, and graded exposure within the context of the postpartum period (see Table 1). The program was delivered in an illustrated comic-style story, with two fictional women experiencing postpartum anxiety and depression symptoms. Participants followed the characters' experiences of learning how to self-manage their symptoms during the postpartum period using CBT skills. Each lesson consisted of a set of lesson slides showing the characters' stories and describing specific CBT skills; a lesson summary and action plan to revise and implement skills (i.e. homework); and a range of additional postpartum-relevant resources.

Participants were encouraged to complete one lesson every one-to-two weeks, for a total treatment period of up to six weeks. All lessons were accessed sequentially via the online Virtual Clinic system, with an automated 5-day lockout period between lessons. Assistance was only available for technical issues, with time spent recorded as the number of minutes spent in contact with the participant via email or telephone.

2.5.2. Control condition

Participants in TAU completed the same pre-, post- and follow-up assessments as those in iCBT, which were accessed via the online Virtual Clinic system. Participants in this group were not restricted from

receiving any usual maternity care or services, including any mental health support provided by health professionals in primary care (e.g. postpartum health check-up by maternal child health nurse). TAU thus varied across participants as is common for RCTs (Watts, Turnell, Kladnitski, Newby, & Andrews, 2015). It was requested that participants notify the research team if any new psychological treatment was started during the trial period.

2.6. Statistical analyses

All analyses were undertaken in Statistical Package for the Social Sciences (SPSS) version 24 (IBM SPSS, IBM Corp., Armonk, NY, USA). Group differences in baseline variables were examined using cross-tabulations, independent *t*-tests, and regression analyses, with differences in baseline outcome measures controlled for in further analyses. A-priori power calculation to determine the minimum sample size was informed by published RCTs of iCBT for postpartum depression (e.g., Milgrom et al., 2016), and iCBT for anxiety and depression in the general adult population (e.g., Newby et al., 2013). To detect a between-group effect corresponding to Hedges' *g* of 0.80, the minimum sample size for each group (alpha set at 0.05, power of 80%) was identified as 25 per group. We aimed to recruit a minimum sample of $N = 100$ to allow for expected attrition (e.g., O'Mahen et al., 2013). To determine treatment efficacy, intention-to-treat linear mixed models were estimated for each outcome measure, with restricted maximum likelihood (REML) estimation used to account for missing data due to participant drop-outs. These models were used to yield more accurate estimates of effect compared to completer as they account for the unbalanced nature of the data (Salim, Mackinnon, Christensen, & Griffiths, 2008). Mixed models were estimated separately for each outcome variable, with time, treatment group, and time by group interaction entered as fixed factors. Planned contrasts were used to compare changes within and between groups from baseline to post-treatment and follow-up for each group. Between-group effect sizes were calculated using the pooled standard deviation of the estimated marginal means and adjusted for sample size (Hedges *g*). Effect sizes of 0.20, 0.50, and 0.80 considered small, moderate, and large respectively (Cohen, 1988).

2.6.1. Clinical and reliable change

Symptom remission rates and reliable change was examined among those who completed treatment. Participants were classified as remitted if they met clinical threshold for a likely diagnosis of MDD or GAD (i.e., total score ≥10) at baseline, and completed treatment with a total score below threshold for a likely diagnosis. Reliable change indices (RCI) were used to determine the proportion of each group who reliably improved or deteriorated between baseline and post-treatment. RCI values were calculated using test-retest reliability values of 0.83 for anxiety (GAD-7; Spitzer et al., 2006), and 0.84 for depression (PHQ-9; Kroenke et al., 2001) and the baseline standard deviation of the marginal means of the entire sample (anxiety = 3.61, depression = 3.15). Based on these estimates, participants who reported changes of 4.13 points for anxiety and 3.49 points for depression were classified as either experiencing reliable improvements or deterioration with 95% confidence (Jacobson & Truax, 1991). Multinomial logistic regressions were then estimated to evaluate whether the groups differed in the extent to which they remitted, and/or experienced a reliable change in anxiety and depression symptom severity.

3. Results

3.1. Baseline characteristics

Participant flow is depicted in Fig. 1. A total of 383 adult women applied to the study, with 131 randomised to iCBT ($n = 69$) or TAU ($n = 62$). Of those, 120 (iCBT: $n = 65$, TAU: $n = 55$) completed baseline questionnaires and were included in analyses.

Participants' were well-matched on clinical and demographic characteristics as shown in Table 2. Overall, participants were aged 32.56 years ($SD = 4.53$; $R = 21–47$), slightly higher than the Australian national average (30 years; Australian Institute of Health and Welfare, 2017), with a mean infant age of 4.55 months ($SD = 3.05$; $R = 0.25–11$). Most women were primiparous (i.e., first childbirth; 58%), married (88%), had a University degree (66%), and were on maternity leave or a stay-at-home parent (60%). Most women were also born in Australia (78%) and resided in major Australian cities (63%). Only 13% of women reported currently taking medication or receiving psychological treatment for depression and anxiety.

The mean EPDS at baseline was 15.06, similar to the mean observed in other Australian samples of depressed postpartum women (e.g., Milgrom et al., 2016). Approximately 11% met clinical threshold (total score ≥10) for a likely diagnosis of GAD only, 12.5% for MDD only, and just over half for comorbid GAD and MDD (59%); 17.5% had remitted to subclinical range by baseline assessment. Less than 33% of participants were classified as experiencing severe symptoms of anxiety (GAD-7 total score = 15–21) and distress (K-10 total score = 30–50), and 6% for depression (PHQ-9 total score = 20–27). There were no significant group differences on baseline outcome measures, except the K-10 ($t(df) = 2.27(118)$, $p = 0.03$) which was controlled for in further analyses.

3.2. Treatment adherence and data return

A total of 131 women who were randomised, 11 were withdrawn for not completing baseline measures. Four women in iCBT were no longer interested in participating, and were withdrawn from the study after starting treatment. A total of 46 women completed all three lessons of treatment (75% completion rate, $n = 46/61$). Of those in iCBT, 82% completed post-treatment questionnaires and 61% completed follow-up questionnaires. Of those in TAU, 85% and 76% provided post-treatment and follow-up data, respectively. Groups did not differ in the extent to which they completed their post-treatment ($\chi^2(1) = 0.26$, $p = 0.61$; OR (95% CI) = 1.29(0.48, 3.49)) or follow-up questionnaires ($\chi^2(1) = 3.33$, $p = 0.07$; OR(95% CI) = 2.10(0.94, 4.70)).

3.3. Treatment effects of the MUMentum postnatal program

Table 3 presents the estimated marginal means and linear mixed model results of participants' symptom severity at baseline, post-treatment and follow-up assessments, and effect sizes for each of the outcome measures. There were significant group by time interactions (controlling for baseline general psychological distress scores) for depression according to the PHQ-9 ($F_{2,\ 93.80} = 9.06$, $p < .001$) and EPDS ($F_{2,\ 87.50} = 10.25$, $p < 0.001$), and anxiety according to the GAD-7 ($F_{2,\ 94.04} = 9.13$, $p < 0.001$). There were also significant interactions for most secondary outcomes including general psychological distress ($F_{2,\ 216.22} = 30.80$, $p < .001$), maternal attachment ($F_{2,\ 87.77} = 16.71$, $p < 0.001$), and the physical health ($F_{2,\ 53.65} = 1.93$, $p < 0.001$), psychological ($F_{2,\ 89.92} = 3.23$, $p < .05$), and environment ($F_{2,\ 90.16} = 4.97$, $p < 0.01$) QOL domains. In contrast, there were no significant group by time interactions noted for social relationships QOL ($F(2,\ 87.12) = 1.21$, $p = 0.30$), or parenting confidence ($F(2,\ 88.81) = 2.10$, $p = 0.13$).

3.3.1. Within-group effect sizes from baseline to post-treatment, and follow-up

From pre-to post-treatment, participants in iCBT demonstrated large and significant effect size reductions (*g*s = 0.84–2.02) for anxiety, depression, distress, attachment, and psychological QOL. Moderate reductions (*g*s = 0.43–0.65) were demonstrated for parenting confidence, and physical health, social, and environment QOL. For those in iCBT, effect sizes observed between pre-treatment and follow-up were also

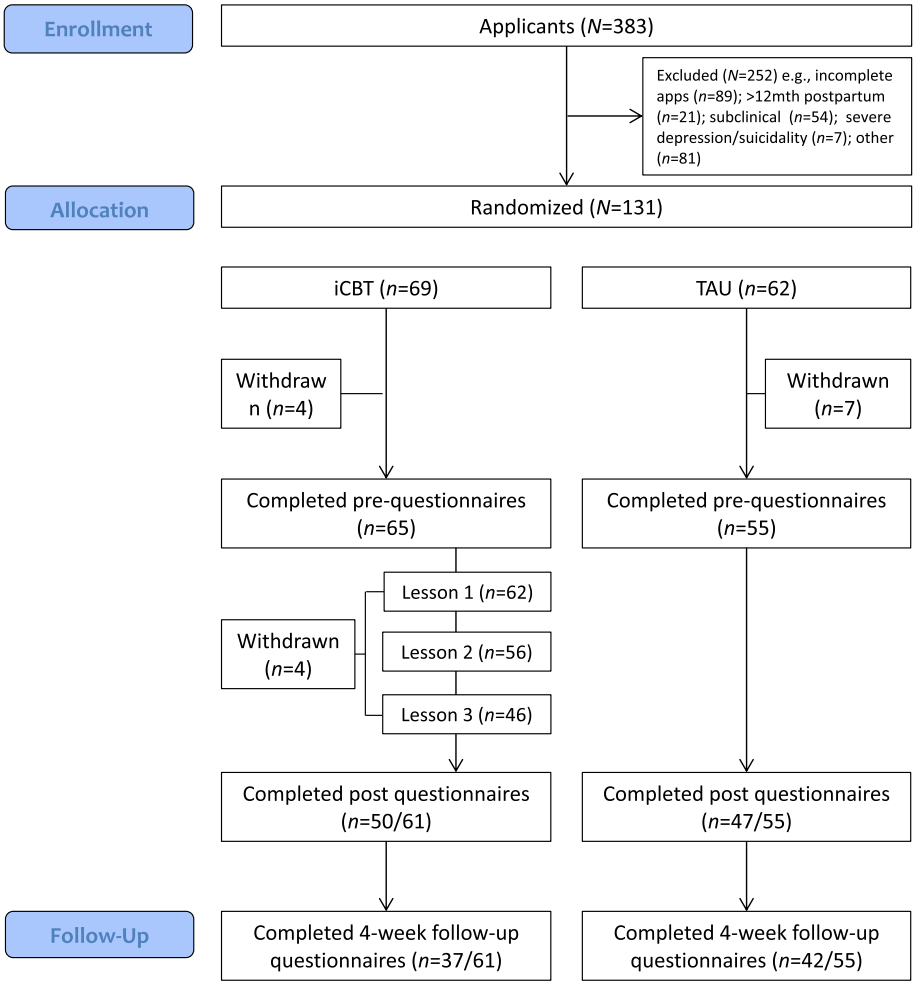

Fig. 1. ICBT for postpartum anxiety and depression.

large and significant for all outcomes, except psychological and social QOL.

For those in TAU, small effect size reductions were observed between pre- and post-treatment for anxiety only, yet moderate symptom reductions were observed for anxiety, depression, and distress (*gs* = 0.47–0.62) between pre- and follow-up.

3.3.2. Between-group effect sizes at post-treatment and follow-up assessment

Participant symptom severity scores at post-treatment were significantly lower in the iCBT group relative to TAU, with large and significant between-group differences for anxiety, depression, and distress (*gs* = 0.78–1.69) and moderate effect size differences for attachment, and psychological and social relationships QOL (*gs* = 0.48–0.70).

At follow-up, participants in iCBT maintained superiority over TAU, for depression, distress, and psychological QOL (*gs* = 0.53–1.32). Notably, participants in iCBT demonstrated larger effect size differences for anxiety at follow-up (*g* = 1.14) than at post-treatment (*g* = 0.78). There were no statistically significant between-group differences observed at post-treatment or follow-up for parenting confidence (*gs* < 0.17), or physical health and environment QOL domains (*gs* < 0.41).

3.4. Clinical and reliable change at post-treatment

For participants that completed post-treatment assessment, there were significant differences between groups in the proportion of participants who remitted, and evidenced reliable change for anxiety and depression primary outcomes (see Table 2). More than half of those in iCBT demonstrated reliable improvements in anxiety (56%) and depression symptom severity scores (60%), compared to less than 30% of those in TAU. No participants evidenced reliable deterioration for anxiety or depression, compared with a total of 6 participants in TAU.

3.5. Treatment satisfaction and time spent

3.5.1. Expectancy

The majority of participants in the iCBT group rated the program as 'somewhat' to 'very logical' at Lesson 1 (i.e. before treatment; 63/65; 97%; *M*(*SD*) = 7.23(1.64); *R* = 3–9) and at Lesson 2 (i.e. after one lesson; 54/56; 96%; *M*(*SD*) = 7.50(1.56); *R* = 3–9). Most also reported that they expected the program to be 'somewhat' to 'very successful' in reducing symptoms at Lesson 1 (54/65; 83%; *M*(*SD*) = 5.94(1.78); *R* = 3–9) and Lesson 2 (47/56; 84%; *M*(*SD*) = 6.02(1.77); *R* = 1–9).

3.5.2. Treatment satisfaction

After treatment, most participants reported feeling 'mostly' to 'very satisfied' with the program (39/49; 80%; *M*(*SD*) = 4.02(0.90); *R* = 1–5), judged the quality of the program as 'good' to 'excellent' (42/49; 86%; *M*(*SD*) = 3.35(0.72); *R* = 2–4). Most participants were confident (> 5) that the program was successful in teaching them skills for managing symptoms (40/49, 82%; (*M*(SD) = 7.31(2.33); *R* = 1–10), and in recommending the program to a friend experiencing postpartum anxiety and/or depression (41/49, 84%; (*M*(SD) = 7.90(2.22); *R* = 2–10). More than half participants reported that they preferred to receive help for their symptoms via an online program rather than another type of treatment (61%, 30/49); approximately 18% would

Table 2
Participant baseline characteristics and proportion of clinical reliable change at post-treatment.

	Total	iCBT	TAU	iCBT vs TAU
	N = 120	*n* = 65	*n* = 55	
Mean age (years), mean (SD)	32.56 (4.53)	32.77 (4.21)	32.31 (4.90)	$t(118) = 0.55$, $p = 0.58$
Age of infant (months), mean (SD)	4.55 (3.05)	4.42 (3.02)	4.71 (3.10)	$t(118) = -0.52$, $p = 0.60$
Gestation at birth (weeks), mean (SD)	38.79 (1.67)	38.84 (1.46)	38.7 (1.89)	$t(101) = 0.35$, $p = 0.73$
Number of children, *n* (%)				$\chi^2(2) = 4.15$, $p = 0.13$
1	70 (58)	34 (52)	36 (65)	
2	35 (29)	24 (37)	11 (20)	
3+	15 (13)	7 (11)	8 (15)	
Rurality, *n* (%)				$\chi^2(1) = 1.63$, $p = 0.20$
Major cities	75 (63)	44 (68)	31 (56)	
Regional or rural areas	45 (38)	21 (32)	24 (44)	
Country of birth, *n* (%)				$\chi^2(1) = 0.73$, $p = 0.39$
Australia	94 (78)	49 (75)	45 (82)	
Other	26 (22)	16 (25)	10 (18)	
Relationship status, *n* (%)				$\chi^2(3) = 1.25$, $p = 0.74$
Single	3 (3)	2 (3)	1 (2)	
In a relationship	10 (8)	6 (9)	4 (7)	
Married/de facto	106 (88)	56 (86)	50 (91)	
Separated/Divorced	1 (1)	1 (2)	0 (0)	
Level of education, *n* (%)				$\chi^2(5) = 4.46$, $p = 0.49$
No qualification	1 (1)	0 (0)	1 (2)	
School-level	14 (12)	7 (11)	7 (13)	
Trade/certificate	17 (14)	11 (17)	6 (11)	
Diploma	9 (8)	7 (11)	2 (4)	
Undergraduate	57 (48)	29 (45)	28 (51)	
Post-graduate	22 (18)	11 (17)	11 (20)	
Employment status, *n* (%)				$\chi^2(4) = 6.99$, $p = 0.14$
Full-time paid work/study	13 (11)	7 (11)	6 (11)	
Part-time paid work/study	17 (14)	10 (15)	7 (13)	
At home parent	45 (38)	18 (28)	27 (49)	
Maternity leave	27 (23)	19 (29)	8 (15)	
Other	18 (15)	11 (17)	7 (13)	
Recruitment, *n* (%)				$\chi^2(3) = 5.36$, $p = 0.15$
Facebook	88 (73)	47 (72)	41 (75)	
Word of mouth	7 (6)	5 (8)	2 (4)	
Health professional	7 (6)	6 (9)	1 (2)	
Other	18 (15)	7 (11)	11 (20)	
Probable baseline diagnosis, *n* (%)				$\chi^2(3) = 3.97$, $p = 0.26$
Anxiety	13 (11)	9 (14)	4 (7)	
Depression	15 (13)	5 (8)	10 (18)	
Comorbid	71 (59)	40 (62)	31 (56)	
Subclinical[a]	21 (18)	11 (17)	10 (18)	
Symptom start, *n* (%)				$\chi^2(2) = 1.06$, $p = 0.59$
Antenatal	69 (58)	33 (51)	36 (65)	
Postnatal	41 (34)	24 (37)	17 (31)	
Don't know	10 (8)	8 (12)	2(4)	
Current medications, *n* (%)				$\chi^2(2) = 2.63$, $p = 0.27$
Yes	16 (13)	7 (11)	9 (16)	
No	103 (86)	57 (88)	46 (84)	
Prefer not to say	1 (1)	1 (2)	0 (0)	
Current psychotherapy[b], *n* (%)				$\chi^2(1) = 1.24$, $p = 0.27$
Yes	15 (13)	6 (10)	9 (16)	
No	103 (87)	57 (90)	46 (84)	
Baseline variables, mean (SD)				
GAD-7	12.21 (4.48)	12.57 (4.60)	11.78 (4.34)	$t(118) = 0.96$, $p = 0.34$
PHQ-9	12.14 (4.37)	12.43 (4.37)	11.80 (4.37)	$t(118) = 0.79$, $p = 0.43$
EPDS	15.15 (4.30)	15.62 (4.37)	14.60 (4.16)	$t(118) = 1.30$, $p = 0.20$
K-10	27.58 (6.32)	28.77 (6.57)	26.18 (5.77)	$t(118) = 2.27$, $p = 0.03$
MPAS	70 (11.14)	68.83 (11.05)	71.62 (11.17)	$t(110) = -1.31$, $p = 0.19$
KPCS	34.28 (5.66)	33.74 (5.91)	34.93 (5.32)	$t(118) = -1.15$, $p = 0.25$
WHOQOL-BREF				
(1) Physical health	56.01 (15.28)	54.95 (14.54)	57.27 (16.15)	$t(118) = -0.83$, $p = 0.41$
(2) Psychological	45 (14.60)	42.82 (14.24)	47.58 (14.74)	$t(118) = -1.79$, $p = 0.08$
(3) Social relationships	49.93 (18.19)	51.79 (17.77)	47.73 (18.60)	$t(118) = 1.22$, $p = 0.22$
(4) Environment	70.03 (13.30)	68.80 (13.49)	71.48 (13.05)	$t(118) = -1.10$, $p = 0.27$
Clinical and reliable change at post-treatment, *n* (%)				
GAD-7				
Remitted[c]	32/99 (32)	22/35 (63)	10/28 (36)	$\chi^2(1) = 6.47$, $p < 0.01$
Improved[d]	40/97 (41)	28/50 (56)	12/47 (26)	$\chi^2(1) = 9.48$, $p < 0.01$
Deteriorated[d]	2/97 (2)	0/50 (0)	2/47 (4)	$\chi^2(1) = 2.97$, $p = 0.09$
PHQ-9				
Remitted[c]	40/66 (61)	26/33 (79)	14/33 (42)	$\chi^2(1) = 9.75$, $p < 0.01$
Improved[d]	44/97 (45)	30/50 (60)	14/47 (30)	$\chi^2(1) = 9.08$, $p < 0.01$

(*continued on next page*)

Table 2 (*continued*)

	Total	iCBT	TAU	iCBT vs TAU
	$N = 120$	$n = 65$	$n = 55$	
Deteriorated[d]	4/97 (4)	0/50 (0)	4/47 (9)	$\chi^2(1) = 5.98$, $p < 0.01$

Note. [a]All participants, including those whose scores had reduced to subthreshold (< 9) between screening and baseline assessment (i.e., ≤2 weeks), were included in analyses; [b]Variable data not available for two participants: total $N = 118$; iCBT $n = 63$; TAU $n = 55$; [c]Remission at post-treatment is defined as scores below clinical threshold for a likely diagnosis of GAD or MDD, only participants who met clinical threshold at baseline were included in analyses; [d]Only those who completed post-treatment assessment were included in analyses; SD = Standard deviation; PHQ-9 = Patient Health Questionnaire 9-item scale; GAD-7 = Generalized Anxiety Disorder 7-item scale; K-10 = Kessler Psychological Distress 10-item scale; EPDS = Edinburgh Postnatal Depression Scale; MPAS = Maternal Postnatal Attachment Scale; KPCS = Karitane Parenting Confidence Scale; WHOQOL-BREF = World Health Organisation Quality of Life-BREF scale.

have preferred both face-to-face and iCBT (9/49).

3.5.3. Time spent

On average, participants in iCBT reported spending approximately 1 h per week completing each lesson (M(SD) = 1.13(0.80); $R = 0.15–4$, $n = 40$), and one and a half hours revising and practising the skills (M (SD) = 1.46(1.73); $R = 0–9.33$, $n = 39$). Over the course of the 11-week trial period, average technician time spent per participant was approximately 14 min for those in iCBT ($M(SD) = 13.74(8.15)$, $R = 1–36$ min) and approximately 8 min for TAU ($M(SD) = 7.78(5.79)$, $R = 1–31$ min).

4. Discussion

This study examined the efficacy and acceptability of a brief unguided iCBT intervention in reducing postpartum anxiety and depressive symptoms. In an Australian sample of adult postpartum women, we found that our *MUMentum Postnatal* program was highly effective, demonstrating significantly greater reductions in anxiety, depression, and psychological distress compared to women receiving usual care. Additionally, the program produced meaningful improvements in maternal bonding, parenting confidence, and quality of life, with high participant engagement, adherence, and treatment satisfaction. These findings have important clinical implications given that no other iCBT programs have specifically targeted the treatment of postpartum GAD, or comorbid GAD and MDD symptoms.

Table 3
Estimated marginal means (standard deviations) for primary and secondary outcome measures, within-group effect sizes, and between-group effect sizes at post-treatment and follow-up.

	EMM (SD)			Within-group ES (95%CI)		Between-group ES (95%CI)	
	Pre-treatment	Post-treatment	Follow-up	Pre to Post-treatment	Pre to Follow-up	Post-treatment	Follow-up
GAD-7[a]							
iCBT	12.08 (3.69)	6.66 (4.23)	5.42 (3.75)	1.26 (0.77, 1.52)***	1.82 (1.34, 2.29)***	0.78 (0.36, 1.19)*	1.14 (0.66, 1.62)*
TAU	12.12 (3.57)	9.97 (4.22)	9.78 (3.82)	0.44 (0.03, 0.79)	0.58 (0.17, 0.99)**		
PHQ-9[a]							
iCBT	11.81 (3.22)	6.11 (4.34)	6.32 (3.60)	1.42 (0.91, 1.67)***	1.54 (1.09, 2.00)***	0.99 (0.57, 1.41)*	0.85 (0.39, 1.31)*
TAU	12.26 (3.11)	10.44 (4.35)	9.52 (3.81)	0.33 (−0.07, 0.68)	0.59 (0.18, 1.00)***		
K-10[a]							
iCBT	27.64 (4.47)	18.19 (4.31)	18.33 (4.14)	2.02 (1.41, 2.25)***	1.97 (1.49, 2.46)***	1.69 (1.23, 2.15)*	1.32 (0.84, 1.81)*
TAU	26.91 (4.33)	25.50 (4.27)	23.96 (4.27)	0.24 (−0.16, 0.59)	0.47 (0.07, 0.88)**		
EPDS[a]							
iCBT	14.91 (3.15)	8.82 (4.96)	8.01 (4.05)	1.41 (0.89, 1.66)***	1.84 (1.37, 2.32)***	0.90 (0.49, 1.32)*	0.99 (0.52, 1.45)*
TAU	15.04 (3.04)	13.34 (4.96)	12.13 (4.22)	0.31 (−0.09, 0.67)	0.62 (0.21, 1.03)***		
MPAS[b]							
iCBT	69.64 (11.10)	76.76 (9.21)	77.69 (9.25)	−0.89 (−1.28, −0.50)**	−1.07 (−1.50, −0.64)***	−0.70 (−1.11, −0.29)*	−0.45 (−0.90, −0.001)*
TAU	72.12 (11.13)	70.40 (8.90)	73.37 (9.75)	0.12 (−0.27, 0.51)	−0.07 (−0.47, 0.33)		
KPCS[b]							
iCBT	33.98 (5.80)	37.41 (5.45)	38.08 (4.84)	−0.62 (−0.99, −0.24)***	−0.80 (−1.22, −0.38)***	−0.17 (−0.57, 0.23)	−0.10 (−0.54, 0.34)
TAU	34.83 (5.60)	36.47 (5.48)	37.57 (5.13)	−0.30 (−0.69, 0.09)	−0.53 (−0.94, 0.12)		
QOL: Physical health[b]							
iCBT	55.65 (15.34)	65.03 (15.63)	66.36 (13.08)	−0.65 (−1.03, −0.28)***	−0.87 (−1.29, −0.45)***	−0.31 (−0.71, 0.09)	−0.41 (−0.86, 0.03)
TAU	56.67 (14.80)	60.12 (15.69)	60.75 (13.78)	−0.19 (−0.58, 0.20)	−0.26 (−0.66, 0.14)		
QOL: Psychological[b]							
iCBT	44.27 (13.42)	56.25 (14.33)	57.84 (14.26)	−0.84 (−1.23, −0.46)***	−0.12 (−0.52, 0.29)	−0.53 (−0.94, −0.13)*	−0.53 (−0.98, −0.08)*
TAU	46.58 (12.94)	48.58 (14.36)	50.03 (14.96)	−0.13 (−0.52, 0.26)	−0.08 (−0.48, 0.32)		
QOL: Social[b]							
iCBT	51.67 (19.17)	58.30 (18.03)	58.40 (18.22)	−0.43 (−0.80, −0.05)**	−0.37 (−0.78, 0.03)	−0.47 (−0.88, −0.07)*	−0.37 (−0.82, 0.07)
TAU	47.60 (18.48)	49.65 (18.12)	51.39 (19.02)	−0.10 (−0.48, 0.29)	−0.19 (−0.60, 0.21)		
QOL: Environment[b]							
iCBT	69.03 (13.67)	74.48 (13.94)	75.09 (11.45)	−0.45 (−0.83, −0.08)***	−0.63 (−1.04, −0.21)***	−0.27 (−0.67, 0.13)	−0.18 (−0.62, 0.26)
TAU	71.30 (13.19)	70.74 (14.05)	72.93 (12.29)	0.03 (−0.36, 0.42)	−0.10 (−0.50, 0.30)		

Note. [a]Positive scores indicate symptom reduction; [b]Negative scores indicate symptom improvement; * = $p < 0.05$; ** = $p < 0.01$; *** = $p < 0.001$; EMM = Estimated marginal means; SD = Standard deviation; ES = Effect size according to Hedges' g; 95%CI = 95% confidence interval; PHQ-9 = Patient Health Questionnaire 9-item scale; GAD-7 = Generalized Anxiety Disorder 7-item scale; K-10 = Kessler Psychological Distress 10-item scale; EPDS = Edinburgh Postnatal Depression Scale; MPAS = Maternal Postnatal Attachment Scale; KPCS = Karitane Parenting Confidence Scale; QOL = Quality of life according to the World Health Organisation Quality of Life-BREF scale.

4.1. Primary findings

The MUMentum Postnatal program demonstrated large improvements for symptoms of anxiety, depression, and distress between baseline and post-treatment (within-group Hedges' $g \geq 1.41$). For depression and general psychological distress, iCBT produced large and superior effect size improvements compared to TAU at post-treatment (between-group $g \geq 0.90$), with gains sustained at follow-up ($g \geq 0.85$). Moreover, compared to TAU, iCBT led to greater improvements in anxiety symptom severity at post-treatment ($g = 0.78$), with an even larger between-group effect size observed at follow-up ($g = 1.14$). Majority of women had a likely diagnosis of comorbid GAD and MDD (59%) and symptoms in the moderate to severe range for anxiety (70%), depression (72%) and distress (68%). Given the severity and comorbidity of our sample, it is promising that the program produced such large improvements. Our results also highlight the importance of assessing for both depression and anxiety symptoms in postpartum women, as conceptualising all distress as depression may mean anxiety symptoms and significant comorbidities (i.e., the majority of our sample) are not recognised and appropriately treated (Matthey, 2008; McCabe-Beane, Stasik-O'Brien, & Segre, 2018). Our findings also highlight the need for transdiagnostic interventions to address symptoms of anxiety *and* depression in postpartum women.

Although we cannot directly compare the benefit of *MUMentum Postnatal* with longer iCBT programs, the effects found in this study are consistent with RCTs investigating longer six lessons iCBT programs for postpartum MDD supported by telephone coaching (e.g., between-group Cohen's $d = 0.83$; Milgrom et al., 2016), as well as face-to-face CBT interventions for postpartum depression (between-group $g = 0.69$; Sockol, 2015). Our findings are also comparable with those investigating brief unguided iCBT for anxiety and depression in general adult populations (within-group g range = 0.65–1.29; Morgan et al., 2017). Together, these findings suggest that brief programs presented in an online and self-help format may be an effective alternative to more costly and time-intensive treatments. It is important to note however that whilst iCBT was compared to a TAU control condition, it is likely that for many participants in TAU this was potentially a 'no treatment' condition given the high prevalence of self-referrals and low rates of medication use and psychotherapy (i.e., only 13% reported currently receiving treatment including antidepressant medication, counselling, and/or peer support). The literature would benefit from directly comparing the effects of iCBT and face-to-face psychotherapy for postnatal anxiety and depression. Doing so would highlight whether the limited differences that have been demonstrated between iCBT and face-to-face therapy for depression in the general adult population (Carlbring et al., 2018) generalize to vulnerable perinatal populations.

4.2. Secondary findings

We also demonstrated that *MUMentum Postnatal* produced large and superior improvements in maternal bonding with their infant at post-treatment ($g = 0.70$), and moderate effect size improvements at follow-up ($g = 0.45$) compared to TAU. These findings have key clinical implications as mother-infant bonding is critical to infant health and wellbeing (Rossen et al., 2017), and depression has been correlated with poor bonding postpartum (Ohoka et al., 2014). Further, we found small to moderate between-group differences in QOL favouring iCBT at post-treatment across two QOL domains (i.e. psychological, $g = 0.53$; social, $g = 0.47$). Careful interpretation of the social relationships QOL outcome is required however, as scale reliability was low. For parenting confidence, moderate to large within-group improvements were demonstrated at post-treatment (within-group $g = 0.62$), which continued to improve over time ($g = 0.80$). Whilst other iCBT studies for postpartum depression have either not measured, or have not found significant benefits on parenting or mother-infant outcomes (e.g., O'Mahen et al., 2014; Pugh et al., 2016), our results highlight QOL and parenting confidence as two important areas of future investigation, which may be essential if we are to maximise treatment benefits for the mother, infant, and family. Additionally, further research should seek to examine the changes in objective measures of bonding and connection between the mother and infant, as our results are reliant on only self-report measures.

The *MUMentum Postnatal* program also demonstrated high program adherence and participant satisfaction. Three quarters of participants (75%) completed all three lessons. These completion rates are consistent with those of longer, telephone-coached iCBT programs for postpartum depression (e.g., 86%, Milgrom et al., 2016; 60%, Pugh et al., 2016), and much higher than those found for an unguided, internet-delivered behavioural activation intervention for postpartum depression (39%, O'Mahen et al., 2013) and brief unguided iCBT for anxiety and depression in the general adult population delivered outside of a research setting (14%, Morgan et al., 2017). These completion rates are promising given that the research technician spent on average only 14 min per participant over the whole trial period, demonstrating the feasibility of the program in terms of time and resources. Participant credibility and satisfaction ratings were also positive, with majority reporting that they were confident that the program would provide techniques to effectively cope with their symptoms. Further research would benefit from exploring factors that promote program adherence and influence program completion, particularly given that unguided iCBT tends to have lower completion rates once disseminated in naturalistic vs. controlled research settings (Morgan et al., 2017). Our sample characteristics also suggest that unguided iCBT may be most acceptable for women who are likely to self-refer and seek help online. We found only 6% of participants came via clinician referral despite a diverse recruitment strategy. This may be reflective of low clinician uptake of iCBT programs in vulnerable populations. Future studies should therefore aim to evaluate iCBT in a more heterogeneous sample and increase the number of participants from clinician referrals and rural communities (where face-to-face services are limited) to examine groups likely to benefit from unguided iCBT.

Our findings provide preliminary evidence that clinician guidance or coaching may not be required to achieve large treatment benefits and high adherence. Brief unguided iCBT programs that do not rely on the operation of staff with specialist training or coaching represent a highly scalable and cost-effective way to offer cognitive behavioural interventions to women in the postpartum period. Within a stepped-care approach, *MUMentum Postnatal* can offer mothers the option to self-refer and self-manage their symptoms. Such programs can be implemented as part of the population-wide screening process recommended in the Australian Clinical Practice Guidelines (Austin, Highet, & Expert Working Group, 2017). This is particularly important if we are to reduce help-seeking barriers and improve treatment coverage in this population. Only 13% of our sample reported currently receiving treatment, despite most women experiencing moderate to severe symptoms of anxiety and/or depression. Moreover, limited clinician resources can then be directed (i.e., via existing clinician-intensive iCBT programs and face-to-face treatment) towards more high-risk mothers and those experiencing severe anxiety and depressive disorders, or those who do not respond to unguided iCBT. Future research should seek to determine whether *MUMentum Postnatal* is cost-effective in a naturalistic setting, and if the program can be transferred to routine care with maintained effects and treatment adherence.

4.3. Limitations

Our findings should be interpreted in the context of the following study limitations. Some caution in generalising our findings is warranted as our sample was self-selected, baseline outcome data was collected post-randomisation, and we did not assess participants using clinician-administered diagnostic outcome measures. We also utilised a TAU control condition and did not impose limitations on access to usual

maternity care or other primary healthcare services (including postpartum counselling from maternal child health nurse or peer support groups). Therefore, we cannot exclude the possible effects of other variables or treatments on clinical outcomes. Lastly, given that our follow-up period was short it is difficult to determine whether symptom improvements were sustained long-term.

5. Conclusions

This study provides preliminary evidence for the efficacy and acceptability of *MUMentum Postnatal,* a brief unguided iCBT intervention for the treatment of anxiety and/or depression in postpartum women. Our findings contribute to the existing evidence base for the efficacy of iCBT for postpartum depression, and establishes preliminary efficacy of iCBT for postpartum GAD, and comorbid MDD and GAD symptoms. This is particularly important for the treatment of postpartum anxiety, which has received little attention to date. Further RCTs are required to replicate our findings and investigate whether treatment effects are sustained long-term. The potential clinical value of unguided iCBT for postpartum women is substantial. *MUMentum Postnatal* can overcome barriers to accessing treatment and improve treatment coverage as a scalable and low cost 'first step' intervention for all women screening positive for distress, anxiety and/or depression in routine care.

Conflicts of interest

All authors declare that they have no conflict of interest.

Authors' contributions

SL, JN, HH, AM, and GA designed the study and developed the intervention. CB and AS supervised all study participants. All authors were involved in the development or evaluation of the program and have contributed to and approved the final version of the manuscript for publication.

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