Assessment of Childbirth-related Post Traumatic Stress Disorder in Australian Mothers: Psychometric Properties of the City Birth Trauma Scale

Abstract

Background: The City Birth Trauma Scale (BiTS; Ayers, Wright & Thornton, 2018) is self-report measure of Post-Traumatic Stress Disorder (PTSD) symptoms following childbirth, based on DSM-5 criteria. We report on the first study of the psychometric properties of the BiTS in the Australian population. **Methods:** Participants were mothers of infants aged 0-12 months (N = 705), who completed the BiTS and measures of related constructs. Confirmatory factor analysis was performed to assess the factor structure of the BiTS. Examination of the reliability, convergent, divergent and discriminant validity and acceptability of the BiTS was also examined. **Results**: Confirmatory factor analysis supported a bi-factor model of Birth-related Symptoms (BRS) and General Symptoms (GS) of post-partum PTSD as well as a global CB-PTSD factor. Internal consistency was found for the BiTS total scale and two proposed subscales (BRS and GS). BiTS total scores were significantly associated with an established measure of PTSD, providing support for convergent validity. Evidence of discriminant validity was examined by comparing the BiTS to an established measure of postpartum depression. **Limitations:** The present sample may over-represent participants with traumatic birth experiences in comparison to the general public. Furthermore, use of self-report measures limits the capacity to confirm the diagnostic status of participants. **Conclusion:** These findings suggest that the BiTS is a valid and reliable measure of childbirth-related PTSD, suited for use in postpartum populations. Total scores on the measure may be informative for clinical and research purposes, while evidence suggests strong support for interpretation of subscale scores.

Keywords: Birth trauma, child-birth post-traumatic stress disorder, postpartum PTSD, post-partum depression

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Maternal postpartum psychopathology has implications for infant development and subsequent mental health (Feldman, 2015). Childbirth-related post-traumatic stress disorder (CB-PTSD) has been recognised in recent decades as stressor-induced psychopathological response to the birth experience (Alcorn, O'Donovan, Patrick, Creedy & Devilly, 2010; Dikmen-Yildiz, Ayers & Phillips, 2018). Prevalence of CB-PTSD is debated, with estimates that approximately 3.1-4% of women in community samples and 15.1-18.5% of women in high-risk samples meet criteria for CB-PTSD (Grekin & O'Hara, 2014; Yildiz, Ayers & Phillips, 2017). Subclinical levels of CB-PTSD have been estimated to effect 16.8% of women (Dekel et al., 2017). In the general Australian public, PTSD is the second most prevalent mental health condition, with a 12-month prevalence rate of 4.4% (McEvoy, Grove & Slade, 2011), though less is known about the prevalence of CB-PTSD and the impact on Australian post-partum women. The rich biopsychosocial context created by pregnancy and childbirth and the primarily voluntary aspect of this life event differentiates it from other traumatic experiences, which are largely unwanted and unexpected (Dekel, Steube & Dishy, 2017).

Research examining adverse birth experiences (often interchangeably referred to as traumatic birth or birth trauma) has focussed primarily on identifying prevalence, risk factors for its occurrence, and on its association with maternal psychopathology (Grekin & O'Hara, 2014; Dekel et al., 2017; Yildiz et al., 2017). This research has shown that CB-PTSD is associated with postnatal depression, both of which may arise from adverse childbirth experiences (Dekel, Ein-Dor, Dishy & Mayopoulos, 2020). Evidence suggests that mothers who have experienced childbirth as traumatic may have difficulty bonding with their infants (Ayers, Eagle & Waring, 2006; Hairston, Handelzalts, Assis & Kovo, 2011; Parfitt & Ayers,

2009), less secure attachment towards their infant (Dekel, Thiel, Dishy & Ashenfarb, 2019) and perceive the parenting role as more stressful at 2 years postpartum (McDonald, Slade, Spiby & Iles, 2011).

In line with Criteria A for PTSD in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5, American Psychiatric Association, 2013), childbirth can be conceptualised as traumatic when complications/events during childbirth lead to actual or perceived threat to the life or bodily integrity of the woman and/or infant (Ayers, Wright & Thornton, 2018). Symptoms of CB-PTSD include intrusions related to the birth experience, avoidance of trauma-related stimuli, alterations in mood and cognitions and symptoms of hyperarousal. In Australia, routine postpartum care focuses on maternal anxiety and depression (RANZCOG, 2018) and neglects other forms of postpartum psychopathology, in particular CB-PTSD.

The City Birth Trauma Scale (BiTS) is a 29-item self-report questionnaire designed to index symptoms of childbirth-related PTSD in line with DSM-5 criteria (Ayers, Wright & Thornton, 2018). In the DSM-5, PTSD is proposed to have four symptom clusters (intrusions, avoidance, negative mood/cognitions, and hyperarousal symptoms), though consensus for this factor structure in other populations has not been reached (Armour, Mullerova & Elhai, 2016). Exploratory factor analysis suggests that the BiTS has a two-factor structure (Ayers, Wright & Thornton, 2018). Symptoms of intrusion, avoidance and two items relating to birth-specific negative mood/cognitions loaded onto the first factor, Birth-related Symptoms (BRS) and symptoms of hyperarousal and the remaining negative mood/cognition items loaded on the second factor, General Symptoms (GS). These results have been replicated in subsequent examination of the psychometric properties of the BiTS internationally (Caparos-Gonzalez et al., 2021; Handlezalts, Hairston & Matatyahu, 2018; Weigl et al., 2021). A recent Confirmatory Factor Analysis examined a bi-factor model whereby a global factor was

proposed to explain the general variance shared by all items on the BiTS and the previously recognised specific factors of BRS and GS were also examined as explaining specific variance over and above the global CB-PTSD factor (Rados et al., 2020). To date, research has yet to examine the psychometric properties of the BiTS in Australia.

The major aim of the current study was to provide the first psychometric evidence for the reliability and validity of the BiTS as a measure of CB-PTSD in Australian mothers. Further aims were to examine the factor structure of the instrument, and its acceptability among Australian mothers. It was hypothesised, first, that the BiTS will demonstrate adequate validity (convergent, divergent, and discriminant validity), reliability (internal consistency), and acceptability. Specifically, it was predicted that the BiTS will evidence high internal consistency, and that scores would be significantly associated with an established measure of PTSD symptom severity (Handlezalts, Hairston & Matatyahu, 2018, Rados et al, 2020). We further predicted that the birth-related subscale of the BiTS would demonstrate divergent validity in relation to a measure of postnatal depression, in line with previous findings from other countries (Rados et al., 2020).

With regard to factor structure, it was hypothesised that a two-factor model in line with the current proposed subscales of the measure (BRS and GS) would provide a superior fit over a four-factor model of PTSD symptoms (intrusions, avoidance, alterations in mood/cognitions and hyperarousal), based on previous international studies (Ayers, Wright & Thornton, 2018; Caparos-Gonzalez et al., 2021; Handlezalts, Hairston & Matatyahu, 2018; Weigl et al., 2021). We further hypothesised that support would be found for a bifactor model, comprised of a global CB-PTSD factor, and two additional factors, Birth-related Symptoms (BRS) and General Symptoms (GS), in line with the findings of Rados et al. (2020).

Method

Participants

Participants were a convenience sample of mothers of infants aged 0-12 months, aged 21-46 years (N = 705, M = 31.06, SD = 3.92). Eligibility included being the mother of a live infant born in the last 12 months as a result of a singleton pregnancy, basic English literacy, having an infant born in Australia and over the age of 16. Full descriptive statistics of the sample can be found in Table 1 (Sample Characteristics), Table 2 (Birth-related Sample characteristics) and Table 3 (CB-PTSD sample prevalence based on BiTS scores). Based on the sample prevalence of CB-PTSD symptoms reported in Table 3, this sample is most comparable to a high-risk sample than a community sample (Yildiz, Ayers & Phillips, 2017).

Recruitment occurred via a social media strategy focussing on mother-specific forums (e.g., Facebook, online parenting forums). Among the 1184 respondents, respondents who did not meet eligibility criteria were excluded (n = 356). Of the eligible 828 respondents, 93 respondents did not complete beyond the demographic data. Chi-square tests and independent t-tests were used to examine differences between groups of participants who completed the BiTS to those who dropped out prior to completion of testing. No significant differences emerged between these groups on demographic variables: maternal education (n= 807, χ^2 (6) = 3.76, p = .71), marital status (n= 812, χ^2 (7) = 8.77, p = .27), household income (n= 807, χ^2 (8) = 4.93, p = .76), employment (n= 807, χ^2 (7) = 4.48, p = .72), mother's country of birth (n= 822, χ^2 (36) = 33.44, p = .59) or maternal age ($t_{127.35}$ = -.67, p = .32). Of the participants who completed the BiTS (n = 734), a small portion had missing data (n = 12). Missing data on the BiTS ranged from 5%-75% of responses (1 item - 15 items). Confirmatory Factor Analysis cannot be completed on incomplete data sets; therefore, the decision was made to exclude participants with missing data on the BiTS.

To further ensure the integrity of the data, analysis of infant date of birth revealed a small subset of participants whose response to the item "have you given birth to a live infant in the last 12 months" was incongruent with the infant date of birth provided (n = 5). These participants were removed from the analyses. Analysis of reCAPTCHA data indicated that a small subset of participants (n = 2) scored less than .05, the recommended cut-off to suggest that the data could not have been created by a bot. A further subset did not generate a reCAPTCHA score (n = 10). This data was removed from final analyses. The final sample size of participants in this study was n = 705.

All research procedures contributing to this study were approved by the Human Research Ethics Committee of the XXXXXX (*XXXXXXX*).

Clinical Measures

The City Birth Trauma Scale (BiTS; Ayers, Wright & Thornton, 2018) is a 29-item self-report measure of PTSD symptoms specific to childbirth as the traumatic stressor, in line with DSM-5 criteria for PTSD. Criterion A for the DSM-5 criteria for PTSD evaluates exposure to a traumatic stressor. The BiTS assesses exposure to a birth-related traumatic stressor through two dichotomous items (yes/no). Frequency of PTSD symptoms, in line with DSM- 5 criteria occurring during the week prior to assessment, are rated using a 5-point Likert Scale and correspond to PTSD criterion B -E (items 3-22). PTSD dissociative subtype can also be assessed through two items (item 23 and 24). Duration (Criterion F, item 26), Distress/Impairment (Criteria G, Items 27 and 28) and Exclusion criteria for PTSD (Criterion H, item 29) are assessed. Current PTSD and PTSD with delayed onset is assessed by Item 25. A score of 0 on item 25 suggests PTSD symptoms prior to birth. The BiTS has two subscales, BRS (items 3-12), covering symptoms of intrusions, avoidance, and two items of negative/mood cognition that specifically relate to the birth experience and GS which explore

the remaining negative mood/cognitions items and hyperarousal items (items 13-22). Good internal consistency of the total scale has previously been reported (α = .92; Ayers, Wright & Thornton, 2018).

Acceptability of the BiTS was assessed using the following item: "Would you be willing to complete the previous questionnaire (regarding your birth experiences and related distress) if used in routine assessment at a health service?". Response options were "yes, no and unsure". An additional item sought qualitative information about the acceptability of the BiTS by asking "If you answered 'no', or 'unsure', could please give reasons for your response?" and offering a free text box.

The Impact of Event Scale- Revised (IES-R; Weiss & Marmar, 1997) is a 22-item self-report scale that assesses PTSD symptoms. Participants rate the severity of their symptoms in the past week on a 5-point Likert scale. In the present study, internal consistency for total scores was high (α = .97). The IES-R has also been used in previous studies of childbirth-related PTSD (Handelzalts, Hairston & Matatyahu, 2018; Rados et al, 2020).

Edinburgh Postnatal Depression Scale (EDPS; Cox et al., 1987) is a 10-item self-report measure of postnatal depression (PND) symptom occurrence and severity in the week prior to completion. The EDPS uses a 4-point Likert scale, and scores range from 10-40. The internal consistency of the EDPS has been supported in previous studies in Australian populations (Small, Lumley, Yelland & Brown, 2007), and was likewise high in the current study (α = .91).

Procedure

The present study used an open survey, where participants reached the survey via a weblink. All research procedures contributing to this study were approved by the Human Research Ethics Committee of the XXXXXX (*XXXXXXX*). Participants read the information

about consent to participate prior to completing the online questionnaire and provided informed consent for this study by clicking a box indicating that they had read and understood informed consent documents and consented to participate. The first two items determined eligibility for participation; English-speaking and mothers who have given birth to a live infant in the past twelve months. If respondents did not meet criteria, they were taken to the final page of the survey and participation was ceased. Following demographic questions, participants completed the clinical measures in the following order: BiTS, IES, EDPS, as well as some additional measures not reported in this paper. At the completion of the questionnaire, participants were provided with details for perinatal support services in all states of Australia. At survey completion, participants were given the opportunity to go into the draw to win one of five $50 (AUD) grocery vouchers by providing an email address. Demographic information and clinical measures were completed online by participants using personal mobile or computer devices. Questionnaires and data output were generated using Qualtrics XM 2020. Participants were able to save their responses and return to the questionnaire for up to one week. The average completion time for each survey was 38 minutes (*SD* = 146.85). Several steps were taken to ensure data integrity. This included the use of reCAPTCHA to prevent data entry by bots; use of response time to screen out participants who had spent insufficient time completing the survey; use of IP address information to prevent participants completing the survey multiple times; and collection of infant date of birth and place of birth.

Analytic Plan

Descriptive analyses were conducted first to ensure that the data was appropriate for factor analysis. Confirmatory Factor Analysis cannot be completed on incomplete data sets; therefore, the decision was made to exclude participants with missing data. Sample sizes are reported for all other analyses due to participant drop-off. Internal consistency for the BiTS,

BiTS subscales and questionnaires used for discriminant analyses was calculated using Cronbach's alpha.

Confirmatory Factor Analysis was conducted using IBM SPSS AMOS (version 27). Several fit indices were used to evaluate the models; Root *M* Square Error of Approximation (RMSEA), Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI). Pearson's bivariate correlations were used to determine convergent and divergent validity. One-way ANOVA, Tukey post-hoc analysis and independent t-tests were used to examine divergent validity.

Results

Descriptive Statistics

Descriptive analysis of the 20 items of the BiTS covering Criterion B-E of the DSM-5 criteria for PTSD (items 3-22) indicated that all items covered the full range from 0-3 (n = 723). No items exceeded the proposed cut-off of 3 for skewness or 10 for kurtosis (Rados et al, 2020; Kline, 2011).

Confirmatory Factor Analysis

A four-factor model, comprised of PTSD symptom domains of Intrusions, Avoidance, Negative Mood/Cognitions and Hyperarousal, was tested first (n = 705). This four-factor model provided a poor fit to the data $\chi^2(164) = 1744.07$, $\chi^2/df = 10.63$, RMSEA = .117, CFI = .83, TLI = .81. The 90% confidence interval for the RMSEA (.11-.12) was outside the recommended cut-off of .08. Given that all indices showed the poor fit of the model, the four-factor model was rejected, in line with the findings of previous studies (Rados et al., 2020; Sandoz et al., 2021).

The two-factor model, first outlined by Ayers, Wright & Thornton (2018), is comprised of two correlated dimensions: BRS and GS. This model showed acceptable fit to

the data according to most fit indices χ^2 (169) = 839.50, χ^2/df = 4.96, RMSEA = .075, CFI = .93, TLI = .92, AIC=961.50 as hypothesized. The model fit was close to being considered an acceptable fit, yet the RMSEA (0.75) was slightly above conventional cut-off values for a close fit (>.06). The 90% confidence interval for the RMSEA (.07-.08) was within the recommended cut-off of .08, which would indicate a reasonable error of approximation, and thus in conjunction with other indicators of model fit could be deemed acceptable (Browne & Cudeck, 1992). The correlation between the two factors of BRS and GS was moderate (r = .50). The standardized factor loadings of BiTS items 3-22 in the two-factor model are reported in Table 4. Clear delineation between the previously identified factors of BRS and GS was supported through these factor loadings. Items 3-12 load strongly onto the BRS factor (except for item 10 which loads moderately) and items 13-22 load strongly on the GS factor. In summary, the two- factor model showed adequate fit to the data based on model fit indices.

Tested next was the bifactor model, comprising a global factor and two specific factors of BRS and GS. Each item was modelled as loading on both on the global factor and on one of the two specific factors. The bifactor model showed the acceptable fit to the data, χ^2 (149) = 630.20, χ^2/df = 4.23, RMSEA = .068, CFI = .95, TLI = .94, AIC=792.20. The 90% confidence interval for the RMSEA (.06-.07) was within the recommended cut-off of between .06 - .08. Within the bi-factor model, the correlation between BRS and GS was low (r = -.06). Considering closer fit on model fit indices and a lower AIC, the bifactor model yields a slightly more acceptable fit to the data than the two-factor model.

The standardized factor loadings of BiTS items 3-22 in the bi-factor model are reported in Table 5. Items 3-12 loaded strongly onto the global factor (except for item 10 which loads moderately), and items 13-22 loaded moderately onto the global factor. Items 3-22 loaded weakly onto the BRS factor. Items 13-22 loaded moderately onto the GS factor.

Reliability. Analysis of the internal consistency of the BiTS using Cronbach's alpha indicated high reliability for the total scale (items 3-22, α=.93), as well as high reliability for the two subscales reported in the two-factor and bifactor models: BRS subscale (items 3-12, α=.94) and GS subscale (items 13-22, α=.91).

Convergent Validity. At the bi-variate level, BiTS total scores were strongly correlated with scores on the IES-R total scores (r (632) = .80, p<.001). When comparing BiTS subscales with total scores on the IES-R, a moderate significant correlation was observed between IES-R total score and scores on the BRS subscale (r (632) = .78, p<.001). The relationship between IES-R total score and scores on the GS subscale were significantly associated, r (632) = .60, p<.001.

Divergent Validity. Divergent validity was assessed via bi-variate correlations between the BiTS total score and subscale scores and total scores on the EPDS. EDPS and BiTS total scores were strongly correlated (r (612) = .71, p<.001). Total scores on the EDPS were more strongly correlated with scores on the BiTS GS subscale (r (612) = .75, p<.001) than with scores on the BiTS BRS subscale (r (612) = .49, p<.001).

Discriminant validity. Discriminant validity of the BiTS total score, as well as subscale scores (birth-related and general symptoms), was examined via known-group differences, as detailed in Table 6. When examining type of birth, there was a statistically significant difference between groups for scores on both the BRS and GS subscale, as well as for the overall BiTS score as demonstrated by one-way ANOVA. Tukey post hoc analysis indicates that participants who experienced a vaginal birth reported statistically lower total scores on the BiTS than participants who experienced a vaginal birth with instrument (p<.001) and emergency c-section (p<.001). Participants who experienced vaginal birth experienced fewer general symptoms (p=.01) and birth-related symptoms (p=<.001) than participants who experienced vaginal birth with instrument. When comparing vaginal birth

with emergency c-section, participants who birthed vaginally reported fewer general symptoms ($p<.001$) and less birth-related symptoms ($p<.001$). There was no statistical significance between mean scores on the GS subscale ($p=.59$) and BRS subscale ($p=1.00$) for participants who experienced vaginal and elective c-section births. There was a statistically significant difference using Tukey post hoc analysis when comparing mean BRS for participants with elective c-section with emergency c-section ($p<.001$) and vaginal birth with instrument ($p<.001$), with participants experiencing elective c-section reporting less birth-related symptoms.

Using an independent samples t-test, there was a statistically significant difference in mean BiTS total scores ($t_{572.40} = 4.77$, $p = .006$) and BRS subscale means ($t_{563.03} = 4.79$, $p = .001$) between participants who had their labour medically induced and those who went into spontaneous labour. Participants who were medically induced had statistically higher means across the BRS subscale and total BiTS score than participants who were not induced. There was no statistically significant difference in scores on the GS subscale for participants based on induction status ($t_{591.77} = 3.38$, $p = .109$).

Acceptability of the BiTS. Participant ratings of the acceptability of the BiTS indicated that a vast majority of participants would be willing to complete the BiTS if used in routine assessment by healthcare providers (88.9%). A small percentage of participants did not respond to this item (.6%), a small percentage of participants indicated they felt unsure (6.4%), and a small percentage of participants indicated they would not be willing to complete the BiTS if used as part of routine assessment by healthcare providers (4.1%).

Discussion

Adverse childbirth experiences and the impact on mothers and infants has been a growing focus of clinical research and practice in recent years. Yet evidence regarding the

structure and measurement of CB-PTSD remains limited. This study provides the first psychometric evidence for the DSM-5 based measure of CB-PTSD, the City Birth Trauma Scale (BiTS), in the Australian population. In line with hypotheses, support was found for a bi-factor structure of the instrument (Rados et al., 2020). The bi-factor model of the BiTS supports a global CB-PTSD factor and two-specific factors of Birth-related Symptoms (BRS) and General Symptoms (GS). Previous studies of the BiTS (Rados et al., 2020; Sandoz et al., 2021) have suggested that support for the bi-factor model can be seen to justify the use of a total scale score in addition to subscale scores (BRS and GS). In relation to this study, the support for a bi-factor model, with distinct subscales (BRS and GS) suggests that a global CB-PTSD factor is present and that all items are related in a unidimensional manner allowing for interpretation of total scale score for the BiTS (Dunn & McCray, 2020). The present study also suggests that the subscale scores offer additional information that cannot be accounted for simply by a unidimensional total scale score. Therefore, when considering model fit, interpretations based on the total scale and two subscale scores would appear valid. Alongside model fit indices, analysis of specific factor loadings yields important information about the multidimensionality of a scale (Dunn & McCray, 2020).

When examining the BiTS factor loadings in the bi-factor model, the BRS factor was observed as a relatively weaker latent factor, with lower factor loadings on the birth-related factor than the global factor, as found by Sandoz et al. (2021). This suggests that when considered alone, BRS accounts for less variance in the data than when considered in the context of the whole scale. In the bi-factor model, ‘general symptoms’ (item 13-22) load more strongly on the GS factor than onto the global factor. This suggests that the ‘general symptoms’ factor represents a strong latent factor within the data. In comparison, in the two-factor model, items in the BRS and GS subscales load strongly onto their respective factors (except for item 10, which loads modestly). Rados et al. (2020) did not report factor loadings

for the two-factor model, so a comparison cannot be drawn however Sandoz et al. (2021) reported similar findings to the present study and suggested that a total scale score could be interpreted in line with the suggestion by Rados et al. (2020). Interestingly, the factor loadings in the bi-factor model may be more consistent with a two-factor model, where the general factor is in fact a proxy for BRS, and the other factor represents GS. Clinically, interpreting specific subscale scores for BRS and GS may be important for differential diagnosis.

Total scores on the BiTS correlate strongly with scores on the EPDS, a measure of postpartum depression. Subscale scores for GS present the strongest correlation between scores on the EDPS, which theoretically makes sense due to overlapping symptoms on the GS subscale measure PTSD symptoms of negative mood/cognitions and hyperarousal. Subscale scores for BRS yield lower comparative correlations to post-partum depression (though are still modestly correlated), consistent with the findings of previous studies (Sandoz et. al, 2020; Weigl et. al, 2021). This finding indicates that the BRS subscale in the BiTS may delineate CB-PTSD from post-partum depression alone and may be useful to examine when determining co-morbidity between CB-PTSD and postpartum depression.

High rates of co-morbid PTSD and depression have been reported in both non-postpartum and postpartum samples (Dekel, Solomon, Horesh & Ein-Dor, 2014, Dekel, Ein-Dor, Dishy & Mayopolous, 2020). In broader PTSD literature, the concept of post-traumatic mood disorder has emerged where in conjunction with other symptoms of PTSD, depressive symptoms alone are significant enough to warrant a co-morbid diagnosis of depression (Sher, 2005). Dekel, Ein-Dor, Dishy & Mayopolous (2020) examined co-morbidity of CB-PTSD and postpartum depression. Using factor analysis, and separate measures of CB-PTSD and postpartum depression, it was determined that postpartum depression symptoms and CB-PTSD factors loaded onto one unidimensional factor (even when removing overlapping

symptoms). However, studies outside of postpartum samples have determined that co-morbid PTSD and depression may represent a specific disorder that is both clinically and physiologically distinct from presentations of PTSD and depression alone. Previous research has identified physiological markers that distinguish between depression, PTSD and co-morbid PTSD/depression presentations such as differences in rapid-eye movement sleep architecture in co-morbid presentations when compared to depression patients, and differences and lower plasma cortisol levels in patients with co-morbid PTSD and depression when compared to depression patients who do not meet criteria for PTSD (Sher, 2005). Furthermore, pertaining to clinical presentation, when compared to individuals suffering from PTSD alone, co-morbid symptoms of PTSD and depression increase symptom severity and functional impairment (Sher, 2005). Dekel et al. (2020) determined that compared to postpartum depression alone, co-morbid presentations of CB-PTSD and postpartum depression were predicted by stressors concerning the childbirth experience. This finding is of importance to the current study as it suggests that overlap between measures of CB-PTSD and postpartum depression may represent a unique post-traumatic stress-depressive response above and beyond the prevalence and severity of postpartum depression or CB-PTSD alone. The BiTS provides a promising avenue for delineating between post-traumatic mood disorder and depression in the postpartum period. Furthermore, symptoms on the GS subscale may be linked to increased symptom severity and functional impairment, therefore this subscale may be a useful tool in clinical settings to determine the severity of symptoms and monitor change.

The findings of this study support previous research on risk factors for CB-PTSD (Grekin & O'Hara, 2014), such as that unexpected complications resulting in birth interventions such as instrumental vaginal birth and emergency c-section place women at greater risk of experiencing childbirth as traumatic. Our findings suggest that vaginal birth

and elective caesarean section result in less general and birth-related symptoms of CB-PTSD and that induction of labour increases the risk of birth-related PTSD symptoms. In Australia, the rate of caesarean sections continues to rise (36% of all births in 2019). Despite this rising intervention rate, the rate of maternal and infant deaths in the perinatal period (between 20 weeks gestation to 28 days post-birth) have remained relatively unchanged in the last two decades (Australian Institute of Health and Welfare, 2021), suggesting an over-use of this surgical intervention. High rates of caesarean section are of concern because unnecessary caesarean sections have significant short and long-term impacts upon the health of mothers and babies (Sandall et al., 2018).

Our findings should be considered considering some study limitations. First, it is possible that participants were motivated to participate due to their own birth experiences, resulting in over-representation of traumatic birth experiences. Notwithstanding this, the distributions of medical interventions in our data seem comparable to those previously reported for the Australian population. According to the Australian Mothers and Babies report (Australian Institute of Health and Welfare, 2021), in 2019, 12.6% of Australian women experienced an instrumental vaginal birth, 36% of women had a caesarean section, and 35% experienced induction of labour. Comparably, in the present sample 17.6% of women experienced instrumental vaginal birth, 35.2% experienced c-section (12.6% elective; 22.6%) and 40.9% experienced induction of labour. In the present study, 12.3% of women met probable full criteria for CB-PTSD, which is in line with estimated prevalence rates for high-risk samples (Grekin & O'Hara, 2014; Yildiz, Ayers & Phillips, 2017).

A further consideration pertaining to the strengths and limitations of this study is the representativeness of the current sample compared to the national population of Australia. Participants in this sample were highly educated, with 73.4% of holding an undergraduate or postgraduate university degree. It should be noted that in Australia in 2020, 48.3% of women

aged 25-29 and 50.1% of women aged 30-34 held an undergraduate or postgraduate university level qualification (Australian Bureau of Statistics, 2020), indicating that participants in this study are highly educated compared to national averages. Furthermore, in 2020, 36% of all recorded births in Australia occurred outside of marriage (Australian Institute of Health and Welfare, 2021). In this study, 28.3% of births occurred outside of marriage, indicating that married participants may be slightly overrepresented within this study. According to the Australia Bureau of statistics, the average annual household income is approximately $120 000 (AUD), whereas approximately 57.1% of the current sample reported higher gross household income than this in the year prior to their infant being born (Australian Bureau of Statistics, 2019-2020). This indicates that participants in this study represent higher income earners when compared to national Australian statistics.

Finally, the study relied on self-report measures, which limited the capacity to confirm the diagnostic status of participants. It would be beneficial for future research investigate the validity of the BiTS further using structured clinical interviews, which would also be informative in determining cut-off scores for clinical and subclinical presentations.

In conclusion, a key strength of the BiTS is that it was designed to map onto DSM-5 criteria for CB-PTSD symptoms, and our findings provide novel evidence that it is a reliable, valid, and acceptable measure of these symptoms among mothers of infants in the Australian context. High internal consistency was found for the total scale, as well as two subscales indexing BRS and GS. While the overall findings do not preclude the use of a total scale score, strong support was found for interpretation of the BiTS subscale scores (BRS and GS). These findings add to growing support for the reliability and validity of the measure from international research. This is welcome, given the importance of recognising CB-PTSD in perinatal settings, and the broad range of potential research and clinical applications for such a measure.

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Table 1

Descriptive Characteristics of the Sample

Characteristic	Participants (n = 705)	
	M (SD)	*n (%)*
Maternal age	31.06 (3.92)	
Marital Status[a]		
Married		498 (70.6)
Widowed		1 (.1)
Separated		7 (1)
Single		11 (1.5)
In a relationship		4 (.6)
Defacto		182 (26.2)
Maternal Education Level[b]		
Never attended school		1 (.1)
Year 10		21 (2.9)
Year 12		47 (6.7)
TAFE/Trade apprenticeship		113 (16)
Undergraduate university degree		255 (36.2)
Postgraduate university degree		262 (37.2)
Other		6 (.9)
Annual Household Taxable Income (AUD)		
Under $25000		8 (1.1)
$25,001-$50,000		30 (4.3)
$50,001- $75,000		61 (8.7)
$75,001-100,000		110 (15.6)
$100,001-$125,000		93 (13.2)
$125,001-150,000		94 (13.3)
$150,001-$175,000		115 (16.3)
$175,001-$200,000		93 (13.2)
Over $200,000		101 (14.3)
Maternal country of birth		
Australia		606 (86.0)
Europe		44 (6.0)
Asia & Pacific (excluding Australia)		28 (3.9)
South/Latin America		4 (0.6)
North America		11 (1.5)
Middle East		3 (0.3)
South Africa		3 (.4)
Missing		6 (.7)
Aboriginal Torres Strait Islander descent		
Mother		14 (2,0)
Infant		30 (4.3)

[a] *Rates of birth outside of marriage in this sample (28.3%) were somewhat lower than those according to national statistics for birth outside of marriage in 2020 (36% of all recorded births in Australia; Australian Institute of Family Studies, 2022)*

[b] *Rates of university level education in this sample (74.3%) were somewhat higher than those according to national statistics (50.1% of Australian women aged 30-34 years held an undergraduate or postgraduate degree; Australian Bureau of Statistics, 2020).*

Table 2

Birth-related Sample Characteristics

Participants (*n* = 705)	
Birth-related variable	*n (%)*
Antenatal model of care	
GP Shared Care	91 (12.9)
Hospital Antenatal Clinic	197 (27.9)
Midwifery Group Practice Program (MGP)	178 (25.2)
Private Midwife	43 (6)
Private Obstetrician	174 (24.7)
Other	22 (3.1)
Physical health problems in pregnancy	
Yes	298 (42.3)
No	406 (57.6)
Missing	1 (.1)
Place of birth	
At home	38 (5.3)
Public Hospital	502 (71.2)
Private Hospital	147 (20.9)
Birth Centre	17 (2.4)
Other	1 (.1)
Mode of birth	
Vaginally	333 (47.2)
Instrumental Vaginal (forceps/vacuum)[a]	121 (17.2)
Elective c-section[b]	90 (12.8)
Emergency c-section[b]	161 (22.8)
Medical induction of labour[c]	
Yes	286 (40.6)
No	418 (59.4)
Missing	1 (.1)

According to the Australian Institute of Health and Welfare (2021);
[a]12.6% of Australian women experienced an instrumental vaginal birth in 2019
[b]36% of Australian women had a caesarean section (either elective or emergency) in 2019
[c]35% of Australian women experienced induction of labour in 2019

Table 3

Probable CB-PTSD sample prevalence based on BiTS scores (self-report based on week prior)

Participants (n = 705)	
DSM-5 PTSD criteria	*n (%)*
Criteria A: Exposure to traumatic stressor	198 (28.0)
Criteria B: Re-experiencing	354 (50.2)
Criteria C: Avoidance Symptoms	280 (39.7)
Criteria D: Negative Cognitions and Mood	533 (75.6)
Criteria E: Hyperarousal	548 (77.7)
Symptom onset	
First six months post-birth	453 (64.3)
At least six months post-birth	23 (3.3)
Prior to birth	60 (8.5)
Full criteria for CB-PTSD met	88 (12.5)

Table 4

Standardized Factor Loadings for the Two-Factor Model of the BiTS

Item	BRS	GS
3. Recurrent unwanted memories of the birth	.86	
4. Bad dreams or nightmares about the birth	.67	
5. Flashbacks to the birth and/or reliving the experience	.72	
6. Getting upset when reminded of the birth	.91	
7. Feeling tense or anxious when reminded of the birth	.92	
8. Trying to avoid thinking about the birth	.83	
9. Trying to avoid things that remind me of the birth	.72	
10.Not able to remember details of the birth	.44	
11. Blaming myself or others for what happened during the birth	.74	
12. Feeling strong negative emotions about the birth	.88	
13. Feeling negative about myself or thinking something awful will happen		.74
14. Lost interest in activities that were important to me		.79
15. Feeling detached from other people		.80
16. Not able to feel positive emotions		.78
17. Feeling irritable or aggressive		.75
18. Feeling self-destructive or acting recklessly		.51
19. Feeling tense and on edge		.76
20. Feeling jumpy or easily startled		.64
21. Problems concentrating.		.71
22. Not sleeping well not due to the baby's sleep pattern.		.62

Note: BRS = Birth Related Symptoms; GS = General Symptoms

Table 5

Standardized Factor Loadings for the Bi-factor Model of the BiTS

Item	General	BRS	GS
3. Recurrent unwanted memories of the birth	.86	.16	
4. Bad dreams or nightmares about the birth	.68	.20	
5. Flashbacks to the birth and/or reliving the experience	.72	.18	
6. Getting upset when reminded of the birth	.91	-.04	
7. Feeling tense or anxious when reminded of the birth	.92	.05	
8.Trying to avoid thinking about the birth	.82	.07	
9.Trying to avoid things that remind me of the birth	.70	.15	
10.Not able to remember details of the birth	.43	-.01	
11.Blaming myself or others for what happened during the birth	.76	-.28	
12.Feeling strong negative emotions about the birth	.91	-.30	
13.Feeling negative about myself or thinking something awful will happen	.44		.60
14.Lost interest in activities that were important to me	.35		.71
15.Feeling detached from other people	.39		.70
16.Not able to feel positive emotions	.40		.66
17.Feeling irritable or aggressive	.31		.70
18.Feeling self-destructive or acting recklessly	.29		.42
19.Feeling tense and on edge	.35		.68
20.Feeling jumpy or easily startled	.37		.51
21.Problems concentrating.	.31		.64
22.Not sleeping well not due to the baby's sleep pattern.	.40		.47

Note: BRS = Birth Related Symptoms; GS = General Symptoms.

Table 6

Discriminant validity of the BiTS

	Birth-related symptoms	General symptoms	Total score
		M (SD)	
Type of birth			
Vaginally	5.47 (7.30)	9.21 (8.39)	14.53 (13.56)
Instrumental vaginal	11.20 (8.97)	11.45 (8.29)	22.88 (14.75)
Elective c-section	5.43 (7.28)	10.20 (7.83)	15.71 (13.01)
Emergency c-section	12.30 (9.21)	12.12 (8.28)	24.40 (14.56)
	F (3,701) = 35.32, p<.001***	F (3,701) = 5.49, p<.001***	F (3,701) = 23.78, p<.001***
Induced			
Yes	9.92 (9.11)	11.65 (8.46)	21.57 (15.19)
No	6.71 (8.08)	9.50 (8.04)	16.21 (13.78)
	$t_{563.03}$ = 4.79, p =.001**	$t_{591.77}$ = 3.38, p = .109	$t_{572.40}$ = 4.77, p =.006**