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RUNNING HEAD: Characteristics of traumatic birth memories

Characteristics of memories for traumatic and non-traumatic birth

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Abstract

Evidence for memory characteristic differences between trauma and other memories in non-clinical samples is inconsistent. However, trauma is frequently confounded with the event recalled. This study compares trauma and non-trauma memories for the *same event*, childbirth, in a *non-clinical* sample of 285 women 4-6 weeks after birth. None of the women met diagnostic criteria for post-traumatic stress disorder. Traumatic birth, defined by the DSM-5 event criterion, was reported by 100 women. The ratings of some memory characteristics did not differ between memories for traumatic and non-traumatic birth: all were rated highly coherent and central to women's lives, with moderate sensory memory. However, women who experienced traumatic births reported more involuntary recall, reliving, and negative/mixed emotions. Thus, trauma memories differed from non-trauma memories. In this non-clinical sample, this is likely to be due to *encoding* during trauma rather than the distinctive memory profile for memories retrieved by those experiencing trauma symptoms.

Introduction

The subjective characteristics of autobiographical memories are affected by several factors. These include the valence and intensity of emotion experienced at the time (e.g. D'Argembeau, Comblain, & van der Linden, 2003; Schaefer & Philippot, 2005; Talarico, LaBar, & Rubin, 2004) and psychological well-being, in particular anxiety and depression (e.g. Berntsen, Willert, & Rubin, 2003; Williams et al., 2007). One aspect of research that has led to extensive debate, and a level of controversy, is whether the characteristics of memories for traumatic experiences differ from those of other autobiographical memories and, if so, in what ways (Sotgiu & Mormont, 2008). Reviews suggest that there are differences between traumatic and non-traumatic memories in clinical samples but that the evidence is less strong in non-clinical samples. For example, Brewin (2007; 2014) concluded that the evidence supports differences between traumatic and non-traumatic memories in clinical samples with full diagnostic post-traumatic stress disorder (PTSD) but that there is little evidence for differences in the qualities of voluntarily recalled memories of traumatic and non-traumatic experiences in healthy, non-clinical samples. Another review by Lorenzzoni, Silva, Poletto, Kristensen and Gauer (2014) concluded that the characteristics of overgeneralisation, vividness, emotional intensity and centrality to self-identity are more evident in the memories of people with PTSD than those who experienced trauma but did not develop PTSD.

Research focused on clinical samples of people with PTSD has tended to argue that memories for trauma have distinctive features that distinguish them from other memories (Brewin, Dalgleish, & Joseph, 1996; Brewin, Gregory, Litpon, & Burgess, 2010; Ehlers & Clark, 2000). This profile of trauma memory includes impaired (fragmented or disorganised) voluntary episodic recall of the trauma event combined with vivid and detailed involuntary intrusions of images (flashbacks) experienced as if they are occurring in the present (Brewin, 2014). By contrast, some researchers taking a cognitive perspective have argued that it is less

clear that trauma memory involves special processing (e.g., Shobe & Kihlstrom, 1997; Rubin, Boals & Berntsen, 2008). Research of this nature tends to compare the phenomenological characteristics of voluntarily recalled traumatic memories with emotional and non-emotional memories in healthy, non-clinical samples. While there may be some phenomenological differences between trauma memories and other memories (e.g., Porter & Birt, 2001), many of the characteristics of trauma memories that have been identified as distinctive are shared with other autobiographical memories encoded in conditions of strong emotional arousal. (e.g., Berntsen et al., 2003).

An important feature that distinguishes the memories studied in the clinical and non-clinical samples is that trauma primarily influences *encoding* in the non-clinical samples whereas both *encoding and retrieval* of the memory are affected in clinical samples of people with PTSD since these individuals are still affected by the trauma when they retrieve the memory. The focus of this study is the characteristics of voluntarily recalled memories *encoded* during an event that was perceived as traumatic or not traumatic in a *non-clinical sample*. Further study is needed because, although some differences have been reported between trauma and non-trauma memory characteristics in non-clinical samples, the degree to which they differ and the ways in which they differ are not consistent across studies (Sotgiu & Mormont, 2008). For example, some studies suggest that trauma memories are less vivid than positive memories (Tromp, Koss, Figueredo & Tharan, 1995) while others report no difference in vividness compared with positive or negative emotional memories (Bohanek, Fivush & Walker, 2005; Byrne, Hyman & Scott, 2001; Porter & Birt, 2001). Similarly, while Tromp et al. (1995) found trauma memories had a less meaningful order than positive or negative memories, Byrne et al. (2001) and Porter and Birt (2001) found no difference in coherence. Different results have also been reported for how well trauma memories are remembered compared with other emotional memories. Tromp et al. (1995) found they were

less well remembered but Porter and Birt (2001) reported that that trauma memories had more information than positive emotional experiences.

These inconsistent findings in non-clinical samples may partly result from two methodological issues. The first is a problem with the 'purity' of the comparisons between trauma and other memories because trauma has been confounded with the event being recalled. Ideally, when comparing trauma memories with other memories, they would differ only in whether the encoded event was perceived as traumatic. However, the trauma variable has typically been confounded with the type of event remembered. The traumatic events recalled have been entirely different from the non-traumatic events. For example, commonly recalled traumatic events, such as the death of a loved one or a serious accident, are different kinds of events from the most commonly recalled positive experiences, such as winning a major award or an exciting incident on a trip (Porter & Birt, 2001). This means that reported memory characteristics may have been influenced not only by the trauma difference, but also by other differences between events such as the centrality of the event in the person's life, the degree to which other people were involved, the time since the event, or the duration of the event (e.g., Johnson, Foley, Suengas & Raye, 1988; Sotgiu & Mormont, 2008).

To eliminate the confounding of the experience of trauma with the type of event recalled, this study examined memory characteristics for the *same* event, childbirth, experienced as traumatic or non-traumatic. Very few previous studies have examined the characteristics of memories for the same event from different emotional perspectives. The few studies that take this approach have examined memories for public rather than personal events, and considered only a limited number of characteristics. Furthermore, they have compared positive and negative memories but not traumatic memories (Kensinger & Schacter, 2006; Levine & Bluck, 2004). This is the first study to compare the characteristics of memories for the same personal event experienced as traumatic or not. Childbirth is an

ideal event for this purpose because, although the details of the event vary, the key features of the experience, namely labour and delivery of a baby, are similar for all women. Crucial to the design of this study is that this singular event can invoke both positive and negative emotions (Slade, MacPherson, Hume, & Maresh, 1993) and can be experienced as traumatic or non-traumatic (e.g., Alcorn, O'Donovan, Patrick, Creedy, & Devilly, 2010; Ayers & Pickering, 2001). The incidence of traumatic birth is estimated to be between 15-34% (Ayers, Harris, Sawyer, Parfitt, & Ford, 2009; Boorman, Devilly, Gamble, Creedy, & Fenwick, 2014; Creedy, Shochet, & Horsfall, 2000; Gamble et al., 2005; Maggioni, Margola, & Filippi, 2006; Soet, Brack, & Dilorio, 2003). The time since the event was also the same for all participants. Women reported the characteristics of memories for birth 4-6 weeks after the event.

The second methodological issue is the way trauma has been defined in studies with non-clinical samples. While a consistent definition based on the event criterion for PTSD has been used in research with clinical samples, studies using non-clinical samples define trauma in a variety of ways. Some simply ask participants to recall their most traumatic experience without instructing them how to define 'traumatic' (e.g., Porter & Birt, 2001; Reviere & Bakeman, 2001). This means that many of these 'traumatic' memories do not meet the traumatic event criterion for PTSD but are more like intense negative emotional memories (Butler & Wolfner, 2000). Similarly, in the childbirth literature there "is no consistent definition of traumatic birth" (Elmir, Schmied, Wilkes, & Jackson, 2010, p. 2143) and studies have often explored 'birth trauma' as defined by women themselves (e.g., Beck, 2004). To ensure all traumatic memories in this study were defined using accepted criteria, trauma was defined using the event criterion for trauma from the definition of PTSD in the Diagnostic and Statistical Manual of Mental Disorders, DSM-5 (American Psychiatric Association (APA), 2013). Thus, the event had to be one where 'the person was exposed to: death, threatened death, actual or threatened serious injury, or actual or threatened sexual violence'.

As well as contributing to the debate about trauma memory characteristics, studying the particular characteristics of women's memories for traumatic birth is interesting in its own right. Some evidence suggests that women who have experienced a traumatic birth have vivid and intrusive memories (e.g. Ayers, 2007) but very little research has compared memories for traumatic and non-traumatic birth. The few studies that have done so have included clinical samples and focused on differences in birth memory characteristics between mothers with and without PTSD symptoms. For example, Foley, Crawley, Wilkie and Ayers (2014) developed the Birth Memories and Recall Questionnaire (BirthMARQ) specifically to measure the characteristics of birth memories and examine differences between women with and without PTSD. Results showed women with PTSD reported more negative and mixed emotional memories, involuntary recall, centrality of the memories to their identity, and less coherent or sensory memories. In another study, Briddon, Slade, Isaac and Wrench (2011) found that postnatal PTSD symptoms were associated with more disorganised memories of the birth six weeks after birth. Memory disorganisation was associated with negative birth experiences and less self-referent processing. These studies suggest that for women with PTSD symptoms, memories for traumatic birth are more disorganised and less coherent; and that self-referent processing and centrality of memories to self-identify is affected. However, previous research has not answered the question of whether there are differences in the memory characteristics of births experienced as traumatic or not in a *non-clinical* sample of women without severe PTSD symptoms.

Aim

The aim of this study was to examine the characteristics of memories for birth in a non-clinical sample of women who experienced birth as traumatic or not based on the DSM-5 criterion for a traumatic event. To ensure a non-clinical sample, none of those remembering the event met diagnostic criteria for PTSD, either in the later stages of the pregnancy (and by

implication during encoding) or at the time of retrieval, and none were receiving any form of psychological or psychiatric treatment. The study therefore addresses the question of whether memories encoded under traumatic circumstances have different subjective characteristics from other emotional autobiographical memories in the absence of PTSD. Any differences identified are likely to be associated with the encoding of a traumatic event rather than to the distinctive profile of features identified in memories retrieved by those with trauma symptoms.

Method

Design and Procedure

Data used in this study were collected as part of a randomised control trial evaluating the effectiveness of a midwife-led counselling intervention, known as PRIME (Promoting Resilience in Mothers' Emotions), for women who experienced a traumatic birth (Fenwick et al., 2013; Turkstra et al., 2015). A sample of 890 women were recruited to the PRIME study in the third trimester of pregnancy at hospital antenatal clinics in two states of Australia between 2008 and 2010. Inclusion criteria were that women were 18 years or over, expecting a live baby, with adequate English language skills, and not currently receiving psychological or psychiatric treatment. All births took place in a hospital or birth centre. At recruitment, women completed questionnaire measures including their demographic details and post-traumatic stress symptoms.

Participants were followed and screened for distress within 24-72 hours of birth. A subsample of 400 women was selected for inclusion in the PRIME trial based on their distress scores. At 4-6 weeks after birth, women completed a range of baseline measures by telephone interview. These measures included a questionnaire measuring post-traumatic symptoms and a questionnaire measuring characteristics of memories for birth. After baseline measures were completed, midwives delivered PRIME to the intervention group

across a 6 week period after birth. Subsequently women in both the control and intervention groups completed several validated measures by telephone across the next 12 months. Approval was obtained from the Human Research Ethics Committees of Griffith University and all participating hospital sites.

Study Participants

For the current analysis, women were excluded if their post-traumatic symptom scores indicated probable PTSD, either during pregnancy or at 4-6 weeks after birth. Thirty-six women were excluded for having post-traumatic stress scores that indicated probable PTSD, and 79 were excluded for not completing one of the questionnaires. This resulted in a final sample size of 285 for the current study.

Measures

The Posttraumatic Symptom Scale

The Posttraumatic Symptom Scale (PSS, Foa, Riggs, Dancu & Rothbaum, 1993) is a 17 item self-report questionnaire assessing PTSD symptoms according to DSM-IV criteria (APA, 2000) from 0 = *not at all* to 3 = *5 or more times per week / very much / almost always*. It was used to measure PTSD symptom scores at recruitment (third trimester of pregnancy) and 4-6 weeks after birth. The instructions for the PSS completed 4-6 weeks after birth were adapted to refer to the experience of childbirth and the response to the event criterion question was used to determine whether birth was experienced as traumatic. According to DSM-IV, a traumatic event is one 'where the person experienced, witnessed, or was confronted with event or events that involved actual or threatened death or serious injury, or a threat to physical integrity of self or others' (Criterion A1) and where they felt an intense emotional response of fear, helplessness or horror (Criterion A2). In the updated DSM-5 (APA, 2013), Criterion A2 was removed so, in the current study, birth was defined as traumatic if it met the first criterion. According to this event criterion, birth was traumatic for 100 of the 285

women in the study (35%). Symptom scores from the PSS were used to identify women with probable PTSD in the third trimester of pregnancy and 4-6 weeks after birth. A score of 14 or above was used to identify women with probable PTSD (Coffey, Gudmunsdottir, Beck, Palyo & Miller, 2006). Of the 36 women who were identified and eliminated from the sample, 18 reached the cut-off in pregnancy, 17 at 4-6 weeks after birth, and 1 at both times points.

Birth Memories and Recall Questionnaire (BirthMARQ)

Characteristics of memories for birth were measured using the BirthMARQ (Foley et al., 2014). This scale was developed specifically to measure the characteristics of memories for birth. It consists of 21 items that form six subscales measuring phenomenological and metamemory aspects of memories for birth: *Emotional memory*, *Reliving*, *Centrality of memory, Sensory memory, Involuntary recall and Coherence*. Items are rated on 7-point Likert scales (see Appendix 1) and memory characteristic scores are calculated as the mean of items for each subscale (range 1 to 7). A high score on the *Emotional memory* subscale indicates more negative emotion and/or mixed emotion because the two items rating positive emotion are reverse scored.

Internal consistency for the six BirthMARQ components was reasonable for most subscales (i.e. Cronbach's α greater than .7), except *Sensory memory* (α = .62) and *Coherence* (α = .65). No items were identified which would improve alpha if they were deleted, with one exception on the *Emotional Memory* subscale (*I experienced mixed positive and negative emotions at the time*). However, the improvement would have been minimal (from 0.79 to 0.80) and, therefore, the item was retained. Pearson's correlations between BirthMARQ subscales were small (ranging from .06 to .40) suggesting the subscales are relatively independent. The highest correlations were found between *Reliving*, *Involuntary Recall*, and

Centrality of memory (r = .40 and .33 respectively) and *Coherence* and *Sensory memory* (r = .32).

Results

Most participants identified themselves as married or cohabiting (82.1%), and originating from Australia (68.3%). Almost half of women were primiparous (46.7%) and ages ranged between 18 and 44 years (M = 30.49, SD = 5.95). Over half of the sample (58.8%) were educated beyond secondary school, 20.8% to degree level, and 14% were employed in professional or managerial/technical roles. Chi-square analyses confirmed no differences between the traumatic and non-traumatic birth groups on any demographic variables (all p > .10). Women who had traumatic births reported significantly more symptoms of PTSD (*Mdn* = 5) than women who had non-traumatic births (*Mdn* = 0), z = -12.15, p < .001, although all scores were in the non-clinical range.

Memory characteristics for traumatic and non-traumatic births

Median ratings of memory characteristics for traumatic and non-traumatic births are shown in Table 1. Comparisons of memory characteristics for traumatic and non-traumatic births were conducted using Mann-Whitney analyses because the items on the BirthMARQ measure were not normally distributed. Overall, across all memories, the highest ratings were for *Coherence* of birth memories and *Centrality* of the birth memories. Lowest ratings were for *Reliving* of birth memories and *Emotional memory*. Women who had traumatic births reported significantly higher levels of *Emotional memory* (indicating more negative or mixed emotions), *Reliving*, and *Involuntary recall* compared to women with non-traumatic births. They did not differ in their ratings of *Centrality of memory*, *Sensory memory* or *Coherence*.

Insert Table 1 about here

Discussion

The study aimed to compare the characteristics of memories for birth in a non-clinical sample of women who experienced birth as traumatic or not based on the DSM-5 criterion for a traumatic event. All women in this study reported their birth memories as highly coherent and central to their life, with a moderate degree of sensory information about sound, smell, taste and touch irrespective of whether their birth experience was traumatic or not. However, those who had a traumatic birth reported significantly more negative or mixed emotional memories, involuntary recall, and reliving.

One difficulty when interpreting studies of trauma memories has been the extent to which trauma memory characteristics overlap with PTSD symptoms which include distinctive memory features such as intrusive recollections. This potential confounding factor was reduced in the current study by excluding women whose post-traumatic symptom scores indicated probable PTSD either during pregnancy (and by implication, during encoding of the birth memory) or at the time of retrieval 4-6 weeks later. In this non-clinical sample, differences were found in the memory characteristics for birth appraised as traumatic or non-traumatic. Thus, while it has been suggested that trauma and non-trauma memories may differ only in clinical samples with a PTSD profile (Brewin, 2014), the current findings suggest some differences in the way traumatic and non-traumatic events are remembered in non-clinical samples. Memories for traumatic birth were more likely to be involuntarily recalled, and were experienced with more negative or mixed emotion and more reliving during voluntary recall.

Two of the six BirthMARQ characteristics, *Involuntary recall* and *Centrality of memory*, are not phenomenological characteristics of the memory but require metacognitive judgements about the birth memory: how often it comes to mind involuntarily and how important it is to the mother's identity and life story. The finding that women who encoded an experience of traumatic birth report more involuntary recall is consistent with previous

research examining trauma memories associated with PTSD, both for memories unrelated to childbirth (Brewin, 2014; Ehlers, Hackmann & Michael, 2004) and for memories of birth (Foley et al., 2014). Involuntary recall is a symptom of PTSD so it is possible this result was influenced by women with traumatic births having more PTSD symptoms than women with non-traumatic births, although the median symptom score for the traumatic birth group is low.

In this study, there was no difference in judgements of the centrality of the memory for traumatic and non-traumatic birth; the median rating for this characteristic was high for both groups. This is perhaps not surprising since a woman's memory of her experience during childbirth is likely to become a significant 'landmark' autobiographical memory in her life story. However, previous research, including Foley et al.'s (2014) study of birth memories, has shown higher ratings of centrality in those reporting PTSD symptoms (e.g., Berntsen et al., 2003; Lorenzzoni et al., 2014). This suggests that a PTSD diagnosis might be associated with particularly high centrality judgement.

Turning to the phenomenological characteristics of the birth memories, the comparison between memories of traumatic and non-traumatic birth yielded the same result as the comparison between memories of birth in those with and without probable PTSD (Foley et al., 2014) for only one of the four characteristics; *Emotional memory*. Memories of traumatic birth were characterised by more mixed or negative emotion than memories of birth that were not experienced as traumatic. This is perhaps not surprising since the women with traumatic births were those who perceived a threat of death or serious injury. The difference when memories were categorised by perceived trauma in the absence of severe PTSD symptoms suggests that it is the encoding of the traumatic experience rather than the development of PTSD that determines the emotional content of the memory.

There was no difference between trauma and non-trauma birth memories in *Coherence,* all memories were rated as highly coherent. There is inconsistency in previous evidence relating to coherence, both in the research with clinical samples with PTSD symptoms and the research with non-clinical samples. Some report less coherence in trauma memories (in clinical samples: Briddon et al., 2011; Foley et al., 2014; Halligan, Michael, Clark & Ehlers, 2003; Kenardy et al., 2007; in non-clinical samples: Tromp et al., 1995) and others report no difference (in clinical samples: Berntsen et al., 2003; in non-clinical samples: Byrne et al., 2001; Porter & Birt, 2001). In a review of studies of fragmentation in voluntary memories of trauma, Brewin (2014) concluded that the most consistent evidence for greater disorganisation comes from studies that use independent judges to rate memory *narratives* for coherence rather than self-report ratings of the memories. However, evidence based on memory narratives may be problematic because narratives do not necessarily reflect memory content; they may be constrained by what someone is willing and able to describe. In previous research, the event being remembered differs with the trauma variable. The current study demonstrates that when the same nominal event was remembered, memories were not less coherent if they were encoded during a traumatic experience.

For *Sensory memory,* there was no difference in ratings between births that were or were not traumatic when the memory was encoded. Although more detailed perceptual recall is often associated with traumatic memories (van der Kolk, & Fisler, 1995), this is usually considered a feature of *involuntarily* recalled intrusive memories in clinical samples (Brewin, 2014). By contrast, the memories in this study were voluntarily recalled by a non-clinical sample so similarities in sensory detail are not unexpected. However, memories of traumatic birth were rated higher for *Reliving* even though this is also a characteristic usually associated with involuntary, intrusive memories of trauma (Ehlers et al., 2004). While these results show that reliving is higher for voluntarily recalled memories encoded during trauma, this study did

not examine levels of reliving of an intrusive memory for those with PTSD symptoms and it is possible that these levels are even higher.

The current study has several limitations that need to be considered prior to drawing conclusions. One limitation is that we used a relatively new measure of memories for birth, the BirthMARQ, and the low internal reliability on two of the subscales in the current sample may indicate some measurement error. The median ratings of birth memory characteristics using the BirthMARQ in this study (at 4-6 weeks after birth) and Foley et al.'s (2014) study (up to 12 months after birth) are similarly high for coherence and centrality, and similarly moderate for negative or mixed emotional memory and sensory memory. The only differences are that ratings of reliving and involuntary recall appear to be higher in the Foley et al. study. The time between encoding and retrieval can influence memory characteristic ratings (Ayers, Nakić Radoš, & Balouch, 2015; Sotgiu & Mormont, 2008) so it may be that the length of time since the birth led to some differences in ratings between the two studies. However, in comparison with the variability in time since the remembered events in other studies (see Sotgiu & Mormont, 2008 for a review), the memories in the current study and those in Foley et al.'s (2014) study were all comparatively recent. In order to make meaningful comparisons over time, further studies are needed using the BirthMARQ to measure characteristics of birth memories longitudinally in the same women.

The strength of this study is that the comparison of characteristics of memories for traumatic and non-traumatic events was not confounded with the type of event recalled because all memories were of childbirth. The results revealed that in a non-clinical sample, memories for a traumatic birth were more likely to be involuntarily recalled and were experienced with more negative or mixed emotion and more reliving during voluntary recall than memories for a non-traumatic birth. The experience of being confronted with a threat of

death or serious injury during the encoding of the birth experience influenced the characteristics of memory for that experience 4-6 weeks later.

Conclusion

This is the first study to compare the characteristics of birth memories in a non-clinical sample of women who experienced birth as traumatic or not. Some memory characteristics were similar for traumatic and non-traumatic birth: all were rated highly coherent and central to women's lives, with moderate sensory memory. However, women experiencing traumatic births reported more involuntary recall, reliving, and negative/mixed emotions. In this non-clinical sample, these differences are likely to be due to encoding during trauma rather than the distinctive memory profile for memories retrieved by those experiencing trauma symptoms.

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Appendix 1: Birth memories and recall questionnaire (BirthMARQ)

This questionnaire asks about what your memories of the birth of your most recent child are like, and how you feel when you remember the birth now. If you had a caesarean under general anesthetic, please answer the questions as best you can for your memory of the experience immediately before and after.

	Emotional Memory	**Strongly Disagree**						**Strongly Agree**
1	My emotions at the time were extremely positive	1	2	3	4	5	6	7
2	My emotions at the time were extremely negative	1	2	3	4	5	6	7
3	I experienced mixed positive and negative emotions at the time	1	2	3	4	5	6	7
4	While recalling the birth now, my emotions are extremely positive	1	2	3	4	5	6	7
5	While recalling the birth now, I am experiencing mixed positive and negative emotions	1	2	3	4	5	6	7
	Centrality of memory							
6	The experience of birth has coloured the way I think and feel about other experiences	1	2	3	4	5	6	7
7	The experience of birth has become central to the way I understand myself and the world	1	2	3	4	5	6	7
8	The experience of birth was a turning point in my life	1	2	3	4	5	6	7
9	I often think about the effects the experience of birth will have on my future	1	2	3	4	5	6	7
	Coherence							
10	My memory for the birth comes to me as a logical, coherent series of events with no major gaps	1	2	3	4	5	6	7
11	My memory for the birth is fragmented, i.e. it comes in bits and pieces with bits missing	1	2	3	4	5	6	7
	Reliving	**Not At All**						**Very Much So**
12	While remembering the birth now, I relive visual impressions I had during the birth	1	2	3	4	5	6	7
13	While remembering the birth now, I relive the bodily sensations I had during the birth	1	2	3	4	5	6	7
14	While remembering the birth now, I feel as though I am reliving it and it is happening now, not in the past	1	2	3	4	5	6	7
15	While remembering the birth now, I relive the sound(s) I heard during the birth	1	2	3	4	5	6	7

	Sensory Memory	None At All						A Lot
16	As I recall the birth I can remember smells	1	2	3	4	5	6	7
17	As I recall the birth, I can remember tastes	1	2	3	4	5	6	7
18	As I recall the birth, I can remember sounds	1	2	3	4	5	6	7
19	As I recall the birth, I can remember touch	1	2	3	4	5	6	7
	Recall	**Never**						**All the Time**
20	My memory for the birth (or parts of the memory) comes to me 'out of the blue' without me trying to think about it	1	2	3	4	5	6	7
21	Things that happen now can unexpectedly bring up memories of the birth (or parts of memories)	1	2	3	4	5	6	7

* Reverse code items 1, 4 and 11

Table 1. Median memory characteristics by traumatic or non-traumatic birth

Memory characteristic	Cronbach's alpha	Overall (N = 285)	Non-traumatic birth (n = 185)	Traumatic birth (n = 100)	z	p	r
Emotional memory	0.79	2.80	2.20	3.60	-5.56	***	0.33
Reliving	0.80	2.50	2.25	3.25	-2.61	**	0.16
Centrality of memory	0.75	5.00	5.00	5.25	-0.92		0.05
Sensory memory	0.62	3.50	3.50	3.50	-0.05		0.00
Involuntary recall	0.79	3.00	2.50	3.00	-1.82	*	0.11
Coherence	0.65	6.00	6.00	5.50	-1.08		0.06

Note: Traumatic birth was categorised by DSM-5 event criterion for post-traumatic stress. * $p < .05$, ** $p < .01$, *** $p < .001$ one-tailed.