# Women's Psychosocial Outcomes Following Cardiotocography (CTG) and ST-Analysis (STan) Fetal Surveillance During Labour: An Australian Randomised Controlled Trial

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## Abstract

The STan Australian Randomised Controlled Trial (START) has been designed to compare two techniques of intrapartum fetal surveillance: cardiotocographic electronic fetal monitoring (CTG) plus analysis of the ST segment of the fetal electrocardiogram (STan+CTG) versus CTG alone. The aim of START, the first trial of its kind in Australia, is to determine if STan+CTG reduces Emergency Caesarean Section (EmCS) rates. It is also the first comprehensive intrapartum fetal surveillance trial worldwide to include the examination of clinical, economic, and psychosocial outcomes. This thesis encompasses four studies (presented as self-contained papers, two of which are published), undertaken alongside the randomised controlled trial (RCT), to integrate the perspectives of women who participated in the study and add important contextual value to the clinical results.

The aim of Study One was to identify, collate and examine the evidence surrounding women's psychosocial outcomes of EmCS worldwide. The systematic review included a large number of studies (*n*=66) from 22 different countries. Key psychosocial outcomes found to be negatively impacted by EmCS included post-traumatic stress, health-related quality of life, overall experiences, infant-feeding, satisfaction, and self-esteem. Post-traumatic stress was one of the most examined psychosocial outcomes, with a strong consensus that EmCS contributes to both symptoms and diagnosis.

The aim of Study Two was to examine women's experiences with the type of monitoring they received in the RCT. Using a qualitative research design, a sample of thirty-two women were interviewed about their experiences with the fetal monitoring. Six themes emerged from analysis: reassurance, mobility, discomfort, perception of the fetal Scalp Electrode (FSE), and overall positive experiences. The primary difference

between the two techniques was whether or not women had an FSE (an FSE is always used with STan+CTG and when necessary with CTG alone). In general, it was found that women were very accepting of STan+CTG as it was perceived as a more accurate form of monitoring than CTG alone.

Study Three examined women's psychosocial outcomes alongside the RCT. A cohort of consecutively recruited women who had participated in the RCT from its initiation were invited to complete a mixed-method psychosocial questionnaire approximately eight weeks after giving birth to explore numerous outcomes including; postnatal depression, quality of life, psychological distress, infant feeding practices, and satisfaction. Of the 527 women invited to participate, 207 women completed the questionnaire (*n*=113/263, STan+CTG; *n*=94/264, CTG alone). Analysis was by intention to treat. This questionnaire provided necessary data for two subsequent papers. The first paper presents the findings in relation to women's satisfaction with birth and monitoring and the second presents findings on women's psychological and health outcomes. In terms of birth satisfaction, while there were no clear statistically significant differences between the two groups in satisfaction with the overall birth, responses about experiences with fetal monitoring tended to favour women randomised to the STan+CTG arm. Women in the STan+CTG arm reported higher average satisfaction with staff competency associated with the monitoring and were more likely to disagree with the statement that they would prefer a different type of monitoring in future labours compared to CTG alone. The qualitative component of this study provides further insight into the key positive and negative aspects of both forms of fetal surveillance and interestingly shows that women in the CTG arm who had an FSE, reported very similar experiences to women in the STan arm, findings that are in line with Study Two. In terms of psychological and health outcomes, both monitoring types

appeared to produce comparable results in terms of postnatal depression, quality of life, distress, and infant feeding.

Results of this research firstly highlight the diverse and significant impact EmCS can have on women's psychosocial outcomes, particularly in relation to traumatic stress. These findings underscore the requirement for evidence-based strategies to provide appropriate psychosocial support and information about EmCS in the context of routine antenatal and postnatal care. Furthermore, against a backdrop of several RCTs worldwide examining the clinical outcomes of STan, this is the first comprehensive trial to include women's perspectives. Overall, policy makers can be assured that STan results in, at the very least, comparable psychosocial outcomes relative to CTG alone. Findings from this trial should be incorporated when developing consumer-based information about intrapartum fetal surveillance, regarding common misconceptions by women and care providers about the potential use of an FSE.

## Declaration

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name, in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree.

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## Published Works

Benton, M., Salter, A., Tape, N., Wilkinson, C., & Turnbull, D. (2019). Women's psychosocial outcomes following an emergency caesarean section: A systematic literature review. *BMC Pregnancy and Childbirth,* 19(1), 535. doi:10.1186/s12884-019-2687-7

Benton, M., Salter, A., Simpson, B., Wilkinson, C., & Turnbull, D. (2020). A qualitative study of a sample of women participating in an Australian randomised controlled trial of intrapartum fetal surveillance. *Midwifery,* 83, 102655. doi:https://doi.org/10.1016/j.midw.2020.102655

**Conference items**

Benton, M., Salter, A., Simpson, B., Wilkinson, C., & Turnbull, D. (2019). *Women's experiences with continuous fetal monitoring alongside a randomised controlled trial.* Paper presented at the Australian Society for Psychosocial Obstetrics and Gynaecology Conference, Melbourne, Australia.

Benton, M., Salter, A., Simpson, B., Wilkinson, C., & Turnbull, D. (2019). *Women's experiences with continuous fetal monitoring alongside a randomised controlled trial.* Poster presented at the 13th Florey Postgraduate Research Conference, Adelaide, Australia.

Benton, M., Salter, A., Simpson, B., Wilkinson, C., & Turnbull, D. (2018). *Women's psychosocial outcomes following an emergency caesarean section: A systematic literature review.* Poster presented at the International Marce Society Conference, Bangalore, India.

Benton, M., Salter, A., Simpson, B., Wilkinson, C., & Turnbull, D. (2017). *Women's psychosocial outcomes of a randomised controlled trial of pregnant women*

*being monitored during labour with CTG or ST-Analysis (STan).* Poster session presented at the 13th Florey Postgraduate Research Conference, Adelaide, Australia.

*Signed:*

*Madeleine Benton* *Date: 17.7.20*

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## Thesis overview

Chapter One provides the contextual background for the research detailed in this thesis, a critical review pertaining to the literature around which this research revolves, and an introduction of the randomised controlled trial (RCT) that inspired this work. Chapter Two provides an exegesis of the overall RCT and each of the studies conducted. The aim of this chapter is to provide additional information relating to methodological details of each study that was constrained in the papers for publication due to word restrictions.

The next four chapters contain research papers that are presented with respective statements regarding each author's contribution. In Chapter Three a systematic literature review is first presented examining the psychosocial outcomes of emergency caesarean section that relate to primary outcome of the RCT. Chapter Four, Five, and Six present research papers that were conducted alongside the RCT. In particular, Chapter Four presents a qualitative study examining women's experiences with the type of monitoring they received in the RCT. Chapter Five presents a mixed-methods study on women's satisfaction with birth and monitoring alongside the RCT, and Chapter Six presents a quantitative study on women's psychological and health outcomes alongside the RCT. Finally, Chapter Seven summarises and integrates the study findings, discusses their limitations, implications, and provides suggestions for future research.

Data collection for this thesis was conducted in Adelaide, South Australia. References and Appendices for all chapters are collected at the end of the thesis. Research papers are presented in manuscript format, with the same typeset as the main body of the thesis. Table and figure numbers are continuous throughout the document. Acronyms are spelt out in full on first use and in section headings and frequently used acronyms are included in the List of Abbreviations on p. xxii.

## List of Abbreviations

| | |
|---|---|
| **BSS** | Birth Satisfaction Scale |
| **CS** | Caesarean Section |
| **CTG** | Cardiotocographic Electronic Fetal Monitoring |
| **ElCS** | Elective Caesarean Section |
| **EmCS** | Emergency Caesarean Section |
| **EPDS** | Edinburgh Postnatal Depression Scale |
| **EQ-5D** | Euro Qol-5 Dimensions |
| **FSE** | Fetal Scalp Electrode |
| **GHQ-12** | General Health Questionnaire - 12 |
| **PND** | Postnatal Depression |
| **PTSD** | Post Traumatic Stress Disorder |
| **S-EFM** | Satisfaction with Electronic Fetal Monitoring |
| **STan** | CTG plus analysis of the ST segment of the fetal electrocardiogram |
| **START** | STan Australian Randomised controlled |

# CHAPTER 1. INTRODUCTION AND LITERATURE REVIEW

## 1.1 Preamble

This thesis was undertaken alongside the first Australian Randomised Controlled Trial (RCT) of a method of intrapartum fetal surveillance, which, compared to standard methods of intrapartum fetal surveillance, has been hypothesised to reduce Emergency Caesarean Section (EmCS) rates. Specifically, this thesis is based on a number of studies that were undertaken alongside the RCT to integrate the psychosocial perspectives of women enrolled into the trial and add value to the clinical results.

I would like to acknowledge my position within this research, as a young female university student. I completed a Bachelor of Psychological Science in 2015, followed by Honours in Psychological Science in 2016 at the University of Adelaide. During my honours year, my thesis utilised data collected from a RCT of outpatient cervical priming for induction of labour and examined the predictors of women's psychosocial outcomes. My honours year provided me with an opportunity to combine both of my interests in psychology and maternal health whereby I was supervised by my current supervisory panel – Professor Deborah Turnbull, Dr. Amy Salter, and Dr Chris Wilkinson.

To set the scene for the current research, a brief overview of the importance of women's mental health in the perinatal period will be provided. Secondly, a discussion about the significant and continuing increase in caesarean section (CS) rates globally will take place along with the implications of this for women's physical and psychosocial health. Intrapartum fetal surveillance will then be discussed followed by an examination of the literature in relation to women's experiences and psychosocial outcomes of this technology. Lastly, the RCT will be introduced.

## 1.2 Literature review

### 1.2.1 Perinatal mental health

With declining maternal mortality and morbidity rates and general improvements in pregnancy outcomes for both mothers and babies in recent decades, the aims of maternity care in developed countries have now expanded to include areas beyond the mere detection and management of factors which threaten various outcomes of pregnancy (Mousavi et al., 2013). Broader aims now include supporting the psychosocial adaptation to pregnancy and childbirth (Mousavi et al., 2013). As such, psychosocial aspects and outcomes of the childbirth experience are recognised as important patient outcomes that are essential to evaluate (Carquillat et al., 2016).

The labour and birth experience is described as a pivotal life event (Matthews & Callister, 2004) that is complex and multidimensional (Larkin et al., 2009; Lavender et al., 1999). The experience incorporates interrelated physiological, psychological, and social elements; further to this women bring their own expectations, ideas, personal views, cultural, and societal values to this experience (Larkin et al., 2009; Olza et al., 2018). It is well recognised that both positive and negative feelings about the experience can coexist and can have lasting effects on women's health and wellbeing (Fallon, 2011; Hanna-Leena Melender, 2002; Taheri et al., 2018). A multitude of psychological sequelae arise in relation to childbirth, including emotional reactions, coping strategies, the perceptions and cognitions associated with labour and birth, changes in status, identity, self-esteem, and effects on mental health and wellbeing (Martin, 2012).

A positive labour and birth experience has been argued to be associated with long lasting benefits (Larkin et al., 2009), significantly influencing a woman's transition to motherhood, contributing to feelings of empowerment and fulfilment, and thus, promoting a healthy bond between mother and baby (Simkin, 1992). Conversely, a

negative experience during labour and birth can have many detrimental effects on women's social, emotional, and mental health, as well as her physical wellbeing (Rowlands & Redshaw, 2012).

The term 'perinatal mental health' describes the mental health of women experienced during pregnancy and the postnatal period. This period of time is typically considered to span from conception through to the end of the first postnatal year and up to two years after childbirth (Austin & Priest, 2005). Perinatal mental health problems include a previous history of a mental disorder, signs and symptoms demonstrated in the antenatal period, along with a range of other disorders that may appear in the postnatal period (Stewart & Henshaw, 2002).

Perinatal mental health problems are common worldwide and are considered a major public health issue (Rahman et al., 2013). It is estimated that as many as one in five women experience a mental health problem in the antenatal or postnatal period (Russell., 2017). Mental health problems arising in the perinatal period have the potential to impact negatively on the woman and her partner, as well as the infant and other family members (Austin et al., 2008). Consequences can include difficulties with mother-infant bonding, infant development (Kingston et al., 2012), and life-long psychological effects for both the mother and her family (Meltzer-Brody & Stuebe, 2014).

### 1.2.2 Modes of birth

There are a myriad of factors that can affect a woman's experience of labour and birth and subsequent adjustment in the perinatal period. Research has identified several demographic, health, pregnancy, and birth related characteristics associated with both positive and negatives outcomes for women (Smarandache et al., 2016). It has been often postulated that when labour and birth are difficult or complicated, women's views

and personal experiences may be negative (Martin, 2012). These difficulties may be due to pre-existing or developing health problems in a mother or a baby, previous adverse experiences, or a consequence of unexpected problems arising in the course of labour and birth (Martin, 2012). Complex labour and birth is, as logic dictates, associated with clinical monitoring and interventions, commonly in an escalating and interdependent way that has the potential to affect women and their partners and the manner in which the events are processed, influencing later behaviour and choices (Martin, 2012).

Overall, mode of birth is one factor that has been consistently identified as influencing the duration and severity of women's physical and psychological wellbeing following childbirth (Rezaei et al., 2018; Rowlands & Redshaw, 2012). Despite receiving significant attention, mode of birth remains much debated in relation to its effect on women's experience of childbirth and postnatal wellbeing. Overall, population-wide evidence to demonstrate this association is largely lacking with the quality and robustness of available research varying considerably (Rowlands & Redshaw, 2012).

### 1.2.3 Caesarean section

Over the past three decades, there has been a dramatic increase in CS rates around the world. Globally, CS is one of the most common surgeries, constituting a method of birth involving surgical birth of a baby through an incision in the abdominal and uterine wall. The operation may be necessary under certain circumstances to protect the health and/or survival of an infant and/or mother (Murphy et al., 2001). CS can be classified as an emergency (EmCS) or an elective procedure. An elective CS (ElCS) is defined as a planned, non-emergency CS birth which occurs before initiation of labour (Zanardo et al., 2016). In contrast, EmCS is defined as an unplanned CS birth performed before or after onset of labour and is typically urgent (Zanardo et al., 2016).

The World Health Organization (WHO) states that, at the population-level, CS rates higher than 10% are not associated with reductions in maternal and newborn mortality rates (2015). In recent times, countries have reported rates of 40.5% in Latin America and the Caribbean, 32.3% in Northern America, 31.1% in Oceania, 25% in Europe, 19.2% in Asia and 7.3% in Africa (Betrán et al., 2016). Globally, CS section rates have almost doubled between 2000 and 2015, from 12% to 21% (Boerma et al., 2018). In the Australian context, the prevalence rates of CS have increased consistently since the early 1990's from 18% in 1991 to 33% in 2015 (Australian Institute of Health and Welfare, 2017). In relation to EmCS, it has been reported in some Australian hospitals that around 18% of babies were delivered via this method (Pregnancy Outcome Unit, 2019).

While there are generally many complex contributors to the increasing rates of CS, including changes in maternal characteristics, previous CS, and sociocultural factors (Betrán et al., 2016; Tadevosyan et al., 2019), some of the most common reasons for EmCS (specifically) are failure to progress through the stages of labour, perceived fetal distress, placental abruption, cord prolapse, uterine rupture or failed instrumental birth (Prosser et al., 2014). The importance of CS, especially EmCS, in potentially protecting both mother and baby from harm is unquestionable. However, it is regarded as a major surgery and is associated with immediate maternal and perinatal risks, which can extend many years beyond the current birth. These can affect the health of the woman, her child, and the mother's future pregnancies (World Health Organization, 2015), so the decision to perform EmCS must always be considered with the potential for these adverse factors for mother and baby in mind.

### 1.2.4 The interrelated physical and psychological impact of caesarean section

#### *1.2.4.1 Physiological outcomes of caesarean section*

Before addressing the psychosocial sequelae associated with CS, a brief overview of the physiological outcomes of CS are offered as these often impact psychosocial sequelae.

Overall, CS carries a higher risk of maternal complications than vaginal birth (Karlström, 2017). It has been reported that maternal mortality and morbidity after CS is nearly five times that of vaginal births (Gupta & Saini, 2018). Regardless of whether CS is performed as an elective or emergency surgery, maternal morbidity is most often related to post-surgical complications such as infections, haemorrhage, and thrombotic events (Karlström, 2017). Longer term complications, which have implications for future pregnancies, include surgical adhesions, placental implantation disorders (placenta accrete/increta/percreta), and uterine rupture, as well as the complications of repeat CS (Boutsikou & Malamitsi-Puchner, 2011).

In one of the most recent reviews examining evidence from large systematic reviews and cohort studies, a number of short-term and long-term outcomes for both women and children were summarised (Sandall et al., 2018). Regarding short-term outcomes, vaginal birth was associated with a reduced length of hospital stay, a lower risk of hysterectomy following postpartum haemorrhage, and a lower risk of cardiac arrest compared with women who experienced a planned CS (Sandall et al., 2018). However, planned CS was associated with a reduced risks of vaginal injury, abdominal and perineal pain during birth and three days postpartum, early postpartum haemorrhage, and obstetric shock, compared with women having a vaginal birth (Sandall et al., 2018). In terms of the long-term sequelae of CS, the review identified a greater risk of pelvic adhesions, small bowel obstruction, chronic pain, sexual

dysfunction, subfertility, urinary and faecal incontinence, and pelvic organ prolapse (Sandall et al., 2018).

There is emerging evidence that babies born by CS have different hormonal, physical, bacterial, and medical exposures, and that these exposures can subtly alter neonatal physiology (Sandall et al., 2018). Short-term risks of CS for babies include altered immune development resulting in, for instance, an increased likelihood of allergy, atopy, and asthma, and a reduced intestinal gut microbiome diversity (Sandall et al., 2018). The persistence of these risks into later life has been less examined, although associations between CS and greater incidence of late childhood obesity and asthma are frequently reported (Sandall et al., 2018). Furthermore, CS has been adversely associated with women's future fertility, pregnancy complications and outcomes (Keag et al., 2018). Specifically, subsequent pregnancies show increased risks of hysterectomy, placental complications, uterine rupture, stillbirth, and preterm birth (Sandall et al., 2018).

#### *1.2.4.2 Psychosocial outcomes of caesarean section*

In addition to poorer physical outcomes after CS, some early research indicated that the negative psychosocial effects of CS can be significant and far-reaching for some women (Mutryn, 1993). Although the relationship is less clear, there has been some quantitative evidence indicating that women who undergo CS are also more likely to have poorer mental health outcomes (Lydon-Rochelle et al., 2001; Yang et al., 2011). Furthermore, a review by Lobel and DeLuca (2007) found that women who deliver via CS were more likely to have a negative perception of their birth, themselves, and their infants. Women also (on average) demonstrated poorer parenting behaviours and it was postulated that they may in turn be at higher risk of emotional distress compared to women with a vaginal birth (Lobel & DeLuca, 2007). These finding have been

corroborated in more recent studies with CS shown to be associated with depression (Moameri et al., 2019) and post-traumatic stress symptoms (Olieman et al., 2017).

Historically, many of these studies have relied on small sample sizes (based mostly on convenience samples), used measures of unknown reliability and validity, and as a result of these methodological limitations, some results may not be considered robust (Lobel & DeLuca, 2007). Furthermore, in the majority of studies, there has been a lack of a comparison group or varying comparison groups in terms of mode of birth studied; for example, some studies compare CS or instrumental birth to spontaneous vaginal birth while others focus on planned versus unplanned birth more generally (Alderdice et al., 2019). In terms of CS, as previously discussed, the procedure can be classified as either elective or emergency and with these different classifications come different experiences for women. In relation to EmCS, the circumstances surrounding this type of CS add an additional layer of complexity to this experience. The sudden and unplanned nature of EmCS accompanied by a series of subsequent rapid psychological adjustments is more likely to be distressing, anxiety-provoking, and emotionally unsettling for women (Roux & Rensburg, 2011; Somera et al., 2010). Furthermore, EmCS has been identified as a traumatic experience for many women, potentially adversely affecting their well-being in the long-term (Rijnders et al., 2008).

As the decision-making process, context of care, and outcomes are very different between ElCS and EmCS it is important to differentiate between them (Carquillat et al., 2016). Despite the obvious differences in clinical experiences and potential subsequent psychosocial impacts for women, much of the literature examining outcomes of CS fails to differentiate between type. Consequently, the literature will be reviewed in terms of psychosocial health outcomes of CS broadly and when available, literature specifically on EmCS will be examined.

#### *1.2.4.2.1 Caesarean section and overall experiences*

It has been well established that the experience of giving birth has long-term implications for a woman's health and wellbeing (Karlström et al., 2015; Olza et al., 2018). A number of studies have examined women's experiences with EmCS and reported that it was more likely to result in a negative birth experience (relative to other modes of birth). For example, a recent large prospective cohort study conducted in Sweden reported that birth experience was likely to be more negative among women who had an EmCS relative to vaginal birth (Karlström, 2017). A number of dated qualitative studies examined women's experiences of EmCS. In these studies, women expressed feelings of failure, a low sense of involvement in the birthing process (Reichert et al., 1993), intense fear of death (own and/or baby's) (Clement, 2001; Ryding et al., 1998a), a sense of loss of control (Ryding et al., 1998a), and feelings of anger towards caregivers regarding the decision to operate (Fenwick et al., 2009). Other research has reported that women have described feeling unfit as mothers since they could not accomplish the process of naturally giving birth (Clement, 2001; Fenwick et al., 2009). Women have expressed a sense of being different, and even excluded from the 'society' of other mothers (Fenwick et al., 2009). Women have also described feeling detached from the experience of giving birth and it appearing to occur without their active participation (Herishanu-Gilutz et al., 2009).

A study examining operative birth in the second stage of labour, including EmCS, reported that women described an information gap in terms of their preparation, feeling that their birth plans had no meaning, and emphasised a mismatch between their expectations and what actually happened during their labour and birth (Murphy et al., 2003). Within in this study, women described their birth experience as uncontrollable and several women expressed concern that the emotional impact of this type of birth

had not been considered as part of antenatal preparation (Murphy et al., 2003). Furthermore, unexpected operative deliveries, including EmCS, had a noticeable impact on women's views about future pregnancies with women describing ongoing anxieties about future pregnancies which, in some cases, was sufficient to deter them from attempting to have further children (Murphy et al., 2003).

*1.2.4.2.2 Caesarean section and postnatal depression*

Postnatal depression (PND) is the most common complication after childbirth affecting approximately 10-15% of women, and as such, represents a considerable public health problem affecting women and their families (O'Hara & Swain, 1996; Petrosyan et al., 2011; Smorti et al., 2019). The Diagnostic and Statistical Manual of Mental Disorders Fifth Edition (DSM-5) (American Psychiatric Association, 2013) defines PND as a depressive episode with moderate to severe severity that begins four weeks after birth. Clinical manifestations of PND include depressed mood, fear of harming, extreme concern and worry about the baby, insomnia, and difficulty concentrating and remembering (Bahadoran et al., 2014).

PND can result in long-term adverse effects for mothers, children, and families (Mehta & Mehta, 2014; Xu et al., 2017). It can affect maternal-infant interaction and infant-feeding outcomes, increase the risks of suicidal ideation, self-harm, and infanticide (Houston et al., 2015). Furthermore, there is substantial evidence linking PND with infant and childhood emotional, cognitive and behavioural problems, and low social competence (Grace et al., 2003; Xu et al., 2017). An association with poor infant growth (Stewart, 2007) and an increased risk of sudden infant death syndrome has also been reported (Howard et al., 2007).

Several risk factors for PND have been identified in the literature including biological, sociodemographic, and psychosocial factors (Gaillard et al., 2014; Smorti et

al., 2019). The consequences of obstetric factors, such as MoD have been proposed among the risk factors for PND. CS has the potential to increase the risk of PND for several reasons, including surgical trauma inducing stress responses for women. As such, the relationships between CS and PND have been thoroughly examined (Alharbi & Abdulghani, 2014; Petrosyan et al., 2011; Rowlands & Redshaw, 2012; Sword et al., 2011; Xie et al., 2011). However, despite extensive examination, research on the association between CS and PND has yielded inconsistent results. Despite an earlier meta-analysis finding no significant association between CS and PND (Carter et al., 2006), more recent meta-analyses including many additional studies, indicated that CS was associated with an increased risk of PND (Moameri et al., 2019; Xu et al., 2017). The literature that does differentiate between types of CS also reports mixed findings. A prospective cohort study comprising 10,934 women from the UK found no increased risk of PND between different types of birth, including EmCS (Patel et al., 2005). In comparison, a recent large longitudinal study reported that compared with spontaneous vaginal birth, women who delivered by EmCS had significantly higher odds (1.45) of having PND six weeks after birth (Eckerdal et al., 2018).

*1.2.4.2.3 Caesarean section and traumatic stress*

A significantly increasing body of research examining post-traumatic stress after childbirth has emerged in recent times (Dekel et al., 2017; Hernández- Martínez et al., 2019). It has been established that women may experience fear for the life or wellbeing of their newborn, as well as their own during childbirth. As such, research suggests that childbirth is an event that could be psychologically traumatic, leading to the development of post-traumatic stress disorder (PTSD) and subsyndromal PTSD (Lopez et al., 2017). It is estimated that 45% of women report childbirth as traumatic and

between 1% and 7% of women experience PTSD in relation to childbirth (Alcorn et al., 2010; Olde et al., 2006).

A traumatic birth can interfere with mother-infant bonding and overall adjustment (Ayers et al., 2014; Parfitt & Ayers, 2009), negatively affect the relationship between mother and partner (Iles et al., 2011), increase the risk of developing long-term depression, and create apprehension of sexual intercourse and of future pregnancies. Furthermore, the risk of suicide is significantly increased (Kessler, 2000).

A recent systematic literature review identified several risk factors for PTSD including negative perception of childbirth, maternal mental health, history of trauma, low social support, mode of birth, and complications (Dekel et al., 2017). Mode of birth, in particular CS, has been extensively investigated and has been repeatedly shown to be a risk factor for PTSD (Lopez et al., 2017). A consistent body of research has reported that EmCS was a contributing factor for post-traumatic stress symptoms and PTSD after childbirth. A recent systematic literature review found that EmCS in particular was the most cited risk factor in terms of mode of birth (Dekel et al., 2017). Furthermore, a prospective cohort study of 1,824 mothers identified EmCS as a risk factor for post-traumatic stress symptoms (Furuta et al., 2016).

*1.2.4.2.4 Caesarean section and quality of life*

Health-related quality of life (HRQoL) is a broad concept that includes physical, psychological, and social domains (Trivino-Juarez et al., 2017). It is a construct based on the degree of satisfaction of a person with their physical condition, emotional state, and family and social life, and on the meaning the individual attributes to their own life (Trivino-Juarez et al., 2017). HRQoL is an important area of maternal health (Mogos et al., 2013). Women's perception of their HRQoL is a crucial measure of the quality and effectiveness of maternal and child health interventions (Mogos et al., 2013; Trivino-

Juarez et al., 2017). Furthermore, assessment of HRQoL assists in understanding the impact on women of possible postpartum complications and the demands of their new roles as mothers (Mortazavi et al., 2014).

A women's HRQoL after birth is influenced by a variety of medical, psychological, social, and obstetric factors (Jansen, Essink-Bot, et al., 2007). The results of a recent systematic review and meta-analysis, which included 18 studies concluded that mode of birth was associated with the HRQoL for woman in the postpartum period (Rezaei et al., 2018). The review reported that, in general, women who had a vaginal birth had a better quality of life than women who gave birth by CS (Rezaei et al., 2018). In terms of EmCS, the small amount of research available has similarly found poorer HRQoL for women who have an EmCS in general. A prospective study conducted in the Netherlands reported that the average period to reach full physical recovery was three weeks after vaginal birth and six weeks after ElCS or EmCS (Jansen, Essink-Bot, et al., 2007). Similarly, a larger more recent study reported that women who had a vaginal, forceps or vacuum-extraction birth, reported better physical functioning at six weeks postpartum than women who had ElCS or EmCS (Trivino-Juarez et al., 2017).

*1.2.4.2.5 Caesarean section and satisfaction*

Women's satisfaction with childbirth provides an important measure of quality of health services and maternity care (Jafari et al., 2017). It is a multidimensional construct where positive and negative feelings may coexist in relation to certain aspects of an experience (Bertucci et al., 2012; Waldenstrom, 1999). Satisfaction can be influenced by both medical and social factors and can have immediate and long-term effects on women's health and the quality of their relationships (Enabudoso & Isara, 2011; Goodman et al., 2004). Research shows that women's satisfaction with labour and birth is associated with the health and wellbeing of the mother and her baby (Green et

al., 1990; A; Sawyer et al., 2013). In general, women who have experienced a satisfying childbirth experience have greater self-esteem, a stronger relationship with their child, and positive expectations of potential future births (Jafari et al., 2017). In contrast, dissatisfaction with childbirth leads to greater likelihood of postpartum depression, anxiety (Mohammad et al., 2011), PTSD (Ford et al., 2009), impaired mother–infant bonding (Bertucci et al., 2012), fear of the next potential child birth (Mohammad et al., 2011), and choice of future CS (Goodman et al., 2004; Harvey et al., 2002; A Sawyer et al., 2013).

The impact of different modes of birth on women's satisfaction has been examined. Research has demonstrated that women who had an EmCS were more likely to appraise their deliveries less favourably than those who delivered via other modes of birth (Baston et al., 2008; Graham et al., 1999; Saisto et al., 2001). In a large prospective cohort study, EmCS appeared to be a contributing factor to a negative appraisal of birth (Baston et al., 2008).

*1.2.4.2.6 Caesarean section and infant feeding*

The advantages of breastfeeding are well recognised with its promotion being widely accepted as an important health-promotion strategy for mothers and their babies (Chowdhury et al., 2015). Much research has shown that infants who are breastfed have reduced risks of developing a variety of childhood diseases and medical conditions. In the short term, breastfeeding decreases the risk of developing respiratory tract infections, gastrointestinal infections, sudden infant death syndrome, and allergic disease; including asthma, atopic dermatitis, and eczema (Bar et al., 2016; Stuebe, 2009). In the longer term, breastfeeding has been shown to be protective against the development of coeliac disease, inflammatory bowel disease, obesity, diabetes, and childhood leukemia and lymphoma, and is associated with better long-term

neurodevelopmental outcomes (Binns et al., 2016; Victora et al., 2015). Breastfeeding also provides benefits to mothers. Mothers who breastfeed typically experience a more timely and efficient return of the uterus to its pre-pregnancy state, and a decreased risk for cardiovascular disease, breast, and ovarian cancer (Chowdhury et al., 2015; Ross-Cowdery et al., 2017; Schwarz et al., 2009).

The choice to breastfeed is recognised as a complex phenomenon, which is strongly influenced by demographic, biological, social, and psychological factors (Bai et al., 2013; Thulier & Mercer, 2009). International recommendations including those from the World Health Organization (2020) recommend that infants should be breastfed exclusively for the first six months of life and that it be continued (non-exclusively) up to twelve months and beyond. However, few women meet these recommendations for varying reasons (Dennis et al., 2018). Several factors that contribute to low breastfeeding rates have been identified including demographic, biological, sociocultural, health system-related, environmental, and knowledge-related factors (Al-Nuaimi et al., 2017; Arora et al., 2017; Asemahagn, 2016).

Mode of birth, in particular CS, is widely believed to adversely affect uptake of breastfeeding (Gale et al., 2012). In fact, it has been suggested that women who undergo CS are less likely to initiate breastfeeding and exclusively breastfeed their baby compared to those who have a vaginal birth (Liu et al., 2012; Zanardo et al., 2010). In terms of EmCS, a recent large scale prospective study reported that women who delivered by EmCS were more likely to have had an unsuccessful first breastfeeding attempt, were less likely to breastfed their baby within the first 24 hours, and were less likely to breastfeed upon leaving the hospital compared to mothers with other modes of birth (Hobbs et al., 2016).

### 1.2.5 Caesarean section and intrapartum fetal surveillance

CS is an essential component of emergency obstetric care and safe motherhood (Enabudoso & Isara, 2011). However, as outlined, the significant increase in births by CS globally has highlighted concerns that women who experience this mode of birth may have poorer physical and psychosocial adjustment after birth. There are a number of reasons for the increases in CS rates and more recently, trends in clinical obstetrical practice have been linked to this increase (Paterno et al., 2016). Central to these practices is the routine use of childbirth technologies during labour, particularly the use of intrapartum fetal surveillance (Paterno et al., 2016). This RCT was initiated in the hope to reduce unnecessary CS, that has been associated with the use of intrapartum fetal surveillance.

### 1.2.6 Intrapartum fetal surveillance

Monitoring of the fetal heart rate in labour is essential practice in midwifery and obstetrics in order to assure fetal wellbeing (Sarrechia, Thomson, & Sermeus, 2013). The aim of fetal surveillance is to improve knowledge about the fetal condition throughout pregnancy and in particular, during labour, and to identify babies who may be in distress to guide additional assessments of fetal wellbeing or determine if the baby needs to be delivered via alternative means (Amer-Wåhlin et al., 2005). The term "intrapartum fetal surveillance" can be considered as a term encompassing all current intrapartum methods of monitoring to keep the fetus safe (The Royal Australian and New Zealand College of Obstetricians and Gynaecologists, 2019).

Although a range of techniques are available for fetal surveillance, the two main monitoring modalities are intermittent auscultation (IA) and continuous electronic fetal monitoring. IA is the technique of listening to and counting the fetal heartbeats for short periods of time during active labour and is an appropriate standard of care for low risk

pregnancies (Blix et al., 2019). It is usually performed using a Pinard stethoscope or a hand-held Doppler device, with the uterine contractions being obvious by the mother's response to them, or palpated by hand (particularly if she has regional analgesia) (Blix et al., 2019).

#### *1.2.6.1 Cardiotocography (CTG)*

Intrapartum fetal surveillance using continuous cardiotocography (CTG) has become almost ubiquitous in the intrapartum setting (Kuah & Matthews, 2017). In 2013, 63.3% of all women who gave birth in South Australia received CTG (Scheil et al., 2015). CTG records changes in the fetal heart rate and their temporal relationship to uterine contractions. It identifies babies who may be reacting to a shortage of oxygen (hypoxic), but may also be confused with the reactions of a baby to benign head or abdominal pressure, cord compression, or temporary maternal low blood pressure or dehydration. It is used to guide additional assessments of fetal wellbeing, maternal-fetal resuscitation or to determine if the baby needs to be delivered via instrumental vaginal birth or CS.

CTG monitoring can be carried out both externally and internally. The external method collects and records information about the fetal heart rate and mother's contractions using a belt-mounted doppler transducer worn around the woman's abdomen (Alfirevic et al., 2013; Chandraharan & Arulkumaran, 2007). When the signal from this external method of CTG is of insufficient quality or is difficult to interpret, an internal method can be used which involves the attachment of a fetal scalp electrode (FSE). During vaginal examination, the spiral shaped wire of the FSE is inserted a few millimetres under the skin on the baby's scalp with a connecting wire leading from the fetus through the cervix and vagina to the CTG machine (Alfirevic et al., 2013).

Despite being a ubiquitous method of monitoring, CTG has a high false positive rate (i.e. low specificity) of up to 60% which means that more often than not, it will indicate fetal compromise in cases when such fetal distress is not present. This may lead to unnecessary interventions such as birth via forceps or EmCS (Chandraharan & Arulkumaran, 2007). This is particularly concerning given the above evidence that EmCS are associated with significant negative clinical and psychosocial outcomes for women.

#### *1.2.6.2 ST-segment analysis (STan)*

In order to increase specificity and reduce unnecessary interventions associated with the use of intrapartum fetal surveillance, computerised ST-segment analysis (STan) (Neoventa) (Rosén & Lindecrantz, 1989) is being trialled for the first time in Australia at the Women's and Children's Hospital in Adelaide. STan is used in conjunction with standard CTG monitoring and includes analysis of the ST segment of the fetal electrocardiogram. STan often provides clinicians with additional information regarding fetal wellbeing during labour relative to CTG alone, allowing for a more definitive diagnosis of fetal distress (Sacco et al., 2015; Timonen & Holmberg, 2018). Similar to the internal CTG monitor, STan monitors require the placement of the FSE to detect and facilitate interpretation of the fetal ECG (Belfort et al., 2015; Sacco et al., 2015). However, unlike CTG, the FSE is always required when using STan monitoring (Sacco et al., 2015).

With up to a 60% false positive diagnosis of fetal distress using CTG alone (Chandraharan & Arulkumaran, 2007), the additional information afforded by STan may have considerable impact on the reduction of a false positive diagnosis of fetal distress and thus a reduction in unnecessary operative births (Sacco et al., 2015).

To date, there have been six international randomised controlled trials (RCTs) comparing STan in addition to CTG with CTG alone (Amer-Wahlin et al., 2001; Belfort et al., 2015; Ojala et al., 2006; Vayssiere et al., 2007; Westerhuis et al., 2010; Westgate et al., 1993). A recent Cochrane review including 26,466 women across six trials found that among other clinical benefits, less surgical assistance in labour was required when STan was combined with CTG (Neilson, 2015). The review did not find significant evidence of a difference in the number of CSs when combining STan with CTG (Neilson, 2015). However, this finding may be due to the already low CS rate in the countries studied compared to that in Australia, and the inclusion of studies with only low-risk participants. In a randomised controlled trial conducted in Sweden, a reduced number of operative deliveries were demonstrated for fetal distress when CTG and STan were combined (Amer-Wåhlin et al., 2005). Additionally, a more recent prospective study of high-risk pregnancies, found a decrease in CS of 1.3% in the birth population after STan was implemented (Kessler et al., 2013). Despite international research and clinical application, STan has not been previously utilised in the Australian maternity care system beyond its introduction and piloting at the study institution (Women's and Children's Hospital) in 2015. STan+CTG, hereafter referred to as STan, is being compared to CTG alone in this institution and the primary aim of the STan Australian Randomised controlled Trial (START) is to determine if STan can reduce EmCS rates and other interventions, whilst maintaining or improving neonatal outcomes (Turnbull et al., 2019).

#### *1.2.6.3 Psychosocial implication of intrapartum fetal surveillance*

In line with the potential reduction of EmCS with STan (Wilkinson et al., 2017) a secondary hypothesis of the trial is that STan monitoring will result in improved psychosocial outcomes (Turnbull et al., 2019). Even if EmCS rates are not reduced,

women may be more (or less) reassured or may perceive the intrapartum fetal surveillance experience with STan as different to CTG alone. Surprisingly, little recent research has examined women's experiences and views in the broad area of intrapartum fetal surveillance, and even less has been conducted on STan monitoring. To date, the psychological impact of intrapartum fetal surveillance has predominantly been researched in the context of satisfaction with CTG and other forms of fetal monitoring.

*1.2.6.3.1 Women's experiences with intrapartum fetal surveillance*

It has been consistently reported that intrapartum fetal surveillance can affect a women's experience and satisfaction with childbirth (Smith et al., 2017). Examination and consideration of women's experiences of and perceptions toward intrapartum fetal surveillance is therefore essential in understanding the impact of this important aspect of care. Significant early research has been conducted in this area, during a period when intrapartum fetal surveillance was becoming increasingly available, from women's perspectives it was understood to provide significant advantage compared to its non-use (Beck, 1980; Snydal, 1988; Starkman, 1976). Despite this research being dated, more recent studies have mirrored many of the views and experiences of women in the earlier studies including feelings of reassurance.

A recent systematic review has explored women's views and experiences of electronic fetal monitoring during labour (Smith et al., 2017). The review reported on 10 studies from which four themes were identified including discomfort, anxiety, reassurance, and communication (Smith et al., 2017). Discomfort emerged in all studies included in the systematic review and was discussed in terms of the intrapartum fetal surveillance equipment such as the internal fetal scalp electrode (FSE) or the abdominal transducer and belts, which were often described as too tight and contributed to increased pain (Smith et al., 2017). Furthermore, women also reported discomfort

arising from enforced immobility associated with intrapartum fetal surveillance and considerable restrictions on freedom of movement (Smith et al., 2017). The second theme identified, anxiety and/or fear, was consistently identified in the included studies and was associated with the auditory sounds emitted from the monitor. Women became frightened when the alarm on the monitor was activated as would happen if the ultrasound transducer moved or internal FSE became detached. The review also reported that women's anxiety levels were increased when they had internal monitoring, expressing concern that the FSE might injure their baby. Despite this, reassurance emerged as another prominent theme in the review and was almost always related to hearing the baby's heartbeat and was described as a safeguard, reassuring them, and their partners, of the wellbeing of their baby, helping them in turn to relax and not worry. Lastly, communication emerged as a dominant theme in the review. Intrapartum fetal surveillance was viewed as a focal point for women to initiate conversations with medical staff, and, for some women, the use of intrapartum fetal surveillance facilitated the participation of their husbands in the process of childbirth, generating, for them, a sense of involvement.

To our knowledge, this is the most recent systematic literature review that has explored women's view and experiences of intrapartum fetal surveillance. However, the review did not include any studies that examined STan as a form of intrapartum fetal surveillance. The review strongly recommended that additional and contemporary research on women's views of fetal monitoring during labour was urgently needed.

### 1.2.7 The randomised controlled trial (RCT)

As previously prefaced, this thesis was part of an Australian first RCT currently underway to compare STan monitoring (supplementing concurrently performed CTG) versus CTG monitoring alone with the primary aim of determining if STan can reduce

the prevalence of EmCS, relative to CTG alone. At the time of writing this thesis, the trial had around twelve months to run in order to finalise the collection of the clinical outcomes. In line with the hypothesised reduction of EmCS with STan, a secondary hypothesis of the RCT is that STan monitoring will result in improved psychosocial outcomes (Turnbull et al., 2019). Overall, it is the first trial of its kind to comprehensively compare clinical, economic, and psychosocial outcomes.

In the following chapter (Chapter Two), the trial aims, hypotheses and design will be described in detail in addition to the studies conducted alongside the RCT that provided data for this thesis. Following that, the four published or ready for publication articles (currently under embargo while the clinical findings are finalised) will be presented (Chapter Three to Chapter Six), and their findings reviewed and synthesised in a final discussion chapter (Chapter Seven).

# CHAPTER 2. OVERVIEW OF RESEARCH METHODOLOGY AND MEASURES

## 2.1 Preamble

This chapter will outline the trial aims, hypotheses, and design, in detail and discuss the methodology of the three contributing studies to this thesis. The inclusion of a separate chapter dedicated to these aspects allows these details to be elucidated more thoroughly than is possible in the confines of a journal-length article. As previously outlined, this thesis was conducted as part of a RCT conducted at the Women's and Children's Hospital and was funded by the National Health and Medical Research Council (NH&MRC). At the time of submission, the RCT is in its final year of completion. This chapter will assist in locating the broader RCT and to explain additional information about studies in this thesis that are not explicit in the papers, notably recruitment flow and questionnaire details.

## 2.2 Outline of research

The objective of Study One was to collate and critically analyse the evidence about maternal psychosocial outcomes of EmCS. As EmCS was the primary outcome of the RCT (previously introduced) this was a critical starting point for the subsequent research. Study Two and Three were conducted alongside the RCT by the PhD candidate and provided data that were analysed in three papers. The aim of Study Two was to explore and examine women's experiences with the monitoring they received as part of the RCT. The primary aim of Study Three was to examine and compare women's psychosocial outcomes related to the monitoring they were randomised within the RCT: either STan or CTG alone. This study provided data for two papers. The first examining women's satisfaction with the monitoring they received and the second examining women's psychological and health outcomes. For additional ease of

orientation, an overview is shown in Figure 1.

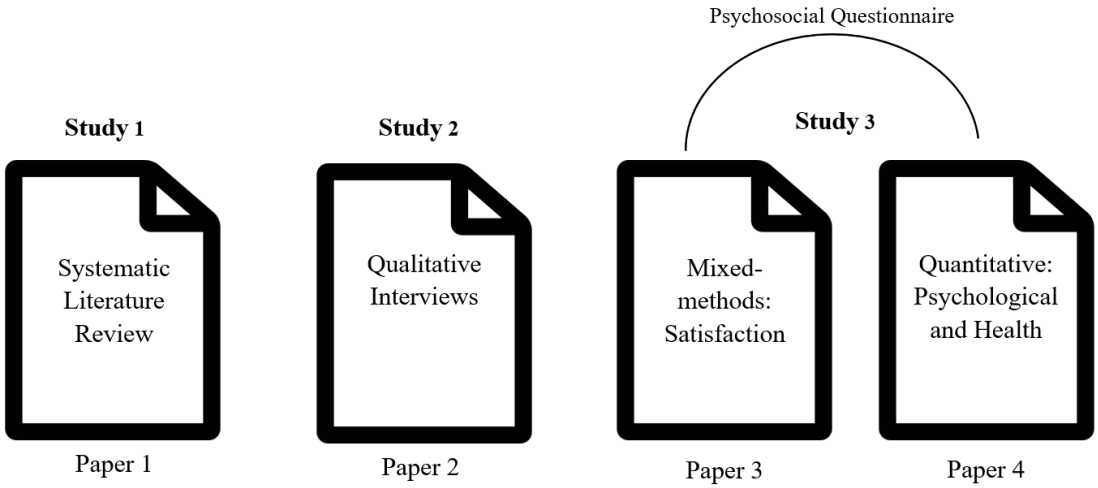


*Figure 1.* Outline of the research by study and papers presented in this thesis.[1]

### 2.3 Study One: Systematic literature review

A systematic review method was chosen for Study One as it constitutes a rigorous method of research for summarising evidence from multiple studies on a specific topic (Higgins & Green, 2008; Nilver et al., 2017; Wong, 2007). A standardised review protocol is essential for the systematic review method and as such, a protocol was developed *a priori*, to guide the literature search, study selection, and data synthesis. Both quantitative and qualitative study designs were included in the systematic literature review. Due to methodological heterogeneity of data, a synthesis was employed to extract and synthesise the data from each article into coherent themes.

### 2.4 Studies Two and Three

Studies Two and Three examined different aspects of women's psychosocial outcomes of the RCT conducted at the Women's and Children's Hospital. The purpose

[1] The studies are presented in the order in which the data were collected.

of Study Two was to explore and examine women's experiences of the fetal monitoring they received as part of the RCT. This was achieved by utilising qualitative methodology. The purpose of Study Three was to examine and compare women's psychosocial outcomes of the monitoring they received as part of the RCT. The study was a mixed-methods design and utilised a questionnaire to examine women's satisfaction and psychological and health outcomes with the monitoring they received. A brief overview of the RCT is now presented.

## 2.5 The randomised controlled trial

### 2.5.1 Trial aims and hypotheses

The aim of the RCT is to compare STan monitoring with CTG monitoring alone. The primary hypothesis of the RCT is that the proportion of EmCS for women who received STan will not be equal to that for women who had CTG monitoring alone. Specifically it is hypothesised that STan monitoring of labouring women will reduce the proportion of EmCSs when compared with CTG monitoring alone, specifically from 17% (for CTG alone) to 12% (Turnbull et al., 2019). In addition to the examination of clinical outcomes, psychosocial and economic outcomes were also of interest.

### 2.5.2 Study setting and population

The trial is administered by the University of Adelaide, Adelaide, South Australia and the Women's and Children's Hospital, Women's and Children's Health Network, Adelaide, South Australia. Participants are recruited at the Women's and Children's Hospital, a high-risk specialist facility with approximately 5,000 deliveries per annum. The aim is to recruit 1,818 women in total.

In terms of the broader context, around 300,000 babies are born in Australia every year (Australian Bureau of Statistics, 2018). Australian maternity care is delivered

through a mix of public and private services with planning and delivery predominantly undertaken by the states and territories through publicly funded programs. It includes antenatal, intrapartum, and postnatal care for women and babies up to six weeks after birth. In 2018, it was reported that 96% of women gave birth in a hospital and of these women, 3 in 4 did so in a public hospital (Australian Institute of Health Welfare, 2020). The average age of women who give birth in Australia is 30.7 years (Australian Institute of Health Welfare, 2020).

### 2.5.3 Research team

The RCT was developed and is being conducted by a multi-disciplinary team. The team includes a number of staff based at the Women's and Children's Hospital including: clinicians (Obstetricians and Gynaecologists), who contribute to participant recruitment and obstetric care; and a research midwife, who oversees the trial, recruits participants, and collects clinical data in addition to assisting with non-clinical research. A number of other clinical staff including Neonatologists, are integral team members. In addition, the team also includes researchers with expertise in psychology, biostatistics, and public health.

### 2.5.4 Study eligibility criteria

Women are included in the study if they are eighteen years or older, are capable of informed consent and literate in English. Women have to be pregnant with a singleton fetus in cephalic presentation. Women are ineligible if they are less than thirty-six weeks gestation, are planning a caesarean, have placenta praevia or vasa praevia, have any contraindication to fetal scalp electrode usage, do not require continuous methods of intrapartum fetal surveillance, have participated in this trial in a previous pregnancy, or if there are known fetal structural or functional cardiac conditions.

### 2.5.5 Randomised controlled trial schedule

Women received information regarding the RCT at 32 weeks gestation within a pack prepared by the hospital containing information about clinical studies, immunisations, and other relevant information for women as they prepare for the birth of their baby. Women could provide informed consent at any time during the antenatal period, in early labour or in established labour but only when they had adequate epidural analgesia. Randomisation did not occur until it was established that the inclusion criteria were met and the woman was in labour and required, or was currently receiving, continuous CTG monitoring as per the RANZCOG guidelines (RANZCOG, 2019). Women were randomised to receive either STan or CTG alone, according to an allocation ratio of 1:1 with stratification for parity, using a remote telephone-based randomisation system provided by the NH&MRC Clinical Trial Centre at the University of Sydney (Turnbull et al., 2019).

Any excluded or voluntarily withdrawn patients receive usual care without prejudice. Clinical observation commences at randomisation and ends six weeks postnatally. The last contact for the subset of women involved in the PhD research was at approximately seven weeks after birth with the receipt of a psychosocial questionnaire. Finally, a subset of women consenting to additional follow-up were contacted for a face-to-face interview.

#### *2.5.5.1 Description of treatment arms*

Fetal surveillance is conducted by Midwives and Obstetricians who have been trained in the use of STan and CTG monitoring. After women give birth, clinical notes describing their labours are reviewed by a multidisciplinary panel of experienced clinicians to assess adherence to fetal surveillance (STan and CTG) protocols and

procedures. Any evidence of STan protocol violations are fed back to the relevant clinical staff to optimise protocol adherence.

*2.5.5.1.1 CTG monitoring*

When a woman is randomised to receive CTG alone, the CTG machine in the birthing room is activated. External monitoring of the fetal heart rate commences by a belt-mounted Doppler monitor around her abdomen. If clinically necessary, an FSE is applied to the fetal scalp, and monitoring continues.

*2.5.5.1.2 Treatment arm (STan)*

When a woman is randomised to receive STan (i.e. STan+CTG), a STan capable monitor is connected to a tocodynometer on a belt applied to the woman's abdomen. If membranes are already ruptured, an FSE is applied to the back of the baby's scalp and monitoring commences. If her membranes are still intact, they are artificially ruptured when it is safe and clinically appropriate. Following this, an FSE is applied and STan monitoring commences. If it is not possible or clinically appropriate to rupture the membranes, external CTG monitoring is to commence via a belt-mounted Doppler monitor. Once clinically appropriate and safe, the membranes are then ruptured, an FSE applied, and STan monitoring commences.

**2.5.6 Ethics**

The RCT was approved by the Women's and Children's Health Network's Human Research Ethics Committee (HREC/17/WCHN/14).

**2.5.7 Study outcomes**

The primary outcome is EmCS (yes/no). Several maternal secondary outcomes are outlined for examination in the study protocol including: type of labour, number and classification of CTG abnormalities and clinician responses, number and type of ST events and clinicians involved; mode of birth, in addition to several others (Turnbull et

al., 2019). Several neonatal outcomes are also outlined for examination, including but not limited to: intrapartum fetal death, birth weight, intubation or external cardiac massage at birth, antibiotic usage, potential complication from use of fetal scalp electrode, scalp trauma, admission to neonatal intensive care, and length of stay. Women participating in the study during the time of the PhD, were offered the opportunity to participate in research observing psychosocial outcomes of the monitoring they received, except if it was deemed that it was not appropriate for the women to receive the questionnaire (further detail is provided below). This research comprises the two studies conducted as part of this thesis which will now be discussed.

## 2.6 Study Two

Study Two utilised a qualitative design, specifically individual, face-to-face, semi-structured interviews to explore women's experiences with the monitoring they received (Michels et al., 2013). The value of using qualitative research within or alongside RCTs is widely acknowledged (Cooper et al., 2014; Snowdon, 2015) and increasing numbers of RCTs are including qualitative components (Lewin et al., 2009). A number of important benefits of qualitative research conducted alongside RCTs have been identified including facilitating interpretation of trial findings, exploring stakeholder perceptions of the feasibility and acceptability of an intervention and facilitating understanding of the effect of social context in which an intervention is delivered (Russell et al., 2016). Further detail of the research methodology and recruitment are described in the Study Three and in Chapter Four.

## 2.7 Study Three

Study Three utilised a mix-methods design, specifically a questionnaire, to examine women's psychosocial outcomes alongside the RCT. Two papers were derived from this study, the first examined women's satisfaction with the monitoring and care

they received as part of the trial and the second examined women's psychological and health outcomes of the monitoring women received.

### 2.7.1 Materials

The questionnaire was constructed using seven scales measuring early labour experiences, postnatal depression, satisfaction, subjective HRQoL, psychological distress, and infant feeding. These scales have been successfully applied in maternity settings in past studies. The questionnaire also included demographic questions and two open response questions. The properties of the measures will be outlined below.

#### *2.7.1.1 Demographic information*

Demographic variables included in the questionnaire were: education level (based on the Australian Bureau of Statistics (Australian Bureau of Statistics, 2014)), language spoken at home, Aboriginal and/or Torres Strait Islander origin, marital status, employment, smoking status, and parity. Further, questions were asked of women who had previously given birth, including previous methods of birth, previous fetal monitoring, and satisfaction with previous birth(s). Other demographic data were collected from hospital records including mother's age, most recent baby's date of birth, use of epidural analgesia, and use of FSE.

#### *2.7.1.2 Satisfaction*

##### *2.7.1.2.1 Satisfaction with Electronic Fetal Monitoring Questionnaire*

Satisfaction with fetal surveillance was measured using a purpose-designed scale, Satisfaction with Electronic Fetal Monitoring Questionnaire (S-EFM). The measure was previously developed and piloted based on earlier research in relation to fetal monitoring, in particular CTG (Garcia et al., 1985; Hindley et al., 2008; Killien & Shy, 1989; Snydal, 1988), and limited research conducted on STan technology (Bryson et al., 2017; Parisaei et al., 2011). The S-EFM included 11-items and required

participants to respond on a 5-point Likert scale ranging from ‘strongly disagree’ to ‘strongly agree’. Five items were negatively worded and reverse scored. The item ‘I was concerned about the attachment of the scalp clip’ includes a ‘not applicable’ option as not all participants received an FSE. Scores were totalled and divided by the number of questions answered. Higher scores indicate greater satisfaction with the monitoring. A Cronbach’s alpha of .87 was observed in a pilot of the measure, indicating good internal consistency (Digenis, 2016).

*2.7.1.2.2 Birth Satisfaction Scale*

Birth satisfaction was measured using the 10-item Birth Satisfaction Scale Revised (BSS-R). The BSS-R is a self-report scale that was produced as a shorter form of the original 30-item BSS (Hollins Martin & Martin, 2014). The BSS-R is an instrument used to measure satisfaction with maternal birth experience (Hollins-Martin et al., 2012; Hollins Martin & Martin, 2014; Martin & Fleming, 2011). The BSS-R consists of one higher-order factor (experience of childbearing) containing three lower-order factors (quality of care provision, women's personal attributes, and stress experienced during labour). Four items measure quality of care provision, four items measure stress during labour, and two items measure women's attributes. Participants were asked to rate their level of agreement on a Likert-scale with each item (0=Strongly Disagree, 1=Disagree, 2=Neither Agree or Disagree, 3=Agree, 4=Strongly Agree), with four items being reverse-scored. Previous research has reported that the BSS-R is a robust, valid and reliable multidimensional psychometric instrument for measuring women's birth satisfaction in the postnatal period (Hollins Martin & Martin, 2014).

In order to make the BSS-R culturally relevant to Australian mothers, one item was modified to use a different term for “unscathed” (“I came through childbirth virtually unscathed”). Researchers thought that this term was not often used in

Australia, so the item was altered to read “I came through childbirth virtually unharmed”. This was based on advice from previous researchers who made this modification for use in a study conducted in the United States. Results showed that United States mothers responded differently when asked if they came through childbirth unscathed versus unharmed; thus, researchers recommend using “I came through childbirth virtually unharmed” in US samples in order to gain more meaningful scores (C; Barbosa-Leiker et al., 2015).

*2.7.1.2.3 Positives and negatives of fetal monitoring*

Two open ended questions were included to capture options for both women’s positive and negative experiences of the fetal monitoring they received.

*2.7.1.3 Physical and mental health*

*2.7.1.3.1 Euro Qol-5 Dimensions*

Women’s health was examined using the Euro Qol-5 Dimensions (EQ-5D) classification of one’s own health which was developed by the international EuroQoL Group (Devlin & Brooks, 2017). The EQ-5D is a widely used measure of health status consisting of two components. The first is a descriptive system which assesses health in five dimensions: mobility, self-care, unusual activities, pain/discomfort, and anxiety/depression. Each dimension has five levels of response (no problems, slight problems, moderate problems, severe problems, extreme problems/unable to). The second component of the EQ-5D consists of a visual analogue scale (VAS) on which perceived health can be rated from 0 (the worst imaginable health) to 100 (the best imaginable health). The EQ-5D questionnaire is cognitively undemanding, taking only a few minutes to complete. Its positive psychometric performance has previously been demonstrated in the maternity context (Petrou et al., 2009).

*2.7.1.3.2 General Health Questionnaire-12*

Psychological distress was measured using the twelve-item General Health Questionnaire (GHQ-12) (Goldberg & Williams, 1991). The GHQ-12 is a shortened version of a 60-item screening tool and is designed to identify disruptions in normal functioning and the emergence of psychological morbidity. The GHQ-12 requires participants to describe how frequently they experience twelve different psychological health symptoms on a 4-point Likert scale, ranging from 0 (not at all) to 3 (much more than usual) producing a possible total score range of 0-36. Higher scores indicate lower levels of psychological health (Golderberg & Williams, 1988). In addition to a total score, three factors can be derived including social dysfunction (6 items), anxiety (4 items), and loss of confidence (2 items) (El-Metwally et al., 2018). The GHQ-12 itself comprises six positively worded descriptions of mood states (e.g "felt able to overcome difficulties") and six negatively worded descriptions of mood states (e.g. "felt like a worthless person"). The psychometric properties of the GHQ-12 are sound and the measure has good internal consistency, construct validity and discriminant validity, and has been validated for use within the postnatal setting (Navarro et al., 2007).

*2.7.1.3.3 Edinburgh Postnatal Depression Scale*

Postnatal depression was measured using the 10-item Edinburgh Postnatal Depression Scale (EPDS) (Cox et al., 1987). The EPDS is the most widely used instrument for population-based screening in postnatal depression studies (Dennis, 2004). Items on the EPDS include questions related to maternal feelings during the previous seven days which refer to depressed mood, anxiety, and suicidal ideation. The EPDS scale does not include common somatic symptoms, such as appetite change and insomnia, which may occur naturally in postnatal women. Participants are asked to respond to statements on a 4-point Likert scale, with each item graded according to

severity or duration. Response categories are scored 0, 1, 2, or 3, yielding a summary score of 0-30 with pre-determined cut points to identify the likely presence of postnatal depression. A summary score between 0-9 indicates a low risk of experiencing symptoms of postnatal depression; a score of 10-12 indicates moderate risk of experiencing symptoms of postnatal depression; and a score of 13 or more indicates a high risk of experiencing symptoms of postnatal depression (Cox & Holden, 2003; Lanes et al., 2011).

*2.7.1.3.4 Infant feeding*

One item was used to measure infant feeding practices. This item was developed specifically for this study and was based on the Australian National Infant Feeding Survey (2010) and the World Health Organization's recommended terms defining breastfeeding practices, which are used to guide breastfeeding data collection and reporting (2008). Specifically, women were asked how they were feeding their baby and were provided with five response options ranging from fully breastfeeding to fully bottle-feeding.

**2.7.2 Procedure**

Women from both arms of the RCT conducted at the Women's and Children's Hospital were offered the opportunity to participate in research observing psychosocial outcomes of the monitoring they received, unless it was deemed not appropriate to contact the woman to receive the questionnaire at that time (e.g. occurrence of a severe adverse event, i.e. intrapartum or neonatal death; poor neonatal outcomes; extended stays in NICU and special care units). Women were recruited between March 2018 and December 2019. It should be noted that a sample size calculation for this study was not conducted. This was a pragmatic decision based on feasibility and the fact that the study was exploratory and not powered on a particular outcome.

A precursor invitation letter for the questionnaire was sent via mail approximately six weeks after giving birth. The precursor letter included a brief description of the study and stated that women would be contacted in the near future with more information about their potential participation.

A study package was sent one week later via post, thus it was assumed that all but a minority of women would have received the questionnaire approximately seven weeks after birth. The specified time of seven weeks was chosen as it was acknowledged that women could be susceptible to a 'halo effect' before this time (Bennett, 1985). The 'halo effect' refers to the initial relief and euphoria that women may experience which can result in women being less likely to report negatively about their experiences (Soet et al., 2003). The study package included an information sheet, consent form, questionnaire, and prepaid return envelope. Two methods of responding to the questionnaire were offered: a hard-copy questionnaire returned by post or an electronic questionnaire with an online response option. To participate online, women were provided with an internet link on the information sheet. The online option was included with the intention to reduce participation burden and increase response rate (Dillman et al., 2014; Ponto, 2015). The electronic questionnaire consisted of the same questions with slightly different formatting.

In an effort to further increase the response rate, participants who did not return the questionnaire three weeks after it was sent were sent a reminder pack including a new copy of the information sheet, consent form, and questionnaire. In the event that the questionnaire was not returned after the mail reminder, an SMS reminder was sent by the research midwife, which included the link to the online version of the questionnaire. It was decided that the study information would first be sent via post as

research indicates that mailed questionnaires can have higher response rates than other modes of collection (Dillman et al., 2014).

Over the course of the study, two methods were trialled to assess which method was more effective in increasing response rates. The first 100 participants received the precursor letter, the study pack, and then another study pack as a reminder, and then a SMS reminder. The second 100 participants received the precursor letter, study pack and then a reminder SMS. The first method elicited slightly more participants and therefore, the decision was made to send women the precursor letter, study pack, reminder pack, and then a SMS reminder.

Upon return of the questionnaire, data from the paper versions were inputted to a custom-built management information system. An alert was produced immediately and sent to the primary researcher and research midwife if a woman's score on the Edinburgh Postnatal Depression Scale indicated severe depression (above 13 in total) or suicidal ideation (1, 2, or 3 on question 10). The research midwife then contacted these women and appropriate referrals were made as needed.

#### *2.7.2.1 Additional consent for Study Two*

Consent for all women willing to participate in Study Three was gained either on paper or electronically (depending on method of questionnaire completion). At the end of the psychosocial questionnaire (Study Three), women could express interest to participate in a further study (Study Two) involving a face-to-face interview in relation to their experience with the fetal monitoring they received. Women who returned the questionnaire and indicated they were interested in participating were contacted. Further details of the procedure for Study Two are explained within Chapter Four.

## 2.8 Summary

This chapter has provided a detailed overview of the three studies conducted as part of this thesis in addition to an overview of the RCT. A flow diagram illustrating participant recruitment for the two studies conducted alongside the RCT is shown in Figure 2. Against the backdrop of this discussion, the four papers are now presented.

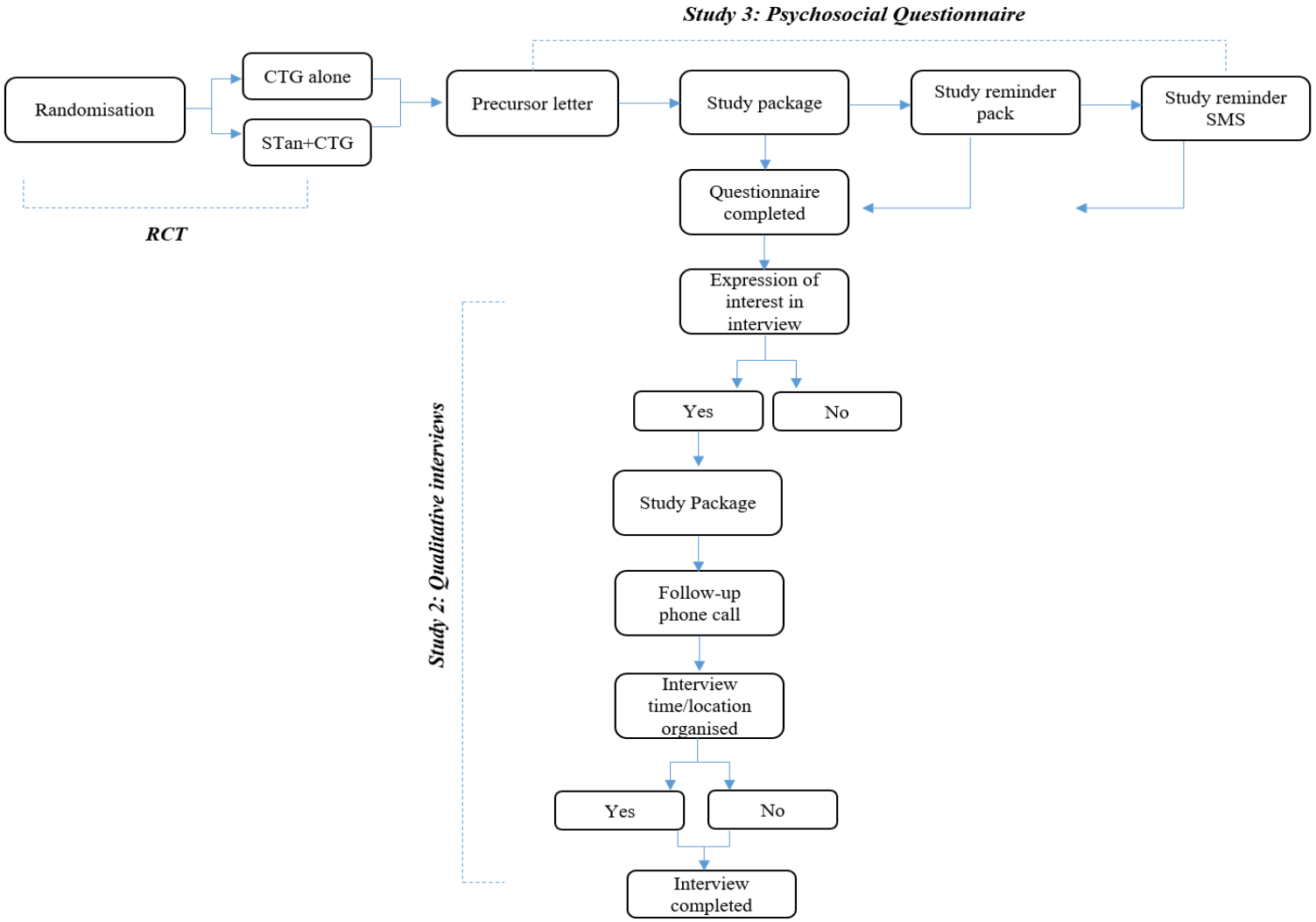


*Figure 2.* Outline of participant recruitment pathway throughout psychosocial studies for consenting participants

# CHAPTER 3. WOMEN'S PSYCHOSOCIAL OUTCOMES FOLLOWING AN EMERGENCY CAESAREAN SECTION

## 3.1 Statement of Authorship

*Title of paper:* Women's psychosocial outcomes following an emergency caesarean section: A systematic literature review.

*Publication status:* Published

*Publication details:* Benton, M., Salter, A., Tape, N., Wilkinson, C., & Turnbull, D. (2019). Women's psychosocial outcomes following an emergency caesarean section: A systematic literature review. *BMC Pregnancy and Childbirth*, 19(1), 535. doi:10.1186/s12884-019-2687-7

### 3.1.1 Principal author

*Name of principal author (candidate):* Madeleine Benton

*Contribution to the paper:* Devised study aims. Planned and carried out data collection and analysis. Wrote and submitted manuscript. Acted as corresponding author.

*Overall percentage (%):* 85%

*Certification:* This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.

*Signature:* *Date: 17.7.20*

### 3.1.2 Co-author contributions

By signing the Statement of Authorship, each author certifies that:

i. the candidate's stated contribution to the publication is accurate (as detailed above);

ii. permission is granted for the candidate in include the publication in the thesis; and

iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

*Name of co-author:* Prof. Deborah Turnbull

*Contribution to the paper:* Supervised development of the work. Provided guidance on the preparation of manuscript and editorial and structural feedback on the paper.

*Signature:* *Date: 17.7.20*

*Name of co-author:* Dr. Amy Salter

*Contribution to the paper:* Supervised development of the work. Provided guidance on the preparation of manuscript and editorial and structural feedback on the paper.

*Signature:* *Date: 17.7.20*

*Name of co-author:* Ms. Nicole Tape

*Contribution to the paper:* Input on data collection and analysis. Provided editorial and structural feedback on the paper.

*Signature:* *Date:17.7.20*

*Name of co-author:* Dr. Chris Wilkinson

*Contribution to the paper:* Provided guidance on the preparation of manuscript and editorial and structural feedback on the paper.

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## 3.2 Published paper

Women's psychosocial outcomes following an emergency caesarean section.

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## 3.3 Abstract

Background: Given the sudden and unexpected nature of an emergency caesarean section (EmCS) coupled with an increased risk of psychological distress, it is particularly important to understand the psychosocial outcomes for women. The aim of this systematic literature review was to identify, collate and examine the evidence surrounding women's psychosocial outcomes of EmCS worldwide.

Methods: The electronic databases of EMBASE, PubMed, Scopus, and PsycINFO were searched between November 2017 and March 2018. To ensure articles were reflective of original and recently published research, the search criteria included peer-reviewed research articles published within the last twenty years (1998 to 2018). All study designs were included if they incorporated an examination of women's psychosocial outcomes after EmCS. Due to inherent heterogeneity of study data, extraction and synthesis of both qualitative and quantitative data pertaining to key psychosocial outcomes were organised into coherent themes and analysis was attempted.

Results: In total 17,189 articles were identified. Of these, 208 full text articles were assessed for eligibility. 149 articles were further excluded, resulting in the inclusion of 66 articles in the current systematic literature review. While meta-analyses were not possible due to the nature of the heterogeneity, key psychosocial outcomes identified that were negatively impacted by EmCS included post-traumatic stress, health-related quality of life, experiences, infant-feeding, satisfaction, and self-esteem. Post-traumatic stress was one of the most commonly examined psychosocial outcomes, with a strong consensus that EmCS contributes to both symptoms and diagnosis.

Conclusions: EmCS was found to negatively impact several psychosocial outcomes for women in particular post-traumatic stress. While investment in technologies and clinical practice to minimise the number of EmCSs is crucial, further investigations are needed

to develop effective strategies to prepare and support women who experience this type of birth.

*Keywords:* Systematic literature review, childbirth, emergency caesarean section, psychosocial outcomes, maternal health, postpartum.

## 3.4 Introduction

There has been a dramatic increase in caesarean section (CS) rates around the world over the past three decades, particularly in middle and high income countries (Mazzoni et al., 2011). At a population level, the World Health Organisation has concluded that CS rates higher than 10% are not associated with reductions in maternal and newborn mortality rates (World Health Organization, 2015). Despite this, recent data has reported rates of 40.5% in Latin America and the Caribbean, 32.3% in Northern America, 31.1% in Oceania, 25% in Europe, 19.2% in Asia and 7.3% in Africa (Betrán et al., 2016). Globally, CS rates have almost doubled between 2000 and 2015, from 12% to 21% (Boerma et al., 2018).

CSs are broadly classified depending on whether they are an elective or emergency procedure. An elective CS is defined as a planned, non-emergency delivery which occurs before initiation of labour (Zanardo et al., 2016). In contrast, emergency caesarean section (EmCS) is defined as an unplanned CS delivery performed before or after onset of labour, which is typically urgent and is most often required due to fetal, maternal or placental conditions (eg. fetal distress, eclampsia, placental/cord accidents, uterine rupture, failed instrumental birth etc) (le Riche & Hall, 2005; Zanardo et al., 2016).

While CS has an important place in potentially protecting both mother and baby from harm, it is associated with short and long term physical and psychological risks which can extend many years beyond the current delivery and effect the health of the woman, her child, and future pregnancies (World Health Organization, 2015). In a review of research on the outcomes of CS, Lobel and DeLuca (2007) noted that the procedure is uniquely challenging as it combines surgery and birth, events that elicit very diverse emotional responses. The circumstances surrounding an EmCS add an

additional layer of complexity to this experience which has thereby prompted researchers to explore the psychosocial impact of this type of birth. The nature of the event accompanied by a series of subsequent rapid psychological adjustments may be distressing, anxiety-provoking and emotionally unsettling for women (Roux & Rensburg, 2011; Somera et al., 2010).

The primary outcome of obstetric care, is of course, to ensure both mother and infant remain physically healthy however, psychosocial aspects and outcomes of maternity care and obstetrics are no less important (Clement, 2001; Haines et al., 2012). Psychosocial outcomes identified and examined in the literature as potentially related to CS include: mental health problems such as, postpartum depression, post-traumatic stress and anxiety; decreased maternal satisfaction with childbirth; the mother infant relationship; parents' sexual functioning; and health behaviours such as infant feeding.

### 3.4.1 The current study

Given the nature of EmCS and the increased risk of psychological distress for women, it is imperative to gain insight into the diverse psychosocial outcomes for women experiencing this type of birth. Knowledge and awareness surrounding the impact of EmCS on women's psychosocial outcomes is likely to enhance the overall quality of maternity care. The aim of the current systematic literature review is to identify, collate, and examine the evidence surrounding women's psychosocial outcomes of EmCS.

## 3.5 Method

A systematic literature review constituting a rigorous method of research for summarising evidence from multiple studies on a specific topic was undertaken (Liberati et al., 2009; Nilver et al., 2017). The present study was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-

analyses (PRISMA) recommendations (Moher et al., 2009). An a priori designed study protocol guided the literature search, study selection and data synthesis, with quantitative meta-analysis attempted when possible. This systematic review was registered in the international prospective register of systematic reviews (PROSPERO) database: CRD42018087677.

### 3.5.1 Search strategy

The search strategy was designed and developed following consultation with a health and medical sciences university librarian in order to ensure a comprehensive search and increase the robustness of the study (Koffel, 2015). The medical and psychological electronic databases of EMBASE, PubMed, Scopus, and PsycINFO were searched between November 2017 and March 2018. When conducting searches, keywords were combined representing the two primary concepts; psychosocial outcomes and EmCS. In this systematic literature review, psychosocial outcomes were considered to be variables that encompass social and psychological aspects of an individual's life (Long & Cumming, 2013). The Boolean operators 'OR' and 'AND' were utilised to facilitate maximum inclusion of relevant articles (Aveyard, 2014). Detailed search algorithms and indexing language used for each database are outlined in the Additional File 1.

To ensure that included articles were reflective of original and recently published research, limits were applied within the literature search to incorporate inclusion criteria such as: research articles, publication within the last twenty years (1998 to 2018), and peer-reviewed articles (Timmins & McCabe, 2005). Further, the search was limited to English language publications due to unavailability of funding for language translation. Grey literature or trial registries were not pursued for practical purposes.

### 3.5.2 Eligibility criteria

Inclusion and exclusion criteria (based on the PICOS [population, intervention, comparison, outcome, study design] framework) were established in advance and documented in the review protocol to identify all pertinent studies.

- **P**opulation: Women who have delivered via EmCS
- **I**ntervention: EmCS
- **C**omparison: Any mode of delivery (MoD) where reported, otherwise no comparison
- **O**utcomes: Psychosocial variables (i.e. postnatal depression, anxiety, post-traumatic stress, infant feeding, sexual functioning, satisfaction, views and experiences)

  **S**tudy Design: Quantitative (excluding case studies), qualitative or mixed methods

### 3.5.3 Study selection

Potential papers were screened initially by title and abstract by two reviewers who reviewed half of papers each (MB and NT) and full texts were retrieved for those citations considered potentially relevant for inclusion. Both reviewers completed an initial subset of papers together in order to ensure consistency in their approach. Reference lists of retrieved full text papers were examined to identify potentially relevant studies not captured by electronic searches (Horsley et al., 2011). Full texts of the remaining articles were independently appraised against the eligibility criteria for final inclusion by two reviewers (MB and NT). In case of disagreement in the selection process, a third reviewer was available for consultation.

### 3.5.4 Data extraction

Utilising a data extraction form designed by the authors, MB extracted descriptive data on study aims, study design, study location, sample size, data collection period, measures utilised, and included a text description summarising the psychosocial and EmCS related findings from each study. These data were cross-checked by NT. A data synthesis of the findings from each article was then performed, involving identification of prominent and recurrent themes in the literature and the synthesis of findings from studies under thematic headings. This approach has been described as flexible, allowing considerable latitude to systematic reviewers, and provides a means of integrating qualitative and quantitative evidence (Horsley et al., 2011).

### 3.5.5 Quality assessment

In line with standard systematic literature review methodology a formal methodological quality appraisal of each included study was performed using the Mixed Methods Appraisal Tool (MMAT) version 11 (Pluye et al., 2011). This tool allows for the critical appraisal of quantitative, qualitative, and mixed methods studies and was developed to address some of the challenges of critical appraisal in systematic mixed studies reviews. The MMAT has been validated and used for quality assessment in similar mixed method systematic reviews (Boerleider et al., 2013). The MMAT comprises 19 items for appraising the methodological quality of 5 different types of studies: qualitative studies (4 items), randomised controlled trials (4 items), non-randomized studies (4 items), quantitative descriptive studies (4 items), and mixed methods studies (4 items). Based on the number of criteria met for an individual study, the overall quality assessment rating (QAR) is presented using descriptors *, **, ***, and ****, ranging from * (single criterion met) to **** (all criteria met). Each study

included in the quality assessment was evaluated by two independent reviewers (MB and NT). A third reviewer was available for consultation if disagreement occurred.

## 3.6 Results

### 3.6.1 Study selection and characteristics

A summary of the search process is illustrated in Figure 3, as recommended by the PRISMA guidelines (Moher et al., 2009). In total 17,189 articles were initially identified. For the initial screening, all search results were imported into citation management software Endnote ×7 where 1,068 duplicates were identified and removed, leaving 16,121 articles (Pubmed, $n$ = 12,960, EMBASE $n$ = 829, PsycINFO $n$ = 56, Scopus $n$ = 2,276). Titles and abstracts were then assessed by two reviewers (MB, NT), with this process ending with the inclusion of 208 articles. Full texts were then retrieved for those citations considered potentially relevant and assessed for eligibility by the two reviewers (MB, NT). Of these 208 articles, 149 were excluded. The most common reason for exclusion was a lack of differentiation between type of CS when reporting study results (see Figure 3). Reference lists of included studies were hand searched by the first author and a further 7 articles were subsequently included. A total of 66 relevant articles (Adams et al., 2012; Adewuya et al., 2006; Ahluwalia et al., 2012; Baas et al., 2017; Baston et al., 2008; Beck & Watson, 2008; Bergant et al., 1998; Bryanton et al., 2008; Burcher et al., 2016; Carquillat et al., 2016; Chen & Wang, 2002; Creedy et al., 2000; Durik et al., 2000; Eckerdal et al., 2018; Enabudoso & Isara, 2011; Fenaroli et al., 2016; Fenwick et al., 2009; Forti-Buratti et al., 2017; Furuta et al., 2016; Gaillard et al., 2014; Gamble & Creedy, 2005; Gibbins & Thomson, 2001; Goker et al., 2012; Graham et al., 1999; Guittier et al., 2014; Handelzalts et al., 2017; Herishanu-Gilutz et al., 2009; Hobbs et al., 2016; Iwata, 2015; Jansen, Duvekot, et al., 2007; Karlström, 2017; Karlstrom et al., 2007; Loto et al., 2010; Loto et al., 2009; Lurie et al., 2013;

Maclean et al., 2000; Modarres et al., 2012; Noyman-Veksler et al., 2015; O'Reilly et al., 2014; Patel et al., 2005; Porter et al., 2007; Redshaw & Hockley, 2010; Rowlands & Redshaw, 2012; Ryding et al., 1998a; Ryding et al., 1998b; Ryding, 2000; Safarinejad et al., 2009; Saisto et al., 2001; Sarah et al., 2017; Shorten et al., 2014; Soderquist et al., 2002; Somera et al., 2010; Spaich et al., 2013; Storksen et al., 2013; Tham et al., 2007; Tham et al., 2010; Trivino-Juarez et al., 2017; Tully & Ball, 2013; Ukpong & Owolabi, 2006; Vossbeck-Elsebusch et al., 2014; Wijma et al., 2002; Wiklund et al., 2009; Wiklund et al., 2008; Xie et al., 2011; Yang et al., 2011; Zanardo et al., 2016) were thus included in the current systematic literature review.

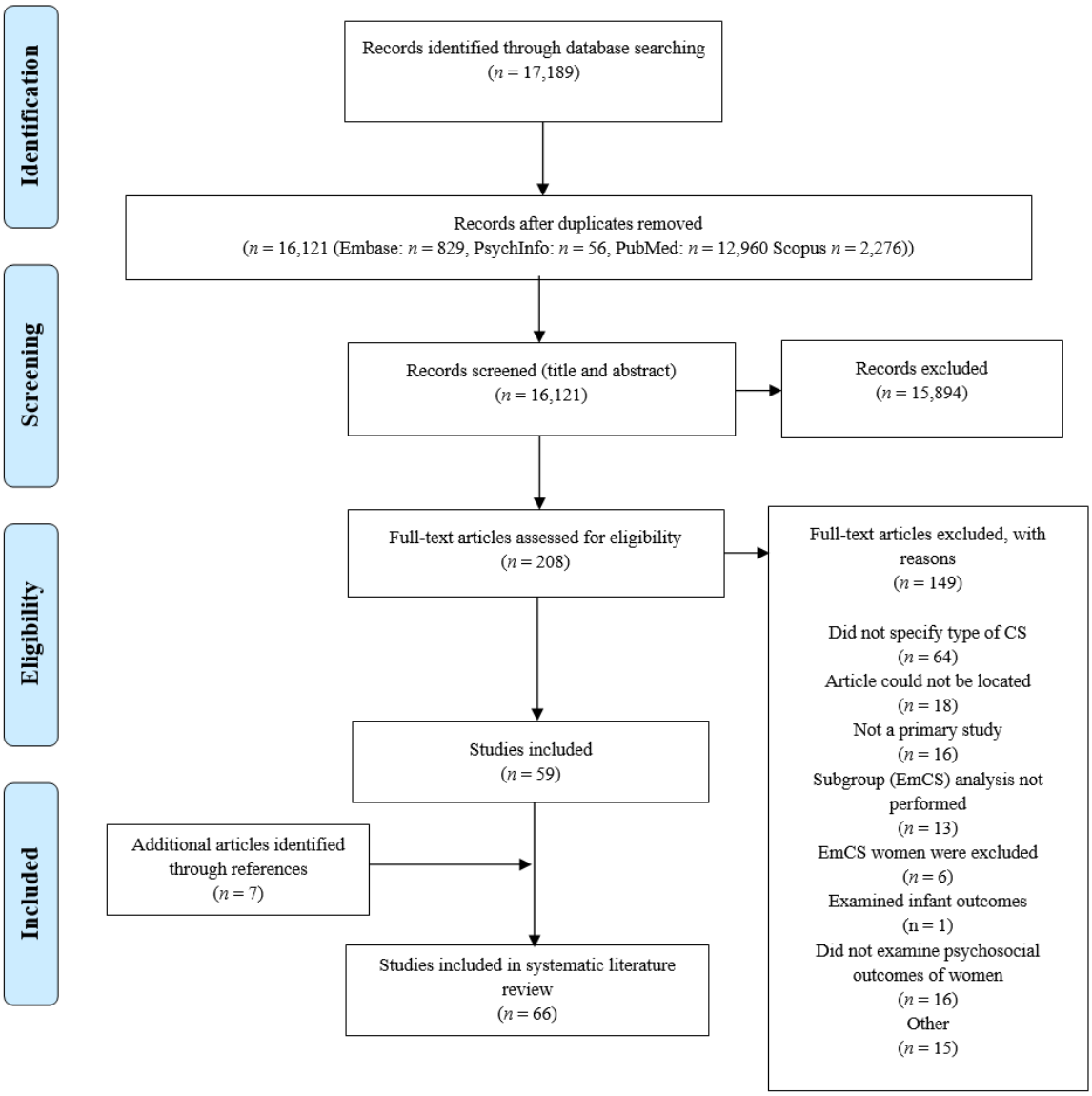


*Figure 3.* Search and Selection Flow Diagram.

### 3.6.2 Description of included studies

Characteristics of the 66 included studies are presented in Table 1. Studies were conducted in 22 different countries with the majority conducted in Sweden (*n* = 12), followed by the UK (*n* = 10), and then Nigeria (*n* = 5). Most studies were quantitative in nature (*n* = 51), followed by qualitative (*n* = 14) and just one study with mixed methods. Cross sectional (*n* = 19) and prospective designs (*n* = 31) were most prevalent.

Table 1

*Summary Characteristics of Included Studies*

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Adams, 2012 | To assess the association between mode of delivery (MoD) and maternal postpartum emotional distress. | Prospective Cohort | Norway | 55, 814 | 17 & 30 weeks gestation and 6 months postpartum | 1998-2008 | Short form of the Hopkins Symptom Checklist-25 (SCL-8) | Emotional Distress | MoD was not associated with the presence of emotional distress postpartum. | ***** |

2 Mixed Methods Appraisal Tool Quality Assessment Rating

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Adewuya, 2006 | To estimate the prevalence PTSD after childbirth and to examine associated factors. | Cross-sectional | Nigeria | 876 | 6 weeks postpartum | 2004 | MINI International Neuropsychiatric Interview, Index of marital satisfaction, Medical Outcomes Study Social Support Survey, Life events scale, Labour agentry scale | PTSD | Instrumental delivery and Emergency Caesarean Section (EmCS) were associated with PTSD, while elective caesarean section (ElCS) sections showed no significant effect. | ***** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Ahluwalia, 2012 | To assess the relationship between MoD and breastfeeding. | Prospective longitudinal | United States | 3,026 | Before birth and 10 times during the year after birth. | 2005-2006 | Study specific | Breastfeeding | Median breastfeeding duration was 20.6 weeks for EmCS. Breastfeeding duration among women who initiated breastfeeding show that the prevalence of breastfeeding at any time through 60 weeks after delivery was lowest for those who had induced vaginal delivery (VD) or EmCS than among those in the other two groups (spontaneous VD or planned CS). |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Beck, 2008 | To explore the impact of birth trauma on mothers' breast feeding experiences. | Qualitative | New Zealand, US, Australia, UK, Canada | 52 | Not specified | Not specified | Study specific | Infant feeding | Women repeatedly explained that their decision to breastfeed was driven by their need to make amends to the infants for the traumatic way they had arrived into the world, for example, by EmCS. | ***** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Baas, 2017 | To understand the relationship between client-related factors and the experience of midwifery care during childbirth to improve care. | Prospective longitudinal | Netherlands | 2,377 | 20 and 34 weeks pregnant and 6 weeks postpartum | 2009-2011 | Study specific and Labour Agency Scale | Experience of care | MoD effected experiences of care. Women who had an unplanned CS were more likely to indicate that they had received “less than good” midwifery care during childbirth. | **** |
| Baston, 2008 | To examine what factors relate to women's appraisal of their birth three years later. | Prospective Cohort | England and Netherlands | 2,048 | 3 years postpartum | 2003-2004 | Study specific | Satisfaction of experience | EmCS was a factor contributing to a negative appraisal of birth in England and the Netherlands. | **** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Bergant, 1998 | To study the subjective psychological and physical stressful experience of childbirth burden. | Cross-sectional | Austria | 1,250 | 5 days postpartum | 1993-1994 | EPDS, Trait-Anxiety Inventory, Burden of childbirth | Burden of childbirth | Women who experienced emergency surgical intervention (EmCS and vacuum extraction) demonstrated higher childbirth burden scores. | **** |
| Bryanton, 2008 | To determine factors that predict women's perceptions of the childbirth experience and to examine whether these vary with the type of birth a woman experiences. | Prospective cohort | Canada | 652 | 12-47 hours postpartum | 2004-2005 | Questionnaire Measuring Attitudes About Labour and Delivery | Perceptions of birth | Women who had a planned CS birth scored significantly lower on birth perception than those who had an EmCS or a VD. | **** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Burcher, 2016 | To elicit women's narratives of their unplanned CS births to identify potentially alterable factors that contribute to CS regret. | Qualitative | United States | 14 | 2-6 weeks postpartum | Not specified | Study specific | Regret and dissatisfaction | Four key themes emerged from patients' unplanned CS narratives: poor communication, fear of the operating room, distrust of the medical team, and loss of control. | ***** |
| Carquillat, 2016 | To compare subjective childbirth experience according to different delivery methods. | Cross-sectional | Switzerland and France | 291 | 4-6 weeks postpartum | 2014-2015 | Questionnaire for Assessing Childbirth Experience | Childbirth Experience | Women who had an EmCS were at highest risk of experiencing childbirth in a negative way. | **** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Chen, 2002 | To compare women who had a VD with those who had a CS in depression, perceived stress, social support, and self-esteem. | Cross-sectional | Taiwan | 357 | 6-weeks postpartum | 1999 | The Beck Depression Inventory, The Perceived Stress Scale, The Interpersonal Support Evaluation List (ISEL) Short Form, Coopersmith's Self-Esteem Inventory | Depression, perceived stress, social support, self-esteem | There was no association found in this study between the type of CS (planned or emergency) and psychosocial measures. | ***** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Creedy, 2000 | To determine the incidence of acute trauma symptoms and PTSD in women as a result of their labour and birth experiences, and to identify factors that contributed to the women's psychological distress. | Prospective Longitudinal | Australia | 499 | 4-6 weeks postpartum | 1997-1998 | Posttraumatic Stress Symptoms interview | PTSD | The experience of an EmCS was correlated with the development of trauma symptoms. | **** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Durick, 2000 | To examine if unplanned CS would be related to less optimal outcomes and that this relationship would be mediated by mother's appraisal of the delivery and would attenuate over time. | Longitudinal cohort | United States | 570 | 4 and 12 months postpartum | Not specified | The Eysenck Personality Inventory Form, The Centre for Epidemiologic Studies Depression Scale, Rosenberg's (1965) self-esteem scale | Mother-infant interactions, Neuroticism, Depression, Self-esteem, appraisal of the birth experience. | The psychological experiences associated with delivery by unplanned CS, by planned CS, or VD are distinct, and unplanned CS deliveries are appraised most negatively. | **** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Eckerdal, 2017 | To explore the association between MoD and postpartum depression. | Longitudinal cohort | Sweden | 3888 | 118th gestational week, the 32nd week of pregnancy, at 6 weeks, 6 months postpartum | 2009-2014 | EPDS | Postpartum depression | A higher prevalence of depressive symptoms at 6 weeks postpartum was noted among women who delivered by EmCS, whereas no significant association with MoD was found regarding PND at six months postpartum. | ***** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Enabudoso, 2011 | To assess the prevalence of satisfaction, and associated factors, among women who had recently delivered by CS. | Cross-sectional | Nigeria | 211 | 2–5 days postpartum | 2010 | Study specific | Satisfaction | Satisfaction with CS was significantly higher among women who had ElCS as compared with EmCS. | *** |
| Fenaroli, 2016 | To explore the influence of cognitive and emotional variables on labour and delivery outcomes and examine how individual characteristics, couple adjustment, and medical factors influence the childbirth experience. | Longitudinal cohort | Italy | 121 | Between 32 and 37 weeks of pregnancy and 30-40 days postpartum | 2010-2012 | Wijma Delivery Expectancy Questionnaire, EPDS, Dyadic Adjustment Scale | Childbirth expectations, depression | There was no relationship found between MoD and perceived emotional experience. | **** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Fenwick, 2009 | To explore women's experiences of CS. | Qualitative | England | 21 | Between 7 and 32 weeks postpartum | 1999-2000 | | Experiences | Feelings of failure were present whether or not the CS was planned or an emergency, and these feelings had an impact on their status passage to motherhood for several reasons. The surgery resulted in the loss of women's familiar, normal, healthy body. From their perspective, their body had let them down, denying them a normal birth. | ***** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Forti-Buratti, 2017 | To compare the mother-to-infant bond of mothers who gave birth by elective C-section versus EmCS. | Prospective cohort | Spain | 116 | 48-72 hrs and 10-12 weeks after delivery | Not specified | Mother-to-Infant Bonding Scale, responses to separation | Mother-infant bonding | No significant differences between the two CS in bonding, newborn response to separation or type of feeding were observed at any time points. | **** |
| Furuta, 2016 | To identify factors associated with birth-related post-traumatic stress symptoms during the early postnatal period. | Prospective cohort | England | 1824 | 6-8 weeks postpartum | 2010 | Impact of Event Scale | PTSD | EmCS was a high risk factor for post-traumatic stress symptoms. | ***** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Gamble, 2005 | To examine the relationship between MoD and symptoms of psychological trauma at 4-6 weeks postpartum | Prospective cohort | Australia | 400 | 72 hrs and 4-6 weeks postpartum | 2001-2002 | Mini-International Neuropsychiatric Interview-Post-Traumatic Stress Disorder (MINI-PTSD) | PTSD | Women who had an EmCS or operative VD were more likely to meet the diagnostic criteria for PTSD than women who had an ElCS section or spontaneous VD. | **** |
| Gaillard, 2014 | To identify socio-demographic, psychosocial and obstetrical risk factors of postpartum depression. | Prospective cohort | France | 312 | 32-41 weeks gestation, and 6-8 weeks postpartum | 2007-2009 | EPDS (French version) | Depression | Women with PND did not differ from the others in MoD (spontaneous vaginal, assisted vaginal, EmCS or ECS). | **** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Gibbins, 2001 | To explore, describe and understand the expectations during pregnancy and subsequent experiences of childbirth in women. | Qualitative | England | 8 | 2 weeks post birth | Not specified | Study specific | Experiences | Women expressed positive feelings about their labours, even though all women felt that labour was different to what they had expected. | ***** |
| Goker, 2012 | To determine the effect of MoD on the risk of postpartum depression. | Cross-sectional | Turkey | 318 | 6 weeks postpartum | Not specified | EPDS | Depression | Delivering by spontaneous VD, ECS, or EmCS had no effect on EPDS scores. | *** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Graham, 1999 | To assess the degree and nature of women's involvement in the decision to deliver by CS section, and women's satisfaction with this involvement. | Qualitative | Scotland | 166 | 3-4 days and 6-12 weeks postpartum | 1995-1996 | Study specific | Satisfaction and decision making | Women undergoing ElCS section generally received adequate information; however, with EmCS, half of the women had not received enough information during pregnancy. A significant proportion of women experienced negative feelings, particularly with EmCS (30%). | **** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Guittier, 2014 | To determine important elements associated with first delivery experience according to the MoD. | Qualitative | Switzerland | 24 | 4-6 weeks postpartum | 2012 | Study specific | Experiences | The MoD directly impacted on key delivery experience determinants as perceived control, emotions, and the first moments with the newborn. | **** |
| Handelzalts, 2017 | To compare the impacts on childbirth experience of `planned' delivery (elective CS and vaginal delivery) versus `unplanned' delivery (vacuum extraction or EmCS). | Cross-sectional | Israel | 469 | Up to 72 hours postpartum | 2014-2015 | Subjective Childbirth Experience Questionnaire and Personal Information Questionnaire | Experience | Unexpected MoD (EmCS) results in a more negative birth experience than a planned MoD. | ***** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Herishanu-Gilutz, 2009 | To examine the significance of the subjective experience of mothers who gave birth by an EmCS. | Qualitative | Finland | 10 | 4-6 months | Not specified | Study specific | Experiences | Themes were identified related to the traumatic experience of the operation, e.g. sense of loss of control regarding the decision to operate, feeling of fear and anger toward the caretaking staff. | ***** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Hobbs, 2016 | To examine MoD and breastfeeding initiation, duration, and difficulties reported by mothers at 4 months postpartum. | Prospective Cohort | Canada | 3021 | 34–36 weeks gestation and 12-14 months postpartum | 2008 | Not specified | Infant feeding | Women who delivered by EmCS had a higher proportion of breastfeeding difficulties (41 %), and used more resources before (67 %) and after (58 %) leaving the hospital, when compared to VD (29 %, 40 %, and 52 %, respectively) or planned CS (33 %, 49 %, and 41 %, respectively). | **** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Iwata, 2015 | To identify factors for predicting post-partum depressive symptoms after childbirth in Japanese women. | Prospective Cohort | Japan | 479 | 1 day before hospital discharge, 1, 2, 4, and 6 months post-partum. | 2012-2013 | EPDS, The Postnatal Accumulated Fatigue Scale, The Postpartum Maternal Confidence Scale, The Childcare Value Scale | Depression | Six variables reliably predicted the risk of postpartum depression including EmCS. | ***** |
| Jansen, 2007 | To investigate fatigue and HRQoL in women after VD, ElCS, and EmCs. | Prospective cohort | Netherlands | 141 | 12-24 hrs after VD and 24-48hr after CS and 1,3, weeks postpartum | 2003-2004 | The Multidimensional Fatigue Inventory, EuroQoL 5D, Short-Form 36 | HRQoL | Patients after VD had higher mean physical HRQoL scores than after CS. The average period to reach full physical recovery was 3 weeks after VD, 6 weeks after elective CS, and 6 weeks after EmCS. | ***** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Karlström, 2017 | To compare self-reported birth outcomes for women undergoing birth through spontaneous onset of labour between those who actually had a vaginal birth and those who eventually had an EmCS. | Prospective Longitudinal | Sweden | 870 | Mid pregnancy (18–19 weeks), late pregnancy ( 32–34 weeks), 2 months and 1 year postpartum/ | Not specified | Study specific | Birth fear and experience | Birth experience were more among women having an EmCS. | **** |
| Karlstrom, 2007 | To investigate women's experience of postoperative pain and pain relief after CS and factors associated with pain assessment and the birth experience. | Cross-sectional | Sweden | 60 | 2-9 days postpartum | 2004 and 2005 | The Visual Analog Scale, and study specific | Experiences | The risk of a negative birth experience was 80% higher for women undergoing an EmCS compared with elective CS. | *** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Loto, 2010 | To examine the association between the MoD, self-esteem, and parenting self-efficacy both at delivery and at 6 weeks postpartum. | Prospective cohort | Nigeria | 115 | Prior to hospital discharge and 6 weeks postpartum | 2007-2008 | Rosenberg self-esteem scale and parent–child relationship questionnaire | Self-esteem | Factors that were significantly associated with low self-esteem include being single and having EmCS. | *** |
| Loto, 2009 | To assess the level of self-esteem of newly delivered mothers who had CS and evaluate the sociodemographic and obstetrics correlates of low self-esteem in them. | Cross-sectional | Nigeria | 109 | | 2007-2008 | Rosenberg self-esteem scale | Self-esteem | EmCS closely correlated with low self-esteem in women who had CS. | **** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Lurie, 2013 | To evaluate sexual behaviour longitudinally in the postpartum period by MoD. | Prospective cohort | Israel | 82 | 6, 12, and 24 weeks postpartum | 2010-2011 | Female Sexual Function Index | Sexual Function | Sexual function did not differ significantly by MoD at 6, 12, or 24 weeks postpartum. | **** |
| Maclean, 2000 | To examine women's distress in response to one of four obstetric procedures: spontaneous VD; induced VD; instrumental VD; or, EmCS. | Cross-sectional | England | 40 | 6 weeks postpartum | 1996-1997 | Impact of Event Scale, Hospital Anxiety and Depression Scale | Experience, wellbeing, distress | Women who gave birth assisted by instrumental delivery reported the childbirth event as distinctly more distressing than the women in the other three obstetric groups (VD; induced VD; EmCS). | **** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Modarres, 2012 | To estimate the prevalence of childbirth-related post-traumatic stress symptoms and its obstetric and perinatal risk factors. | Cross-sectional | Iran | 400 | 6-8 weeks after birth | 2009 | Post-traumatic Symptom Scale-Interview | PTSD | EmCS was a significant contributing factor to PTSD after childbirth. | **** |
| Noyman-Veksler, 2015 | To investigate the protective role of sense of coherence (SOC) and perceived social support in the effect of EmCS/ELCS on postnatal psychological symptoms and impairment in mother–infant bonding. | Prospective Longitudinal | Israel | 142 | 6 and 12 weeks postpartum | Not specified | Post-partum bonding questionnaire, Post-traumatic diagnostic scale, Edinburgh post-natal depression questionnaire, Sense of coherence, Social support questionnaire | Depression, bonding, PTSD, social support | No effect was found of the MoD on bonding with the infant. An EmCS predicted an increase in PTSD symptoms in Time 2, but only among women with low levels of Time-1 social support. | **** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| O'Reilly, 2014 | To establish a greater understanding of the emotional and cognitive mechanisms associated with CS. | Cross-sectional | France | 201 | At least 6-8 weeks postpartum | 2011-2012 | Labour Agentry Scale, Maternal Self Report Inventory, Unconditional Self-Acceptance Questionnaire | Sense of control during the delivery, maternal self-esteem self-acceptance | Sense of control during labour and delivery was significantly higher for women who had a spontaneous VD when compared to those who had undergone an instrumental VD, a planned, or an EmCS. | ***** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Patel, 2005 | To assess the association between elective CS section and PD compared with planned VD and whether EmCS or assisted VD is associated with PD compared with spontaneous vaginal delivery. | Prospective cohort | UK | 10,934 | 8 weeks postpartum | 1991-1992 | EPDS | Depression | No increased risk of PD was found between MoD. | ***** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Porter, 2007 | To explore the factors that women identified as distressing so as to understand their responses to standard questions on satisfaction. | Mixed methods | Scotland | 1661 | Up to 22 years postpartum | 2002 | Study specific | Distress | Many women had never had an operation before and the fact that their CS was classified as an ‘‘emergency’’ frightened them. | **** |
| Redshaw, 2010 | To gain a better understanding of CS by investigating women’s recent experiences and reflections on their care. | Qualitative | England | 2960 | 3 months postpartum | 2006 | Study specific | Experiences with care | Fear and confrontation with the unexpected were themes identified from women who had an EmCS. | ***** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Rowlands, 2012 | To examine the physical and psychological outcomes of women in the first three months after birth, and whether these varied by MoD. | Cross-sectional | England | 5332 | 3 months postpartum | 2010 | Study specific | PTSD and general psychological outcomes | Women having unplanned CS section births were marginally more likely to report PTSD-type symptoms, however, there was no association between PTSD type symptoms and planned CS section births. | **** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Ryding, 1998 | To describe women's thoughts and feelings during the process of a delivery that ended in an EmCS, to ascertain if an EmCS might fulfil the stressor criterion PTSD according to DMS IV. | Qualitative | Sweden | 53 | 2 days after birth | Not specified | Study specific | PTSD and Experiences | 55% of women experienced intense fear for their own life or that of their baby. 8% felt very badly treated by the staff. Almost all women had adequate knowledge of the reasons for the EmCS. | ***** |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Ryding, Wijma 1998 | To compare the psychological reactions of women after EmCS, ElC, instrumental VD, and normal VD. | Prospective cohort | Sweden | 326 | 2 days and 1 month postpartum | 1992-1993 | Wijma Delivery Expectancy Experience Questionnaire the Impact of Event Self-Rating ScaleI, 35-item version of the Symptoms Check List | Experiences and trauma | The EmCS group reported the most negative delivery experience at both times, followed by the lVD group. At a few days postpartum the EmCS group experienced more general mental distress than the VD group, but not when compared with the ElCS or the instrumental VD groups. At 1 month postpartum the EmCS group showed more symptoms of post-traumatic stress than the ECS and instrumental | **** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | VD groups, but not when compared to the VD group. | |
| Ryding, 2000 | To investigate the possibility to categorize women's experiences of EmCS based on the patterns displayed in their narration of the event, and to describe typical features of those categories. | Qualitative | Sweden | 25 | A few days and 1-2 months postpartum. | Not specified | Study specific | Experiences | The narratives of the 25 women were categorized as follows: Pattern 1 - confidence whatever happens (n 5); Pattern 2 - positive expectations turning into disappointment (n 7); Pattern 3 - fears that come true (n 9); and Pattern 4 - confusion and amnesia (n 4). | * |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Safarinejad, 2009 | To quantify the relationship between MoD and subsequent incidence of sexual dysfunction and impairment of quality of life (QOL) both in women and their husbands. | Prospective cohort | Iran | 912 | Every month post delivery up to 12 months. | 2006-2007 | Female Sexual Function Index (FSFI), and International Index of Erectile Function (IIEF), | Sexual Function, QoL | Women with VD and EmCS had statistically significant lower Female Sexual Function Index (FSFI) scores as compared with planned CS Section women | ***** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Saisto, 2001 | To examine the extent to which personality characteristics, depression, fear and anxiety about pregnancy and delivery, and socio-economic background, predict disappointment with delivery and the risk of puerperal depression. | Prospective Longitudinal | Finland | 211 | Once after the 30th week of pregnancy, and 2–3 months after delivery | Not specified | Beck's Depression Inventory, the NEO-PI Scale for neuroticism, a partnership satisfaction scale, a Pregnancy Anxiety Scale, a revised version of a fear-of-childbirth questionnaire | Disappointment with delivery and satisfaction | Strongest predictors of disappointment with delivery were labour pain and EmCS. | ***** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Sarah, 2017 | To investigate the relationship between type of delivery and postpartum depression. | Cross-sectional | Iran | Unspecifed | Not specified | 2013 | Beck depression inventory | Depression | The prevalence of postpartum depression is 33.4%, respectively, of which 13.8% related to EmCS, 7.2% of vaginal deliveries, and 8% of elective CS. | ** |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Shorten, 2014 | To explore women's values and expectations during their process of decision making about the next birth. | Qualitative | Australia | 187 | 36-38 weeks pregnant and 6-8 weeks postpartum | Not specified | Study specific | Decisions after prior CS | Women described long labours ending in CS did not want to go through it again, and especially did not want to repeat the "emergency" scenario. Many described a sense of loss after the previous CS experience and expressed a personal need to remedy this feeling through a better experience in the next birth. "After an emergency CS I felt I had failed, I felt cheated of the childbirth | ***** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | experience I had wanted". | |
| Soderquist, 2002 | To study whether or not a more stressful delivery was positively related to traumatic stress after childbirth. | Cross-sectional | Sweden | 1550 | Not specified | 1994-1995 | Traumatic event scale | Traumatic stress | Traumatic stress symptoms and having a PTSD symptom profile were both significantly related to the experience of an EmCS or an instrumental VD. | **** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Somera, 2010 | To explore women's experience of an EmCS birth to gain a better understanding of their thoughts, and feelings throughout the birth process. | Qualitative | Canadian | 9 | 1-5 days after birth and 11-27 days after birth | Not specified | Open-ended questions | Experience | Seven themes were identified describing the women's experience: (1) It was for the best, (2) I did not have control, (3) Everything was going to be okay, (4) I was so disappointed, (5) I was so scared, (6) I could not believe it and (7) I was excited. | ***** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Spaich, 2013 | To investigate the extent to which satisfaction with childbirth depends on the MoD, and evaluated factors determining postpartum satisfaction. | Prospective cohort | Germany | 335 | Not specified | 2010-2011 | Salmon's Item List | Experience | There were no women in the subgroup with EmCS who score indicating an overall negative birth experience. The subjective experience of birth was described as 'good/very good' in 89% of the women who underwent EmCS. | **** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Storksen, 2013 | To assess the relation between fear of childbirth and previous birth experiences. | Prospective cohort | Norway | 1657 | Weeks 17 and 32 pregnant | 2009–2011 | Wijma Delivery Expectancy Questionnaire | Fear | EmCS and vacuum extraction were associated with fear of childbirth in subsequent pregnancies. | ***** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Tham, 2007 | To examine the associations between new mother's sense of coherence (SOC) and obstetric and demographic variables a few days postpartum, and post-traumatic stress symptoms 3 months' postpartum in relation to women who had undergone an emergency CS section. | Prospective cohort | Sweden | 122 | 2 days and 3 month postpartum | Not specified | Sense of Coherence Scale (SOC-13), Impact of Event Scale (IES-15). | PTSD | 25% of the women reported symptoms of post-traumatic stress to a moderate degree (indicating a need for follow-up), and 9% had a high degree of symptoms (indicating possible PTSD). | **** |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Tham, 2010 | To describe women with and without symptoms of post-traumatic stress following EmCS, and how they perceived the support received in connection with the birth of their child. | Qualitative | Sweden | 84 | 6-7 months postpartum | Not specified | Questions seeking the women's experienced social and emotional support from the staff and from their families | Experience and support | The midwives' action, the content and organisation of care, the women's emotions, and the role of the family were main categories that seemed to influence the interviewees' perceptions of support in connection with childbirth. Women with PTSS further mentioned nervous or non-interested midwives, intense fear and feelings of shame during delivery, lack of postnatal follow-up, long-term | **** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | postpartum fatigue and inadequate help from husbands as influencing factors. Women without symptoms reported involvement in the EmCS decision and a feeling of relief. | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Trivino-Juarez, 2017 | To conduct a longitudinal study to analyse differences in HRQoL at the sixth week and sixth month postpartum, with mode of birth as the main independent variable. | Prospective Longitudinal | Spain | 547 | 6 weeks and 6 months postpartum | 2013-2014 | EPDS, SF-36 | HRQoL | Women who had vaginal, forceps or vacuum-extraction births at the sixth week postpartum reported better physical functioning than women who had elective or EmCS. At the sixth month postpartum, a significantly higher proportion of women in the forceps group (34%) than in the EmCS group (15%) reported being less satisfied with their sexual relations than | **** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | before pregnancy. | |
| Tully, 2013 | To examine women's experiences of and explanations for undergoing cesarean delivery. | Qualitative | England | 115 | Not specified | 2006-2009 | Study specific | Experiences | All mothers described labour prior to their unscheduled caesareans as wasted effort. | ***** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Ukpong, 2006 | To investigate postpartum emotional distress including depression women who had a CS by comparing them at 6-8 weeks following childbirth with 47 matched controls who had normal vaginal delivery. | Cross-sectional | Nigeria | 94 | 6-8 weeks postpartum | Not specified | General Health Questionnaire (GHQ-30), Beck Depression inventory | Depression, general health | There was no relationship between the depression scores and being scheduled for either ElCS or EmCS. | **** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Vossbeck-Elsebusch, 2014 | To replicate earlier findings regarding the prediction of PTSD levels following childbirth by known prenatal, perinatal and postnatal predictors. | Prospective cohort | Germany | 224 | 1-6 months | Not specified | Posttraumatic Diagnostic Scale (PDS), University of California, Los Angeles Social Support Inventory (UCLA-SSI-d), Peritraumatic Dissociative Experience Questionnaire (PDEQ), Posttraumatic Cognitions Inventory (PTCI), Responses to Intrusions Questionnaire (RIQ), German version of the Perseverative Thinking Questionnaire (PTQ) | PTSD | The mean PDS (Posttraumatic Diagnostic Scale) score for women who had an EmCS were significantly higher than the PDS score for women who had a normal VD. | ***** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Wijma, 2002 | To examine whether the women's psychological condition during pregnancy correlates with their psychological well-being after EmCS. | Prospective cohort | Sweden | 1981 | Gestation week 32, a few days, and one month | Not specified | Wijma Delivery Expectancy/ Experience Questionnaire, Spielberger Trait Anxiety Inventory, Stress Coping Inventory, Impact of Event Scale, Symptom Checklist | Fear | Surgical complications including EmCs correlated with postpartum fear of childbirth negatively a few days after the operation, but positively one month later. | **** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Wiklund, 2009 | To examine changes in personality from late pregnancy to early motherhood in primiparas having vaginal or CS. | Prospective cohort | Sweden | 314 | 37–39 gestational weeks in pregnancy and 9 months after delivery. | 2003-2006 | Karolinska Personality Scales | Personality | Women who had an EmCS scored higher on the subscale measuring Psychasthenia (low degree of mental energy and stress susceptible) 9 months after birth compared to those who had a spontaneous VD. | **** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Wiklund, 2008 | To examine the expectations and experiences in women undergoing a CS on maternal request and compare these with women undergoing CS with breech presentation as the indication and women who intended to have VD acting as a control group and to study whether assisted delivery and EmCS in the control group affected the birth experience. | Prospective cohort | Sweden | 496 | Prior to delivery and 3 months postpartum | 2003-2005 | Wijma Delivery Expectancy/Experience Questionnaire | Experiences | Women planning a VD but experiencing an EmCS or an assisted VD had more negative birth experiences than the other groups. | **** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Xie, 2011 | To examine whether or not CS delivery is associated with increased risk of postpartum depression. | Cross-sectional | China | 534 | 2 weeks postpartum | 2007 | Chinese version of the EPDS (EPDS), Social Support Rating Scale, | Depression | PND rate was higher in the group who had elective CS delivery than in the group who had EmCS. | **** |
| Yang, 2011 | To examine whether MoD are associated with postnatal depression. | Prospective cohort | Taiwan | 10535 | Not specified | 2003-2006 | Data collected from the National Health Insurance Research Database | Depression | Risk of acquiring PND was lower in mothers with a normal VD or an instrumental VD compared to mothers with an EmCS. The women who elected to have a CS section was higher risk than an EmCS. | **** |

| Author/ Year | Aim | Study design | Study location | Participants | Time frame | Study period | Measure | Psychosocial outcomes | Relevant key findings | MMAT QAR[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Zanardo, 2016 | To assess feelings towards newborn infants in mother swho delivered by elective (ElCD) or emergency EmCS. | Cross-sectional | Italy | 573 | Not specified | 2014-2015 | Mother-to-Infant Bonding Scale (MIBS) | Mother-infant bonding | EmCS negatively affected mother bonding and opening emotions, and originated in mother feeling sadness and disappointment for the unplanned delivery. | ** |

### 3.6.3 Quality assessment

Mixed Methods Appraisal Tool quality assessment ratings (MMAT QARs) are included in Table 1. Among the 51 quantitative non-randomised studies, 14 met all five criteria, 31 met four criteria, 4 met three criteria and 2 met two criteria. Of the 14 qualitative studies, 12 met all five criteria. The one study with mixed methods met four of the five criteria. The main reason several quantitative studies did not meet all criteria was a lack of reporting for the complete set of outcomes (without adequate justification), response rate or follow-up rate.

### 3.6.4 Data extraction and synthesis

Key psychosocial outcomes were examined in the final 66 studies. Data synthesis was employed to extract and synthesise data pertaining to key psychosocial outcomes from each study into coherent themes. Psychosocial outcomes potentially associated with EmCS included postpartum depression, post-traumatic stress, health related quality of life, mother infant bonding, infant feeding, sexual function, experiences, satisfaction, self-esteem, distress, and fear. Due to an excess of methodological heterogeneity between studies (even for subsets of studies with some common features), a meta-analysis was deemed inappropriate. Table 2 summarizes evidence of associations for identified psychosocial outcomes and EmCS.

Table 2

*Associations of Identified Psychosocial Outcomes and EmCS*

| Key psychosocial outcomes | Number of studies | Association between EmCS and psychosocial outcomes | Inconclusive associations between EmCS and psychosocial outcomes | Qualitative summary |
|---|---|---|---|---|
| Postpartum depression (PND) | 12 | | + | Studies reported inconsistent findings. The majority of studies reported no significant association (*n*= 7) between EmCS and PND whereas the remaining studies reported a relationship between EmCS and increased symptoms of PND (*n*=5). |
| Post-traumatic stress disorder (PTSD) | 11 | + | | All studies (*n*=11) reported consistent findings that EmCS was a contributing factor to increasing post-traumatic stress symptoms and PTSD after childbirth. |

| Key psychosocial outcomes | Number of studies | Association between EmCS and psychosocial outcomes | Inconclusive associations between EmCS and psychosocial outcomes | Qualitative summary |
|---|---|---|---|---|
| Health related quality of life | 2 | - | | Consistent findings were found across studies (*n*=2) that women who had an EmCS had poorer physical functioning compared to other MoDs. |
| Mother infant bonding | 3 | | - | Studies reported inconsistent findings. In *n=1* study EmCS appeared to have a negative association with mothers bonding and opening emotions with their baby. In contrast, no significant affect was found in terms of MoD on mother-infant bonding in the remaining studies (*n*=2). |

| Key psychosocial outcomes | Number of studies | Association between EmCS and psychosocial outcomes | Inconclusive associations between EmCS and psychosocial outcomes | Qualitative summary |
|---|---|---|---|---|
| Infant feeding | 3 | - | | Consistent findings were found across studies in that EmCS impacted negatively in varying ways on infant feeding (*n*=3). Women who have an EmCS were more likely to have had an unsuccessful first breastfeeding attempt, were less likely to breastfed their baby within the first 24 hours and upon leaving the hospital, and to breastfeed for a shorter duration of time compared to other MoDs. |
| Sexual function | 3 | | +/- | Studies were inconsistent in their findings (*n*=3) in terms of satisfaction with sexual relations after birth and sexual function postpartum. |

| Key psychosocial outcomes | Number of studies | Association between EmCS and psychosocial outcomes | Inconclusive associations between EmCS and psychosocial outcomes | Qualitative summary |
|---|---|---|---|---|
| Experiences | 21 | +/- | | In terms of quantitative research (*n*=9), the majority of studies found that EmCS was more likely to result in a negative birth experience (*n*=6), *n*=1 study reported MoD had no influence on mother experiences and *n*=2 studies reported that EmCS was related to positive experiences in comparison to other MoDs. In terms of the qualitative studies (*n*=12) women described a wide variety of emotions as salient aspects to their EmCS experience however, a number of dominating negative experiences were consistent across all studies |
| Satisfaction | 4 | - | | Consistent findings were reported across all studies (*n*=4) with women who had an EmCS more likely to appraise their deliveries less favourably than those who delivered via other MoDs. |

| Key psychosocial outcomes | Number of studies | Association between EmCS and psychosocial outcomes | Inconclusive associations between EmCS and psychosocial outcomes | Qualitative summary |
|---|---|---|---|---|
| Self-esteem | 3 | - | | Consistent findings were reported across all studies (*n*=3). Women who had an EmCS were more likely to report feelings of emotional vulnerability after delivery including feelings of failure, regret, and lower self-esteem. |
| Distress | 3 | | - | Findings were inconsistent in terms of distress after EmCS. No significant association between MoD and distress were reported in a study (*n*=1), another study reported other MoD causing more distress than EmCS (*n*=1), the final study reported a relationship between EmCS and distress. |

| Key psychosocial outcomes | Number of studies | Association between EmCS and psychosocial outcomes | Inconclusive associations between EmCS and psychosocial outcomes | Qualitative summary |
|---|---|---|---|---|
| Fear | 2 | | - | Inconsistent findings were reported. With *n*=1 study reporting EmCS was associated with increased fear of childbirth in subsequent pregnancies and *n*=1 study reporting a correlation with fear of childbirth a few days after the operation, however this decreased one month later. |

| Key psychosocial outcomes | Number of studies | Association between EmCS and psychosocial outcomes | Inconclusive associations between EmCS and psychosocial outcomes | Qualitative summary |
|---|---|---|---|---|
| Other | | | | |
| Childbirth Burden | 1 | + | | Women who experienced emergency surgical intervention (i.e EmCS) were more likely to demonstrate higher childbirth burden scores than any other MoD (*n*=1). |
| Feelings of control | 1 | - | | Women who had a spontaneous VD reflected having a significantly higher sense of control during their labour and childbirth relative to with an instrumental VD, a planned CS, or an EmCS (*n*=1). |

+ indicates that some (or all) evidence supports a positive association

- indicates that some (or all) evidence supports a negative association

### 3.6.5 Key outcomes

#### *3.6.5.1 Postpartum depression*

Twelve studies examined depression as an outcome of EmCS (Chen & Wang, 2002; Eckerdal et al., 2018; Fenaroli et al., 2016; Gaillard et al., 2014; Goker et al., 2012; Iwata, 2015; Noyman-Veksler et al., 2015; Patel et al., 2005; Sarah et al., 2017; Ukpong & Owolabi, 2006; Xie et al., 2011; Yang et al., 2011). These studies used varying measures, with the majority (*n*=8) utilising the Edinburgh Postnatal Depression Scale (EPDS), three using Beck's Depression Inventory (BDI) and one study not specifying the measure used. Studies identified reported mixed findings in terms of postpartum depression (PND) and the experience of EmCS. The majority of studies found no significant association between having an EmCS and PND relative to other MoDs (Chen & Wang, 2002; Fenaroli et al., 2016; Gaillard et al., 2014; Goker et al., 2012; Patel et al., 2005; Ukpong & Owolabi, 2006; Xie et al., 2011). For example, a prospective cohort study (*n*= 10, 934) from the UK found no significant evidence of increased risk of PND between different MoDs including EmCS (Patel et al., 2005). In contrast, a much smaller prospective cohort study reported EmCS was a predictor of PND (Iwata, 2015). Additionally, a recent cross-sectional study conducted in Iran (Sarah et al., 2017) reported that the prevalence of PND was 33.4%, of which the highest proportion consisted of women who had experienced EmCS at 41.3%. Furthermore, a recent large longitudinal study found that compared with spontaneous VD, women who delivered by EmCS had significantly higher odds of PND 6 weeks after delivery (OR = 1.45) (Eckerdal et al., 2018). Additionally, a cohort study (*n*=10, 535) reported that the odds of PND was significantly lower for women who had a normal VD (OR = 0.67) or an instrumental VD (OR = 0.56) compared to women who had EmCS (Yang et al., 2011). However, women who had an elective CS had higher

odds of PND than women who had EmCS (OR=1.48, p=0.0168) (Yang et al., 2011). Heterogeneity in the tools, their use and findings can be seen in Table 3 and makes the comparison of these figures problematic.

Table 3

*Heterogeneity Across Studies Examining Depression*

| Study | Cut score | Time post-partum | Sample size | Participants with depression | EmCS subgroup | EmCS subgroup with depression | Evidence of association between EmCS and PND |
|---|---|---|---|---|---|---|---|
| **Edinburgh Postnatal Depression Scale** | | | | | | | |
| Eckerdal, 2017 | EDPS>12 | 6 weeks | 3888 | 505 (13%) | 346 | 50 (16.7%) | No |
| Gaillard, 2014 | EDPS>12 | 6-8 weeks | 264 | 44 (16.7%) | 44 | 6 (13.6%) | No |
| Goker, 2012 | EDPS>13 | 6 weeks | 318 | 100 (31.4%) | 106 | 37 (34.9%) | No |
| Iwata, 2015 | EDPS>9 | 6-months | 479 | 21.50% | 60 | 24 (40%) | Yes |
| Patel, 2005 | EDPS>13 | 8 weeks | 10934 | N/A | 572 | 56 (9.8%) | No |

| Study | Cut score | Time post-partum | Sample size | Participants with depression | EmCS subgroup | EmCS subgroup with depression | Evidence of association between EmCS and PND |
|---|---|---|---|---|---|---|---|
| Xie, 2011 | EDPS>13 | 2 weeks | 534 | 103 (19.3%) | 149 | 24 (16.1%) | Yes: PND higher in ElCS than EmCS |
| **Beck Depression Inventory** | | | | | | | |
| Chen, 2002 | BDI 9-10 | 6 weeks | 357 | N/A | N/A | N/A | No |
| Sarah, 2017 | N/A | N/A | N/A | 33.4%, | N/A | 13.8% of 33.4% | No mention |

| Study | Cut score | Time post-partum | Sample size | Participants with depression | EmCS subgroup | EmCS subgroup with depression | Evidence of association between EmCS and PND |
|---|---|---|---|---|---|---|---|
| Ukpong, 2006 | BDI >9 significant, 10-18 mild/moderate, 19-29 moderate/severe, 30-63 extreme | 6-8 weeks | 47 | 29.80% | 40 | N/A | No |

*3.6.5.2 Traumatic stress*

Eleven included studies examined trauma as an outcome of an EmCS (Adewuya et al., 2006; Creedy et al., 2000; Furuta et al., 2016; Gamble & Creedy, 2005; Modarres et al., 2012; Noyman-Veksler et al., 2015; Rowlands & Redshaw, 2012; Ryding et al., 1998a; Soderquist et al., 2002; Tham et al., 2007; Vossbeck-Elsebusch et al., 2014). These studies were conducted across a diverse range of countries including Australia, Nigeria, UK, Iran, Israel, Sweden and Germany. Study designs included, six cross-sectional, four prospective and one qualitative. All studies consistently reported that EmCS was a contributing factor for post-traumatic stress symptoms and Post Traumatic Stress Disorder (PTSD) after childbirth. Several of the studies stated that any unplanned interventions during childbirth including EmCS were predictors of PTSD (Adewuya et al., 2006; Gamble & Creedy, 2005). For example, a prospective cohort study ($n$=1,824) identified EmCS as a risk factor for post-traumatic stress symptoms (Furuta et al., 2016). Findings from a smaller cross-sectional study in Australia reported a greater than expected frequency of PTSD in women who had EmCS, specifically, 73% reporting trauma symptoms four to six weeks postpartum (Gamble & Creedy, 2005). Further, a qualitative research study conducted in Sweden concluded that experiences of women who delivered via EmCS were traumatic enough to fulfil the stressor criterion of PTSD in the DSM IV (Ryding et al., 1998a). This study stated that 55% of women interviewed a few days after an EmCS reported feelings of intense fear of death or injury to themselves or to their baby during the delivery process (Ryding et al., 1998a).

*3.6.5.3 Health related quality of life*

Two studies specifically examined Health Related Quality of Life (HRQoL) (Jansen, Duvekot, et al., 2007; Trivino-Juarez et al., 2017). One study utilised the Short-Form 36 (SF-36) to measure HRQoL (Trivino-Juarez et al., 2017) and the other utilised

the SF-36 and the EuroQoL 5D (Jansen, Duvekot, et al., 2007; Trivino-Juarez et al., 2017). Both studies reported consistent findings that women with an EmCS had poorer physical functioning, relative to other MoDs. A prospective study in the Netherlands reported that the average period to reach full physical recovery was three weeks after VD, six weeks after elective CS and EmCS (Jansen, Duvekot, et al., 2007). Similarly, a larger more recent study reported that women who had a vaginal, forceps or vacuum-extraction delivery, had better physical functioning at six weeks postpartum relative to those with elective CS or EmCS (Trivino-Juarez et al., 2017). In a cohort study in Sweden, women who had EmCS scored higher on the subscale measuring Psychasthenia (low degree of mental energy and stress susceptible) nine months after birth relative to those with spontaneous VD (Wiklund et al., 2009).

*3.6.5.4 Mother-infant bonding*

Three studies examined the relationship between EmCS and mother-infant bonding (Forti-Buratti et al., 2017; Zanardo et al., 2016) with conflicting results. Two studies utilised the Mother-to-Infant Bonding Scale (Durik et al., 2000; Forti-Buratti et al., 2017; Zanardo et al., 2016) and the third utilised the Parent-Child Early Relational Assessment Tool (Durik et al., 2000). A recent, large scale cross-sectional study found EmCS appeared to have a negative association with mothers bonding and opening emotions with their baby. In contrast, a similar sized study reported no significant differences in mother-infant interactions at four or twelve months postpartum between MoD (Durik et al., 2000). Similarly, a smaller scale cohort study found that type of CS did not appear to significantly affect mother-infant bonding in the first seventy-two hours following delivery or at twelve weeks postpartum (Forti-Buratti et al., 2017).

*3.6.5.5 Infant feeding*

Three studies examined the relationship between infant feeding and EmCS (Ahluwalia et al., 2012; Beck & Watson, 2008; Hobbs et al., 2016). Study designs were prospective cohort, cross-sectional, and qualitative. The large scale prospective cohort study reported that women with EmCS were more likely to have an unsuccessful first breastfeeding attempt and were less likely to breastfed their baby within the first 24 hours and upon leaving the hospital (Hobbs et al., 2016). Furthermore, the study reported that women with EmCS had more breastfeeding difficulties (41%), and used more hospital resources before and after leaving the hospital (67%, 58%), in comparison to those with a VD (29%, 40%, and 52%, respectively) or a planned CS (33%, 49%, and 41%, respectively). Additionally, a similar sized cross-sectional study reported that breastfeeding duration varied substantially with MoD (Ahluwalia et al., 2012). In the same study, median breastfeeding duration was 45.2 weeks among women who had a spontaneous VD, 38.7 weeks among planned CS, 25.8 weeks among induced VD and 21.5 weeks among women with EmCS (Ahluwalia et al., 2012). In the qualitative study women frequently stated that their decision to breastfeed was driven by their desire to make up for the traumatic way their baby was delivered, including, by EmCS (Beck & Watson, 2008). In this study a women with EmCS stated, ‘‘breastfeeding became almost an act of vindication. I had to make up for failing to provide my daughter with a normal birth, so I sure wasn’t going to fail again” (Beck & Watson, 2008, p. 233).

*3.6.5.6 Sexual function*

Three studies, conducted in Israel, Iran and Spain, examined the relationship between EmCS and sexual function postpartum (Lurie et al., 2013; Safarinejad et al., 2009; Trivino-Juarez et al., 2017), with inconsistent findings. A prospective cohort

study reported a significantly higher proportion of women at six months postpartum being less satisfied with their sexual relations after birth in the forceps group (34%) relative to the EmCS group (15%) (Trivino-Juarez et al., 2017). In contrast, a larger prospective cohort study reported that women who had a VD or EmCS had statistically significantly lower Female Sexual Function Index (FSFI) scores on average relative to those with a planned CS (Safarinejad et al., 2009). These findings were contrary to that of a small scale cohort study that found no significant difference between average sexual function scores and various MoD postpartum (Lurie et al., 2013), potentially due to a lack of power.

*3.6.5.7 Experiences*

A large number (*n*=21) of identified studies examined women's experiences with EmCS. A variety of measures were used across studies including: Impact of Event Scale, Wijma Delivery Expectancy/Experience Questionnaire, and Questionnaire for Assessing Childbirth Experience (QACE). Studies examined varying aspects of women's experiences of EmCS including women's overall birth experiences, emotional experiences and experiences with care and staff.

The majority of quantitative research studies found that EmCS was more likely to result in a negative birth experience. For example, a recent large prospective cohort study in Sweden reported that birth experience was more likely to be negative among women with EmCS relative to VD (Karlström, 2017). Similar findings were reported in another recent but smaller cross-sectional study, where unexpected MoD including EmCS resulted in a higher likelihood of negative birth experiences (Handelzalts et al., 2017) with this finding supported in numerous other studies (Carquillat et al., 2016; Karlstrom et al., 2007; Wiklund et al., 2008). Contrary to this finding, two prospective cohort studies reported that MoD had no direct influence on women's experience of

childbirth (Fenaroli et al., 2016; Spaich et al., 2013). Interestingly, in one of these studies no women in the EmCS subgroup attained a score which indicated a negative birth experience; rather 89% of these women described the birth experience as 'good/very good' (Spaich et al., 2013). Furthermore, the majority of women in this study with EmCS also evaluated their feelings of control during labour and the opportunities they had to make informed choices/decisions as 'good/very good' (Spaich et al., 2013). Interestingly, a large prospective study found that women who had a planned CS scored significantly lower in terms of negative birth perception than those who had an EmCS or a VD (Bryanton et al., 2008).

Twelve studies utilised a qualitative design to examine women's experiences of an EmCS (Burcher et al., 2016; Fenwick et al., 2009; Gibbins & Thomson, 2001; Guittier et al., 2014; Herishanu-Gilutz et al., 2009; Redshaw & Hockley, 2010; Ryding et al., 1998a; Ryding, 2000; Shorten et al., 2014; Somera et al., 2010; Tham et al., 2010; Tully & Ball, 2013). In all of these studies, women described a wide variety of emotions as salient to their EmCS experience however, a number of dominating negative experiences were consistent across all studies including: loss of perceived control and feelings of helplessness (Burcher et al., 2016; Fenwick et al., 2009; Guittier et al., 2014; Herishanu-Gilutz et al., 2009; Somera et al., 2010); fear (own or/and for baby) (Burcher et al., 2016; Redshaw & Hockley, 2010; Ryding et al., 1998a; Ryding, 2000; Somera et al., 2010; Tham et al., 2010); and disappointment (Ryding et al., 1998a; Somera et al., 2010; Tham et al., 2010). In a study conducted by Shorten et al. (2014, p. 131) one participant reported "after an emergency caesarean I felt I had failed, I felt cheated of the childbirth experience I had wanted".

*3.6.5.7.1 Experiences with maternity care and staff*

A large prospective cohort study reported that women who had an unplanned CS were more likely to indicate that they had received "less than good" midwifery care during childbirth (Baas et al., 2017). It was suggested that as women who have an EmCS often have their care transferred to other care providers during childbirth, it is possible that the discontinuity of care between the providers may influence women's experiences with staff (Baas et al., 2017).

*3.6.5.8 Satisfaction*

Four studies examined women's satisfaction after EmCS (Baston et al., 2008; Enabudoso & Isara, 2011; Graham et al., 1999; Saisto et al., 2001) with all reporting that women with EmCS were more likely to appraise their deliveries less favourably than those with other MoDs. In a large prospective cohort study conducted in both the Netherlands and England, EmCS appeared to be a contributing factor to a negative appraisal of birth (Baston et al., 2008).

*3.6.5.9 Self esteem*

Three studies examined women's self-esteem and EmCS (Carquillat et al., 2016; Loto et al., 2010; Loto et al., 2009) with all studies reporting consistent findings. A cross sectional study reported that MoD influenced women's mood at one-month postpartum, with an item reading 'I am proud of myself', representing self-esteem, being more likely to have negative results for women with EmCS (Carquillat et al., 2016). In two smaller Nigerian studies, women were more likely to report feelings of emotional vulnerability after delivery including feelings of failure, regret, and lower self-esteem (Loto et al., 2010; Loto et al., 2009).

*3.6.5.10 Distress*

Three studies in Norway, Scotland and England examined distress in relation to EmCS (Adams et al., 2012; Maclean et al., 2000; Porter et al., 2007). In a very large prospective cohort study (*n*=55,814) conducted over a 10 year period, no significant association between MoD and emotional distress postpartum was reported (Adams et al., 2012). Further, a small cross-sectional study reported that women who gave birth assisted by instrumental delivery were more likely to report that their birth was distinctly more distressing than women in three other obstetric groups (VD, induced VD, EmCS) (Maclean et al., 2000). A mixed methods study reported that the fact that a CS was classified as an ‘‘emergency’’ frightened women, resulting in feelings of distress (Porter et al., 2007).

*3.6.5.11 Fear*

Two studies examined fear as an outcome of EmCS (Storksen et al., 2013; Wijma et al., 2002). A large prospective cohort study reported that EmCS was associated with increased fear of childbirth in subsequent pregnancies (Storksen et al., 2013). A similarly designed and sized study found that EmCS correlated with increased postpartum fear of childbirth a few days after the operation, however this decreased one month later (Wijma et al., 2002).

*3.6.5.12 Other outcomes*

Childbirth burden and feelings of control were examined in two studies. A large cross-sectional study reported that women who experienced emergency surgical intervention (EmCS and vacuum extraction) were more likely to demonstrate higher childbirth burden scores than those with any other MoD (Bergant et al., 1998). A small cross-sectional study reported that women who had a spontaneous VD had a

significantly higher sense of control during their labour and childbirth relative to those with an instrumental VD, a planned CS, or an EmCS (O'Reilly et al., 2014).

## 3.7 Discussion

### 3.7.1 Summary of findings

A number of psychosocial outcomes were consistently and negatively reported to be associated by EmCS including post-traumatic stress, HRQoL, infant feeding, experiences, satisfaction and self-esteem. All studies examining post-traumatic stress consistently found that EmCS was a contributing factor for symptoms and PTSD after childbirth. Two studies exploring HRQoL reported consistent findings that women with EmCS had poorer physical functioning relative to other MoDs. Three studies examining infant-feeding reported that women with EmCS were more likely to have an unsuccessful first breastfeeding attempt, less likely to breastfed within the first 24 hours and upon leaving the hospital, and to breastfeed for a shorter duration of time in comparison to other MoDs. These results are consistent with those reported by Ahluwalia et al. (2012) who noted that women with EmCS often experience; a difficult labour, stress, and delays in mother-infant interactions, each of which may reduce the likelihood or duration of breastfeeding.

Consistent findings were reported for satisfaction in that women with EmCS were more likely to appraise their deliveries less favourably than those with other MoDs. Studies examining self-esteem found women who had an EmCS were more likely to report feelings of emotional vulnerability after delivery including feelings of failure, regret, and lower self-esteem. Twenty-one articles examined varying aspects of women’s experiences of EmCS, which constituted the most commonly examined psychosocial outcome among included studies. In both quantitative and qualitative studies it was reported that women with EmCS were often at the highest risk of

assessing their childbirth experience in a negative way and described a wide variety of negative emotions including: loss of perceived control and feelings of helplessness, fear (own or/and for baby), and disappointment.

Psychosocial outcomes including depression, mother-infant bonding, sexual function, fear, and distress were also identified and examined within in the literature. However, studies either reported mixed findings or no sufficient evidence of an association between these outcomes and EmCS.

### 3.7.2 Limitations

We recognise that potentially relevant articles could have been missed, written in languages other than English, or indexed in other databases other than those chosen and therefore may not have been identified. Studies identified in the review were conducted in 22 diverse countries and as such it must be acknowledged that cross-cultural differences are common and can greatly influence women's psychosocial outcomes of childbirth (Halbreich & Karkun, 2006). Postnatal access to healthcare; procedural differences; quality of available care; levels of social support; religious beliefs; poverty; societal attitudes regarding pregnancy, birth and motherhood; gender roles and attitudes regarding mental health problems are just a few of the known socio-cultural and environmental factors that may influence findings in the identified studies (Dankner et al., 2000).

Of the included articles the strengths and meaningfulness of the findings differ substantially due to variations in study design, sampling procedures, and sample size. It has been previously identified that research examining the psychosocial outcomes of CS have generally suffered from numerous methodological limitations including; reliance on small sample sizes, use of measures of unknown reliability and validity and the lack of a comparison group or varying comparison groups (DiMatteo et al., 1996). Several of

these limitations were present in the included studies. For example, as noted previously, one of the primary reasons for excluding articles was the failure to specify or differentiate between type of CS for women in a study. Furthermore, there was often no discussion within included studies about reasons and causes for EmCS and it is possible that some causes are more strongly associated with the psychosocial outcomes examined. Studies identified in the review reported on wide varying time frames for postpartum data collection, with collection ranging from hours after birth to years after birth as well utilising different cut-points on the same measures for diagnosis. The timing of data collection is an important methodological consideration as there is considerable evidence that the impact of a women's birth experience changes over time (Larkin et al., 2009). As time passes, the positive affect from one's baby and satisfaction with being a mother has been shown in some cases to favourably influence a women's feeling about her labour experience (Larkin et al., 2009).

As a result of the heterogeneous nature of these factors (exemplified in Table 3 for depression), meaningful pooled quantitative measures of study findings were unable to take place, even for subsets of studies. Overall, there appears a paucity of published evidence with consistent measures and adherence to guidelines for reporting (e.g. for cut-scores) which is crucial to rectify in future studies so that (gold standard) systematic literature reviews can meaningfully pool data in a quantitative manner.

### 3.7.3 Strengths and implications

To our knowledge, this study is the first to systematically review the available literature on women's psychosocial outcomes of EmCS. The review presents the findings of quantitative, qualitative, and mixed methods studies from a vast array of countries and as a result identifies and examines a wide variety of psychosocial outcomes.

The review has highlighted the need for the further development of technologies and clinical practices to reduce the number of unnecessary EmCSs. Critically, it underscores the requirement for evidence-based strategies to provide psychosocial support and information about EmCS in the context of routine antenatal and postnatal care. While high-level research currently exists in this area, for example in the form of routine debriefing to prevent psychological trauma after childbirth (103), it fails to show benefit. More broadly, while programs for postnatal psychosocial support have been promoted in many countries to improve maternal knowledge related to parenting, mental health, quality of life, and physical health, it has been concluded in a systematic review that the most effective strategies remain unclear (Shaw et al., 2006).

## 3.8 Conclusion

The review has highlighted the diverse impact that EmCS can have on women. Numerous psychosocial outcomes that are negatively impacted by this MoD were identified including post-traumatic stress, health-related quality of life, experiences, infant-feeding, satisfaction, and self-esteem. In particular, there was strong consensus that EmCS contributes to symptoms and diagnosis of post-traumatic stress. This review has also highlighted the need for further investigation on this topic using robust methodology including the use of consistent, valid and reliable measures with consistent use of guidelines for appropriate cut scores, consistent comparison groups, adequately powered studies and differentiation between types of CS. Overall, enhanced knowledge and understanding in this area will provide an imperative step towards implementing effective strategies to improve women's health and well-being following EmCS.

# CHAPTER 4. A QUALITATIVE STUDY OF A SAMPLE OF WOMEN PARTICIPATING IN AN AUSTRALIAN RANDOMISED CONTROLLED TRIAL OF INTRAPARTUM FETAL SURVEILLANCE

## 4.1 Statement of Authorship

*Title of paper:* A qualitative study of a sample of women participating in an Australian randomised controlled trial of intrapartum fetal surveillance.

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### 4.1.1 Principal author

*Name of principal author (candidate):* Madeleine Benton

*Contribution to the paper:* Devised study aims with supervisors. Planned and carried out data collection and analysis. Wrote and submitted manuscript. Acted as corresponding author.

*Overall percentage (%):* 85%

*Certification:* This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.

*Signature:* *Date: 17.7.20*

### 4.1.2 Co-author contributions

By signing the Statement of Authorship, each author certifies that:

iv. the candidate's stated contribution to the publication is accurate (as detailed above);

v. permission is granted for the candidate in include the publication in the thesis; and

vi. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

*Name of co-author:* Prof. Deborah Turnbull

*Contribution to the paper:* Supervised development of the work. Provided guidance on the preparation of manuscript and editorial and structural feedback on the paper.

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*Contribution to the paper:* Supervised development of the work. Provided guidance on the preparation of manuscript and editorial and structural feedback on the paper.

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*Contribution to the paper:* Assisted with participant recruitment. Provided guidance on the preparation of manuscript and editorial and structural feedback on the paper.

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## 4.2 Published paper

A qualitative study of a sample of women participating in an Australian randomised controlled trial of intrapartum fetal surveillance.

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## 4.3 Abstract

Background: The STan Australian Randomised controlled Trial (START), the first of its kind in Australia, compares two techniques of intrapartum fetal surveillance (cardiotocographic electronic fetal monitoring (CTG) plus analysis of the ST segment of the fetal electrocardiogram (STan+CTG) with CTG alone) with the aim of reducing unnecessary obstetric intervention. It is also the first comprehensive intrapartum fetal surveillance (IFS) trial worldwide, including qualitative examination of psychosocial outcomes and cost-effectiveness. In evaluating and implementing healthcare interventions, the perspectives and experiences of individuals directly receiving them is an integral part of a comprehensive assessment. Furthermore, the added value of using qualitative research alongside randomised controlled trials (RCTs) is becoming widely acknowledged. This study aimed to examine women's experiences with the type of IFS they received in the START trial.

Methods: Using a qualitative research design, a sample of thirty-two women were interviewed about their experiences with the fetal monitoring they received. Data were analysed using thematic analysis.

Results: Six themes emerged from analysis: reassurance, mobility, discomfort, perception of the Fetal Scalp Electrode (FSE), and overall positive experience.

Conclusion: Interestingly, it was found that women who had an FSE in the CTG alone arm of the trial reported very similar experiences to women in the STan+CTG arm of the trial. Despite STan and CTG differing clinically, from women's perspectives, the primary difference between the two techniques was the utilisation (or not) of the FSE. Women were very accepting of STan+CTG as it was perceived and experienced as a more accurate form of monitoring than CTG alone. Findings from this study have significant implications for health professionals including midwives and obstetricians

and implications for standard practice and care. The study has demonstrated the importance and significance of incorporating qualitative enquiry within RCTs.

## 4.4 Introduction

Intrapartum fetal surveillance (IFS) using continuous cardiotocography (CTG) has become almost ubiquitous in the intrapartum setting (Kuah & Matthews, 2017), with routine data collection and other reports from Australia (East et al., 2015; Pregnancy Outcome Unit, 2019), the setting for START (STan Australian Randomised controlled Trial), demonstrating that it is used in 60-70% of all labours (East et al., 2015; Pregnancy Outcome Unit, 2019). Although there is some benefit from CTG during labour (Alfirevic et al., 2017) there is also evidence of it being associated with increased rates of caesarean section which are accompanied by risks to the mother and child (Alfirevic et al., 2017; Paterno et al., 2016; Sandall et al., 2018). Furthermore, there are psychosocial sequalae of emergency caesarean section that are often not considered (Benton et al., 2019).

Alfirevic et al. (2017) describe CTG as the electronic recording of the baby's heart rate and the mother's uterine contractions. The fetal heart rate can be monitored by one of two methods: external CTG utilises a Doppler ultrasound transducer which is held to the mother's abdomen by an elastic strap; internal CTG utilises a fetal scalp electrode (FSE) attached to the back of the baby's scalp to calculate the fetal heart rate from the R-R' interval of the fetal electrocardiogram (Symonds et al., 1999). Resultant restriction to mothers' mobility using either method has been noted by Alfirevic et al. (2017). A pressure transducer is also utilised regardless of external or internal means of detecting the fetal heart rate. This transducer is also held by an elastic strap to the mother's abdomen, typically in proximity to the top of the uterus in order to monitor the timing of their contractions.

An alternative to CTG alone, is monitoring which undertakes ST analysis (STan) of the fetal electrocardiogram (Neoventa Medical, Gothenburg, Sweden) (Rosén

& Lindecrantz, 1989) in addition to CTG. This approach identifies changes to the ST segment which are related to metabolic acidosis in the unborn baby, and these changes are interpreted together with the CTG (Rosén et al., 1984; Rosén & Lindecrantz, 1989; Westgate et al., 2001). Similar to the internal CTG monitoring, STan monitoring requires the placement of an FSE to detect the fetal ECG (Belfort et al., 2015; Sacco et al., 2015). With up to a 60% false positive diagnosis of fetal distress using CTG alone (Chandraharan & Arulkumaran, 2007), the additional information afforded by STan may have considerable impact on the reduction of a false positive diagnosis of fetal distress and thus a reduction in unnecessary operative births (Sacco et al., 2015).

To date, there have been six international randomised controlled trials comparing STan in addition to CTG with CTG alone (Amer-Wahlin et al., 2001; Belfort et al., 2015; Ojala et al., 2006; Vayssiere et al., 2007; Westerhuis et al., 2010; Westgate et al., 1992). Meta-analyses have also been conducted which include some or all randomised controlled trials (Becker et al., 2012; Blix et al., 2016; Neilson, 2015; Potti & Berghella, 2012; Salmelin et al., 2013; Schuit et al., 2013). To our knowledge, STan has not been previously utilised in the Australian maternity care system beyond its introduction and piloting at the study institution (Women's and Children's Hospital) in 2015. CTG+STan is being compared to CTG alone in our institution and the primary aim of the randomised controlled trial (START) is to determine if STan in addition to CTG can reduce emergency caesarean section rates and other interventions, whilst maintaining or improving neonatal outcomes (Turnbull et al., 2019).

In evaluating and implementing healthcare interventions, the perspectives and experiences of individuals directly experiencing those interventions are critical (Brewster et al., 2015; Sekhon et al., 2017; Smith et al., 2017). Examination of women's views and experiences of maternity care has become an important indicator of the

quality of health-care provision, with growing acceptance of the need to adapt services to improve women's experiences (Karlström et al., 2015). Overall, women's views, including their thoughts, opinions, preferences and experiences toward aspects of maternity care, carry important implications for postnatal psychological functioning (Michels et al., 2013). Furthermore, the added value of using qualitative research alongside RCTs is becoming widely acknowledged (Cooper et al., 2014; Snowdon, 2015) and increasing numbers of RCTs are including qualitative components (Cathain et al., 2013). A number of benefits of this qualitative research in RCTs have been identified including; a more comprehensive interpretation of trial findings, exploration of users perceptions of the feasibility and acceptability of an intervention, and understanding of the effect of social context in which an intervention is delivered (Russell et al., 2016).

Surprisingly, little recent research has examined women's experiences and views in the broad area of IFS. Thus, this RCT offered the ideal opportunity to examine women's experiences of two different fetal monitoring techniques. A recent systematic review has explored women's views and experiences of electronic fetal monitoring during labour (Smith et al., 2017). The review reported on 10 studies from which four themes were identified including: discomfort; anxiety; reassurance; and communication (Smith et al., 2017). However, the systematic literature reviewed did not identify any studies that examined views and experiences of STan monitoring. To the author's knowledge, only one quantitative study conducted in the UK has examined women's retrospective self-reported satisfaction with STan (Parisaei et al., 2011), with the majority of women viewing STan as acceptable. However, beyond this binary measure of acceptability, no views or opinions were sought. Subsequently, a pilot exploratory investigation on pregnant women's hypothetical views about STan monitoring was

conducted by our group prior to the current trial (Bryson et al., 2017). Pregnant women were interviewed about their perceptions of both STan and CTG after reading hypothetical vignettes describing the two forms of monitoring. While women tended to prefer CTG, their views were multifaceted and complex.

The current study builds on the earlier small study with the aim of generating insights in terms of IFS by investigating women's retrospective experiences of the type of fetal monitoring they received during their participation in START.

## 4.5 Method

This qualitative study utilised individual, face-to-face, semi-structured interviews to explore women's experiences with the type(s) of IFS they received.

### 4.5.1 Procedure

Women were recruited for the qualitative study from the participants of START, conducted at the Women's and Children's Hospital, a public tertiary hospital that manages the largest number of births in South Australia. As part of the trial women were randomised to one of two arms: CTG alone or STan+CTG. In the study institution, continuous fetal monitoring by CTG is the most common method of IFS and its use over intermittent auscultation of the fetal heart during labour is guided by recommendations listed in the Royal Australasian College of Obstetricians and Gynaecologists (RANZCOG) guidelines for intrapartum fetal surveillance (RANZCOG, 2019). In our study setting, women may have experienced several monitoring methods during their birthing experience. All women were deemed to require continuous CTG monitoring, per the RANZCOG guidelines (RANZCOG, 2019) prior to randomisation. If randomised to the CTG alone arm, the fetal heart rate may have been obtained via external (CTG no FSE) or internal (CTG with FSE) methods depending on the clinical situation. CTG was conducted with transducers connected to the monitor or via

telemetry dependant on the type of machine already in the birthing room the woman was allocated to. Women who were randomised to the STan+CTG arm initially received CTG monitoring as described for CTG alone until it was clinically appropriate to commence STan monitoring. This was immediate if an FSE was already in situ and connected to a monitor capable of ST analysis (Neoventa) or may have been delayed until it was clinically possible to apply an FSE and/or connect to a Neonventa monitor brought into the birthing room.

Approximately seven weeks after birth, expressions of interest for interviews from women recruited to START were sought. A precursor letter and information sheet were sent to women who had expressed an interest in an interview. The researcher made telephone calls to these women to discuss the study, and interview times and locations were arranged with those who wished to participate, with written informed consent obtained directly before conducting the interview.

It was initially planned to adopt ‘maximum variation sampling’ (Palinkas et al., 2015) in which participants are sampled based on predetermined criteria (i.e. type of IFS received in the trial, parity and previous experiences of fetal monitoring) in order to cover a range of constituencies to ensure representativeness and diversity. However, this approach proved to be impractical and so we moved to a more pragmatic approach where we interviewed consenting women based on the type of monitoring they received, irrespective of their broader clinical and demographic profile.

A pilot interview, aimed at gauging the comprehensibility and flow of the interview questions was conducted prior to the commencement of formal interviews with one women who had recently given birth and received fetal monitoring (but was not enrolled in START) and clinical staff including a midwife. The pilot interviews

provided feedback to the researcher regarding the effectiveness of the interview questions and amendments were made to the interview schedule accordingly.

Women interviewed were asked open-ended questions designed to elicit discussion which was guided by an interview schedule. The interview schedule allowed the researcher to pursue the same basic lines of inquiry with each participant and assisted in managing the interviews in a systematic and comprehensive way (Al-Busaidi, 2008). The interview schedule was informed by relevant literature on women's experiences of fetal monitoring in labour (Smith et al., 2017), as well as literature on STan monitoring in general (Bryson et al., 2017).

To enhance methodological rigour throughout the research process, criteria for rigorous qualitative research were followed, specifically Tracy (2010) “Big-Tent” criteria for excellence in qualitative research. As recommended, an audit trail was kept by the researcher to ensure transparency and rigour in the research process, which included records of all interactions with participants, reflections on the quality of the interview process, notes surrounding emerging themes and methodological decisions.

A further important element of qualitative research is self-reflexivity, considered to be honesty and authenticity with one’s self, one’s research, and one’s audience (Tracy, 2010). It is important to acknowledge the potential impact of the researcher’s subjective values, biases and preconceptions on the research. The primary researcher, who conducted the interviews, is a young female who has no children of her own, and thus this may have influenced the way in which women responded to the interview. A number of women expressed their appreciation in being able to talk about their experiences. The third author is a male obstetrician with a child of his own and the remaining authors were women with children of their own. As such, the authors approached the data analysis from their respective positions.

### 4.5.2 Data analysis

Transcripts were analysed using Thematic Analysis (TA) to identify, analyse and report patterns (themes) within the data. A semantic approach was taken allowing the analysis to be driven by the research question without searching for meaning beyond what the participants reported (Braun & Clarke, 2006). We used a combined deductive/inductive approach in order to examine the data according to previous research, specifically the previous pilot study (Bryson et al., 2017), while also identifying additional themes suggested from the data itself (Nowell et al., 2017).

Braun and Clarke (2013) describe six steps involved in undertaking TA. The first step involved familiarisation and immersion with the data. The researcher achieved this through familiarisation with transcription, multiple readings and beginning to note preliminary ideas. The second step involved generating initial codes by grouping interesting features across the dataset. Third, the initial codes were collated into potential emergent themes and sub-themes. Fourth, these themes were reviewed in relation to the raw data, initial codes, and relevance to the research aims. Fifth, themes that best represented the data were refined, defined, and named. Finally, transcript extracts were selected to illustrate each theme. To improve the consistency and trustworthiness of the chosen themes, Braun and Clarke (2013) also recommend that the codes and themes are cross-checked by multiple researchers. Three authors discussed initial emerging themes (MB, DT, AS) at which point the observation was made that women were commenting in very similar ways, irrespective of the type of monitoring received; so the decision was made that study arms would not be routinely compared and the data set would be analysed as a whole, and not by treatment arm. Subsequently, two authors (DT and AS) crossed-checked initial codes and emerging themes identified

by the primary researcher (MB). Themes emerging from the data were discussed throughout analysis by three authors (MB, DT and AS).

### 4.5.3 Ethical considerations

Human Research ethics approval was gained from both Women's and Children's Hospital Network Human Research Ethics Committee and the University of Adelaide Human Research Ethics Committee (HREC/17/WCHN/14).

## 4.6 Results

### 4.6.1 Participants

Interviews were conducted with thirty-two women who were between seven and twenty-four weeks postpartum from May, 2018 to August, 2019. All interviews were conducted by the primary researcher (MB) with four interviews being conducted in public locations, including cafes, and the remaining 28 completed in women's homes for their convenience. All interviews were audiotaped and the mean interview time was 23 minutes (between 11 and 60 minutes). Data saturation was determined by the 30th interview as the most recently conducted interview appeared to yield no new themes. To ensure this was the case, two additional interviews were completed (Guest et al., 2006). Audio-taped interviews were transcribed verbatim by the primary researcher using study numbers and pseudonyms to maintain anonymity of participants.

Participants were aged between 20 and 42. Sixteen participants were randomised to STan+CTG and 16 participants to CTG alone, of which 12 had a FSE applied for clinical reasons and 4 did not. Key characteristics of the participants are described in Table 4.

Table 4

*Participant Characteristics*

| Participant name* | Monitoring | Age | Parity | Weeks postpartum | Epidural |
|---|---|---|---|---|---|
| Ida | CTG wt FSE | 26 | 1 | 15 | Yes |
| Alice | STan | 22 | 1 | 14 | Yes |
| Olivia | STan | 33 | 2 | 20 | Yes |
| Sophia | STan | 31 | 1 | 13 | Yes |
| Samantha | CTG wt FSE | 30 | 2 | 11 | No |
| Mia | CTG no FSE | 20 | 3 | 17 | No |
| Christianna | CTG wt FSE | 25 | 1 | 13 | No |
| Michelle | CTG wt FSE | 30 | 1 | 23 | Yes |
| Caroline | STan | 31 | 2 | 18 | Yes |
| Julia | STan | 27 | 1 | 17 | Yes |
| Victoria | CTG wt FSE | 27 | 2 | 13 | Yes |
| Emily | CTG wt FSE | 42 | 1 | 12 | Yes |

| Participant name* | Monitoring | Age | Parity | Weeks postpartum | Epidural |
|---|---|---|---|---|---|
| Naomi | STan | 33 | 1 | 19 | Yes |
| Isabelle | STan | 31 | 1 | 14 | Yes |
| Rose | STan | 35 | 1 | 13 | Yes |
| Mary | CTG no FSE | 31 | 1 | 15 | Yes |
| Irina | CTG no FSE | 36 | 1 | 14 | Yes |
| Florence | STan | 36 | 1 | 16 | Yes |
| Elena | CTG wt FSE | 32 | 1 | 12 | Yes |
| Grace | CTG wt FSE | 31 | 1 | 16 | Yes |
| Josephine | CTG no FSE | 38 | 1 | 18 | Yes |
| Charlotte | STan | 36 | 2 | 9 | Yes |
| Fiona | STan | 31 | 1 | 17 | No |
| Sarah | STan | 31 | 2 | 11 | Yes |
| Leila | CTG wt FSE | 30 | 1 | 25 | Yes |

| Participant name* | Monitoring | Age | Parity | Weeks postpartum | Epidural |
|---|---|---|---|---|---|
| Jane | STan | 31 | 1 | 14 | Yes |
| Clara | STan | 42 | 1 | 13 | Yes |
| Ava | STan | 41 | 2 | 12 | Yes |
| Mila | STan | 21 | 1 | 19 | Yes |
| Penelope | CTG wt FSE | 29 | 1 | 11 | Yes |
| Zoe | CTG wt FSE | 35 | 2 | 8 | Yes |
| Caroline | CTG wt FSE | 29 | 1 | 12 | Yes |

* Participant names are pseudonyms.

It is important to preface that meaningful differences in women's experiences between each treatment arm of the trial were expected to be found but this wasn't the case. Interestingly, it was found that the main point of difference for women was whether the FSE was present or not. Women's intrapartum monitoring experiences typically began with standard external CTG monitoring before they were randomised to either arm of the trial (CTG alone or STan+CTG). More often than not, women in the qualitative study population had received an FSE in the CTG alone arm due to clinical necessity and women in the STan+CTG arm always received a FSE (as described previously). Participants will have experienced one of four combinations of IFS: external CTG only; external CTG converted to internal CTG when a FSE was applied

for clinical reasons; external CTG then CTG+STan after FSE was applied to enable STan as randomised to STan arm; and external CTG converted to internal CTG for clinical reasons and then STan enabled as randomised to STan arm. It should be noted that women's descriptions of their monitoring experience may be influenced by, and in reference to any part of their IFS experience and therefore quotes may appear out of context with the type of IFS stated that they received.

Five key themes that describe women's experiences with the fetal monitoring they received were identified: reassurance, mobility, discomfort, perception of the FSE, and overall positive experience.

### 4.6.2 Reassurance

In general, reassurance emerged as a dominant theme across interviews and was strongly related to opportunities women had to hear their baby's heartbeat.

> *"It just gave me that sound of mind of everything being okay" (Mia - CTG no FSE).*

Women explained that hearing their baby's heartbeat allowed them to feel more relaxed knowing the baby was safe so they could in turn increase focus on labour.

> *"It was lovely knowing that they knew exactly what was happening with him and they were confident, which made me a lot more relaxed and everything throughout the process" (Caroline - STan+CTG).*

#### *4.6.2.1 Belt-mounted ultrasound transducers: Inaccuracy and Stress*

Several women described the belt-mounted ultrasound transducers as causing additional stress and anxiety in labour due to their experienced inaccuracy. This experienced inaccuracy was typically due to the ultrasound transducer moving and losing contact with baby's heartbeat.

*"The whole time, I was super anxious because it was just all over the place… I found the bands just way to inaccurate" (Jane - STan+CTG).*

*4.6.2.2 FSE: Reliable monitoring*

Women described the FSE (whether it be with STan+CTG or CTG alone) as a more reliable form of monitoring and therefore more reassuring in comparison to their experiences with external CTG alone. Women reported that internal monitoring utilising a FSE was able to provide constant monitoring of their baby's heartbeat whereas belt-mounted ultrasound transducers often moved on women's abdomens and contact would be lost with the baby's heartbeat.

*"I didn't have to ever worry about losing track of the baby's heart rate, it was actual proper continuous monitoring. Whereas I feel with the bands it wasn't, it was just up and down, up and down" (Isabelle - STan+CTG).*

Several women also expressed increased feelings of safety with the FSE.

*"I felt safer with it on her head because the fact that they kept losing the heart rate with the one on the tummy…it made me feel more comfortable so that I knew she was safe"(Christianna - CTG with FSE).*

*"It was good having that constant … accurate monitoring as opposed to the CTG … it just kept falling off" (Fiona - STan+CTG).*

In addition to increased feelings of safety, women also described feeling more relaxed and in control when they had the FSE, either with STan+CTG or CTG alone in comparison to when belt-mounted ultrasound transducers were used (external CTG) as they didn't have to worry about a loss of contact with their baby's heartbeat.

*"I felt like there was a lot more control and it was much more accurate because I know when I had the thing on my belly … it'd drop in and out and you're freaking out" (Olivia – STan+CTG).*

*"The clip [FSE] just gave us piece of mind and one less thing we had to worry about in labour" (Samantha - CTG with FSE).*

*4.6.2.3 Monitoring impact on partner*

Women reported the continuous monitoring generally appeared to reassure their partners and generate a sense of their involvement in labour.

*"He liked being able to see what was happening with contractions and things like that as well, because obviously I could feel them and I knew what was going on but he was able to be a bit more involved by actually being able to see what was happening" (Penelope - CTG with FSE).*

In contrast, a small sub-set of women described anxiety the monitoring caused their partner either in terms the belt-mounted ultrasound transducer losing contact with their baby's heartbeat or in terms of the application of the FSE. One women described her husband's reaction to when the belt-mounted ultrasound transducer was not picking up their baby's heartbeat.

*"He actually got quite stressed out and thought that the baby had died because everything had dropped of the monitor" (Grace - CTG with FSE).*

*4.6.2.4 Technology informing staff*

Many women described further reassurance by the FSE (either with STan+CTG or CTG alone) as they considered it a valuable source of added information for staff to base clinical decisions on.

*"They were able to explain more with the one on his head" (Caroline – CTG with FSE).*

Furthermore, STan was seen as a new technology that could potentially reduce women's chances of experiencing additional intervention. Women also said if they were

required to have an emergency caesarean section, they knew it was because it was necessary.

> *"It definitely made me confident that I could keep going the way I was going and made my obstetrician confident that everything was fine so there was no rushing to do anything" (Caroline – STan+CTG).*

### 4.6.3 Mobility

Maintaining mobility was discussed as a significant preference and was consistently reported as an important pain management technique during women's labour. Women discussed the significance of mobility in terms of moving around the bed and changing positions. Women described the belt-mounted ultrasound transducer as inhibiting their desire to remain mobile as they reported the belts repeatedly moved on their abdomen and were having to be constantly readjusted.

> *"It didn't allow me to do any movement whatsoever, every time I moved during a contraction … the bands would slip off" (Isabelle - STan+CTG).*
>
> *"In-between every contraction I had to lie back on my back for them to strap the thing back on and find the heartbeat. In between contractions, it's ridiculous" (Samantha - CTG with FSE).*

To overcome the problem of the belts moving, women reported having to stay in one position or holding the belts so they would not slip off in order to allow for a consistent reading of their baby's heartrate.

> *"because it doesn't stay there properly, I didn't move after that. I just kept one position. Or when I wanted to move I just held it and pressed it. So I didn't move too much" (Florence - STan+CTG).*
>
> *"I was literally stuck in the same position on the bed" (Josephine - CTG no FSE).*

Several women discussed how this focus on the belt-mounted ultrasound interrupted their overall mindset and focus on labour, increasing their anxiety and frustration.

> *"every time … I had a break in contractions I had to lie completely still in a position to get it reapplied … so it just sort of disturbed my train of thought of not trying to get to caught up in the pain" (Isabelle - STan+CTG).*
>
> *"it was frustrating, it was like I didn't want to be paying attention to those [belt-mounted ultrasound transducer], I wanted to be kind of in the moment I guess, talking to my husband rather than going "uh this freakin bands" it was definitely a distraction" (Leila - CTG with FSE).*

In comparing their experiences, women who had an FSE either with STan+CTG or CTG alone reported considerably increased mobility during labour as it would provide constant readings of the baby's heart rate.

> *"You can kind of do whatever you wanted to, like you weren't restricted as much so it was a lot easier than the CTG for sure" (Fiona - STan+CTG).*
>
> *"I felt a lot better when the clip [FSE] was on cause I felt like I could do whatever I wanted without disrupting it, I felt a bit more free to move compared the other scan thing [CTG alone]" (Jane - STan+CTG).*

### 4.6.4 Discomfort

Discomfort was discussed and associated with the monitoring equipment for women in both treatment arms of the trial in terms of either the application of the internal FSE or the belt-mounted ultrasound transducer. Some women who had the FSE described the application as unexpectedly uncomfortable.

> *"I think because it did quite hurt when they attached it the first time. I didn't realise there would be any sort of discomfort to be honest so I wasn't prepared*

*… so when it happened I was sort of a bit taken back by it (Caroline - STan+CTG).*

Women expressed that more information surrounding the application may be useful to prepare them for any discomfort with application.

*"would hate for it to discourage women to use it but I suppose if you are mentally prepared for it to be a little bit uncomfortable you are sort of more [physically] prepared for it (Caroline - STan+CTG).*

Several women expressed the difficulty some staff had in inserting the FSE, with some women describing several application attempts having to be undertaken by staff causing women stress, anxiety and feelings of panic. One women described the application as traumatic and later resulting in a panic attack.

*"The actual application of the clip [FSE] I found quite traumatic" (Grace - CTG with FSE).*

One woman described the application of the FSE with staff attempting to attach it three times before it was successfully applied. She described the impact on her partner.

*"It [the application] made my husband really anxious… he was concerned for her [baby] wellbeing and knowing there were three attempts at jabbing into her head and he was super just concerned" (Leila - CTG with FSE).*

However, epidural anaesthesia reduced discomfort associated with the application of the FSE.

*"Couldn't even feel it ... I don't even know they were putting it in there but I can imagine if I hadn't [had an epidural], maybe putting something in there might be uncomfortable" (Naomi - STan+CTG).*

Women also described the application of the FSE as less invasive, relative to other procedures they had experienced during labour.

*"Compared to all the other things going on it was insignificant" (Jane – STan+CTG).*

Discomfort was consistently reported by women in terms of the belt-mounted ultrasound transducer.

*"The belts were really uncomfortable after a while because they are pushing in to really get the heartbeat and the contractions so they actually leave little dents (Rose - STan+CTG).*

Women also described discomfort arising from the enforced immobility with the belt-mounted ultrasound transducer.

*"It's uncomfortable because I need to stay there in one position for hours" (Florence - STan+CTG).*

**4.6.5 Perception of the FSE**

In terms of the FSE, women who either received STan+CTG or CTG alone with the FSE described their initial concerns when staff described it to them.

*"It sounds painful. Even just the name doesn't sounds appealing" (Sarah - STan+CTG).*

*"They called it the "scalp clip" and I was like that sounds terrifying "what", they're like we put it on your baby's head when they are still in there and I was like "how" … This sounds silly, I didn't like the name scalp clip. I was like that sounds really invasive for the baby (Jane - STan+CTG).*

Some women didn't understand how the FSE either with STan+CTG or CTG alone functioned.

*"I actually thought it was going to be a little suction cap" (Caroline - STan+CTG).*

*"I was thinking… like a full metal clip that somehow attached" (Ava - CTG with FSE).*

Other women were misinformed about the impact of the FSE, particularly on mobility, with some women opting not to have as FSE until they had an epidural.

*"They told me that I couldn't move, that I had to be lying down for it [FSE], had to be still, not still but I had to labour on the bed with it and I was kind of like ohh no I don't want to do that " (Leila - CTG with FSE).*

Many women further expressed concerns in relation to how the FSE would impact their baby.

*"The idea of it being inserted and that it was a metal clip being attached to the scalp made me feel uncomfortable just cause you know its metal, and attaching to your new born baby's scalp like so I found it a little unsettling" (Ava - CTG with FSE).*

However, these concerns in relation to the FSE were then typically described as an acceptable trade-off for potentially better outcomes for their baby.

*"You worry that it's going to hurt the baby but I guess from our experience of knowing what could go wrong …[resuscitation in previous birth] that was a really minor impairment …I guess for us we rationalised that putting a probe in, in a really quick procedure …would be much better if it could avoid some of those more drastic medical procedures"(Sarah - STan+CTG).*

Several women also described feelings of guilt they had in terms of the marks left by the FSE on the baby's head.

*"There was like a little bit of mark on the head for a while and I was like "ohh" you know, of course you're a mother and you're like "ohhh I'm sorry" (Fiona - STan+CTG).*

*"When baby was born I found it a little distressing to see the clip [FSE] and to see clearly that she had been bleeding … not that it was gushing but it's still again your brand new little baby to see a little sore on their head already … you kind of have to reconcile that" (Ava - CTG with FSE).*

Women suggested additional information about the potential impact on their baby would be beneficial.

*"Setting that expectation of what you can visibly see when the baby comes out" (Ava - CTG with FSE).*

**4.6.6 Positive experience**

Overall, women described having the FSE whether it be with STan or with CTG to be a more positive experience overall in comparison to experiences with the belt-mounted ultrasound transducer. The FSE allowed women to focus on labour and reduce worry in relation to fetal monitoring.

*"they switched to the scalp monitoring [STan] which obviously once that was connected it never lost connection again I found it a lot more relaxing, I could just focus on labour and delivery…. the whole experience was a lot more positive and less bothersome than the bands" (Isabelle - STan+CTG).*

The FSE was discussed as a method to possibility mitigate unnecessary interventions such as emergency caesarean section and therefore was frequently embraced by women.

*"I definitely had more faith …if there was distress then it was genuine distress … if there was intervention to come from it then that was necessary" (Ava - CTG with FSE).*

Women conveyed they would have liked to have been offered and received the FSE earlier in their labour.

*"If anything I probably would have asked for the scalp monitoring sooner even right from the beginning instead of struggling with the bands for so long" (Isabelle - STan+CTG).*

## 4.7 Discussion

The current study examined women's experiences with two different techniques of IFS. Overall, the FSE was found to be used more frequently than anticipated, due to clinical indication of need rather than solely to facilitate STan, which led to findings that were not originally anticipated. Interestingly, it was found that women who had an FSE in the CTG alone arm of the trial reported very similar experiences to women in the STan+CTG arm of the trial. Despite STan+CTG and CTG alone differing clinically, from women's perspectives the primary difference between the two IFS techniques was the utilisation (or not) of the FSE. Overall, five key themes were identified that describe women's experiences with the fetal monitoring they received including: reassurance, mobility, discomfort, perception of the FSE, and overall positive experience.

### 4.7.1 Reassurance

Supporting previous research (Barber et al., 2013; Smith et al., 2017) women found IFS generally reassuring. However, women reported the FSE added an additional layer of reassurance to their labour experience especially when compared to the belt-mounted ultrasound transducers alone. This was typically a result of the inaccuracy of the belts related to loss of contact with the baby's heartbeat with women's movements.

The FSE was perceived as a more reliable and accurate addition to monitoring as it provided women with a constant record of their baby's heartrate resulting in increased feelings of safety and allowing women to relax and focus during labour. Women who experienced STan+CTG expressed that knowing they were using newer technology that had the potential to reduce their chance of intervention provided them additional feelings of safety. These findings are contrary to the previous pilot study of women's prospective views (which examined women's preferences guided by hypothetical scenarios) rather than lived experiences towards different IFS techniques whereby STan+CTG was perceived as somewhat risky as it was a newer technology to the study institution (Bryson et al., 2017). Monitoring of either type was also discussed as helpful in providing reassurance to partners and an increased sense of involvement. This finding has also been described in other studies (Barber et al., 2013; Starkman, 1976).

### 4.7.2 Mobility

It is recognised that mobility is an important preference in labour for women due to its perceived physiological benefit such as pain management (Priddis et al., 2012). Interestingly, the limited research examining women's experiences of FSEs suggests that they do not increase women's mobility. A qualitative study of staff perspectives describe contrasting views of staff in relation to mobility and the FSE (Kerrigan et al., 2015). The study described a common assumption of staff that the application of an FSE would lead to a higher incidence of immobility during labour whereas other staff members saw the use of the FSE as a way to increase mobility (Kerrigan et al., 2015). Women in the current study described meaningful increases in mobility with the FSE in contrast with CTG alone which utilised the belt-mounted ultrasound transducer. Women reported the belt-mounted ultrasound transducers would often lose contact with their baby's heart rate, due to the belts moving on their abdomen leading to a reduction in

mobility as women felt the need to stay in one position so a consistent fetal heart could be detected. Thus, with regard to mobility, the authors suggest that women perceived the advantage of the FSE as contributing to the ability to move and change position without losing contact with the fetal heart rate, rather than permitting movement around the birthing room during labour per se. In our study setting, the ability for unrestricted ambulation is facilitated by the monitors that have telemetry (not all monitors) and additionally these monitors can only be used for CTG only (with or without an FSE). Our version of Neoventa monitors (S31) do not have telemetry and additionally, current STan technology does not allow for telemetry with STan enabled.

Overall, these findings highlight the need for updated consumer information from women's perspectives to clearly explain the impact of the FSE on mobility, and the potential for it to actually increase women's mobility rather than decrease it as previously suggested.

### 4.7.3 Discomfort

Discomfort was associated with the monitoring equipment for some women in both treatment arms of the trial in terms of either the application of the internal FSE or the enforced immobility and continual readjustment of the transducer belts. We acknowledge that the belt holding the pressure transducer to measure contraction timing remained after the application of a FSE, however, women did not specifically state that this belt presented a problem. Similarly, to the current findings, discomfort in the systematic literature review was reported in relation to the FSE and transducer belts particularly around enforced immobility associated with continuous monitoring and considerable restriction in movement (Smith et al., 2017).

### 4.7.4 Perception of FSE

Women expressed initial concerns when the FSE was introduced to them by midwifery and medical staff. Concerns were typically centred around the impact the FSE may have on their baby and women described a lack of adequate information in relation to this. Interestingly, the previous pilot study also described women's feelings of uncertainty and concern in relation to the FSE (Bryson et al., 2017). Furthermore, women in the current study outlined that staff primarily referred to the FSE as a "scalp clip" which frightened women and they also felt it was not an accurate representation of the technology. Several women suggested that staff referring to it as a "scalp electrode" may increase acceptability of the technology. Women's initial concerns towards the FSE underlines the need for clear information to explain the procedure and potential risks, to enable decision making and that is aligned with women's views and preferences. The provision of clearer information will assist in mitigating potential issues around the application of the FSE and perceived mobility. However, it should be noted that this is not always possible, women described several instances where there was often no time for full explanation and consideration of the intervention if there were serious clinical concerns about the unborn baby's heart rate and the FSE needed to be placed immediately.

### 4.7.5 Positive experiences

Women described several positive impacts that the FSE had on their labour experiences, particularly when compared to their experiences with the belt-mounted ultrasound transducer. Benefits of the FSE reported by women included: increased mobility during labour; providing further reassurance; providing increased information for staff, which lead to increased feelings of safety, allowing women to relax and concentrate on labour. Contrary to our findings, the pilot study of women's prospective

views towards monitoring described the FSE as adding an additional level of uncertainty to labour (Bryson et al., 2017). This speaks to the need for care providers to examine and consider women's experiences towards their care and incorporate them into practice.

### 4.7.6 Strengths and limitations

To our knowledge, this is the first qualitative study to explore women's retrospective experiences with STan, which, for the first time, is being trialled in Australia. Previous research incorporating women's perceptions and experiences with STan has been limited with only one other qualitative study exploring women's prospective views of the monitoring using hypothetical vignettes. Furthermore, this is one of the few studies to examine women's experiences with different techniques of IFS. In terms of the research methodology, following Tracy (2010) model for quality and excellence in qualitative research lends additional credibility to the study's findings. Moreover, analysis was conducted with rigour, with emerging themes being corroborated between authors (MB, DT & AS) and all authors reaching consensus on the final interpretations. While this study provides significant insight into women's experiences of monitoring of the fetal heart rate during labour, the findings need to be considered within the context of the following limitations.

Despite the sample having diverse demographic characteristics, women were only sampled from one hospital (the RCT site), thus potentially limiting the generalisability of the findings beyond this setting. Women had to express interest in the interview to take part, and they may have been more inclined to participate when having criticism they wanted to share and it is also possible that women experiencing too much stress may have been less inclined to participate. Many of the birthing women at Women's and Children's hospital have risk factors that may have necessitated periods

of continuous CTG during the antenatal period and thus may be exposed to more than one monitoring experience during that pregnancy episode which could shape their experience and perception beyond what was directly experienced within the RCT setting. Furthermore, as previously described, there was a range of potential experiences women may have had with fetal surveillance during participation in START. This study did not aim to tease out the nuanced differences but rather to examine experiences with monitoring at a more general level – STan+CTG compared with CTG alone, with the main finding being that differences related more to whether or not a women received an FSE. Additionally, although all of the women openly shared their experiences, there is always the potential for recall bias in interviews that are retrospective in nature.

### 4.7.7 Implications

Incorporating this qualitative component in relation to women's experiences of monitoring alongside the RCT with a primary focus on clinical outcomes has allowed for an exciting opportunity to demonstrate the importance of the additional examination of women's views and experiences. Findings from this study will have significant implications for health professionals including midwives and obstetricians, as well as implications for standard practice and care. Overall women were very accepting of STan in addition to CTG as it was perceived and experienced as a more accurate form of monitoring than CTG alone. STan was reported to provide several benefits to women including a reduction in the chance of medical intervention including emergency caesarean section. In terms of the FSE which is always used with STan and more often than not used with CTG, women described it as reassuring, proving more accurate monitoring, and enabling increased mobility when compared to the belt-mounted ultrasound transducer belts alone. In contrast the belt-mounted ultrasound transducers were described as reducing mobility, providing less accurate monitoring and distracting

women. These findings may therefore be used to inform staff perspectives and the development of consumer information to best support women to make informed and value-based choices about monitoring methods in labour. Further, findings provide support for the acceptability of STan in addition to CTG to women in Australia.

### 4.7.8 Conclusion

The current study has demonstrated the diverse impact that variances in monitoring technique can have on women's experiences of labour. Consideration of women's experiences and perceptions towards IFS is crucial to an understanding of this important aspect of care. Health care professionals must remain knowledgeable of the current evidence on IFS to engage in evidence-base care. Regular education for all staff that incorporates experiences of women, as identified in this study, will provide a useful opportunity to engage in effective evidence base practice informed not only by clinical outcomes, but also by views of women receiving this care. Findings may be used to inform the development of staff and consumer information to best support both women and staff make informed and value-based individualised choices about utilisation of fetal monitoring technology during labour. Whilst START is comparing two forms of IFS (CTG alone compared to STan+CTG) from a clinical perspective, the current study has outlined that women's lived experiences were not determined by trial arm, but by whether the FSE was used or not. As a result, this study has importance and relevance in advancing the value of RCTs, as it provides an example of the valuable contribution that a qualitative enquiry can bring.

# CHAPTER 5. WOMEN'S SATISFACTION WITH INTRAPARTUM FETAL SURVEILLANCE: A MIXED-METHOD STUDY WITHIN THE STAN AUSTRALIAN RANDOMISED CONTROLLED TRIAL

## 5.1 Statement of Authorship

*Title of paper:* Women's satisfaction with intrapartum fetal surveillance: a mixed-method study within the STan Australian Randomised Controlled Trial.

*Publication status:* Unpublished work written in manuscript style

*Publication details: N/A*

### 5.1.1 Principal author

*Name of principal author (candidate):* Madeleine Benton

*Contribution to the paper:* Devised study aims with supervisors. Planned and carried out data collection and analysis. Wrote manuscript.

*Overall percentage (%):* 85%

*Certification:* This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.

*Signature:* *Date: 17.7.20*

### 5.1.2 Co-author contributions

By signing the Statement of Authorship, each author certifies that:

vii. the candidate's stated contribution to the publication is accurate (as detailed above);

viii. permission is granted for the candidate in include the publication in the thesis; and

ix. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

*Name of co-author:* Prof. Deborah Turnbull

*Contribution to the paper:* Supervised development of the work. Provided guidance on the preparation of manuscript and editorial and structural feedback on the paper.

*Signature:* *Date: 17.7.20*

*Name of co-author:* Dr. Amy Salter

*Contribution to the paper:* Supervised development of the the work and input regarding analysis of data. Provided guidance on the preparation of manuscript and editorial and structural feedback on the paper.

*Signature:* *Date: 17.7.20*

*Name of co-author:* Dr. Bronni Simpson

*Contribution to the paper:* Assisted with participant recruitment. Provided guidance on the preparation of manuscript and editorial and structural feedback on the paper.

*Signature:* *Date:17.7.20*

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*Contribution to the paper:* Provided guidance on the preparation of manuscript and editorial and structural feedback on the paper.

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## 5.2 Paper

# Women's satisfaction with intrapartum fetal surveillance: a mixed-method study within the STan Australian Randomised Controlled Trial.

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## 5.3 Abstract

Background: Satisfaction with childbirth can have immediate and long-term implications for the health and well-being of a woman and her newborn. In an Australian-first randomised controlled trial (RCT), two techniques for intrapartum fetal surveillance are being compared; STan monitoring plus cardiotocographic (CTG) compared to CTG monitoring alone. The aim is to determine if STan can reduce emergency caesarean section rates whilst maintaining or improving neonatal outcomes. This study compares women's experiences of and satisfaction with the two techniques of intrapartum fetal surveillance.

Methods: A cohort of consecutively recruited women participating in a randomised controlled trial from March 2018 to January 2020 in a South Australian tertiary hospital were invited to complete a questionnaire which included open-ended and forced choice response formats approximately eight weeks after giving birth. The analysis principle was intention to treat.

Results: Questionnaires were sent to the first 527 participants and completed by 207 women (*n*=113/265, STan+CTG; *n*=94/265, CTG alone). On average, birth satisfaction appeared to be very similar in both arms of the trial. In relation to monitoring technique, women in the STan+CTG arm reported higher average satisfaction with staff competency associated with the monitoring. Furthermore, women randomised to STan+CTG were more likely to disagree with the statement that they would prefer a different type of monitoring in future labours compared to CTG alone. Results from the qualitative component highlighted that from women's perspectives, the primary difference between the two techniques was the utilisation (or not) of the fetal scalp electrode (FSE) (the FSE is always utilised with STan+CTG and when clinically

necessary utilised with CTG). Interestingly, women commonly viewed the use of the FSE positively as it was perceived to permit greater mobility.

Conclusions: Policy makers can be assured that STan results in, at the very least, comparable outcomes in terms of general satisfaction with the experience of labour as well as monitoring. Findings from this trial should be incorporated when developing consumer-based information about electronic fetal surveillance, in particular regarding common misconceptions by women and care givers about the potential use of a FSE.

*Keywords:* Satisfaction, fetal surveillance, fetal monitoring, STan, CTG

## 5.4 Introduction

Satisfaction is an important health outcome and is one of the most frequently reported measures of quality of care (Goodman et al., 2004; Jafari et al., 2017; Nilvér et al., 2017; A Sawyer et al., 2013). When evaluating and drawing conclusions from care in childbirth, the examination of women's satisfaction with their experiences is of considerable importance (Nilvér et al., 2017). Satisfaction with childbirth can have immediate and long-term implications for the health and well-being of a woman and her newborn (Goodman et al., 2004). For example, in a cross-sectional study conducted with 664 Australian women, evidence of an association was demonstrated between a satisfying childbirth and high postnatal functioning (Michels et al., 2013). In contrast, dissatisfaction with childbirth has been shown to be associated with negative impacts on a woman's mental health, with a recent systematic review reporting that a negative birth experience may contribute to postnatal depression (Bell & Andersson, 2016).

Monitoring of the fetal heart rate during labour is a required standard practice in midwifery and obstetrics in order to ensure fetal wellbeing. This monitoring, also known as intrapartum fetal surveillance, comprises technologies that are designed to provide an objective view of fetal wellbeing and can be practically used over long periods of time without risk of injury to either the mother or baby (Crawford et al., 2017). Intrapartum fetal surveillance (IFS) using continuous cardiotocography (CTG) has become almost ubiquitous in the intrapartum setting (Kuah & Matthews, 2017). However, CTG is known to have a high false positive rate (i.e. low specificity) of up to 60% which means that it can indicate fetal compromise in cases when it is not present and in some instances, can lead to unnecessary interventions such as delivery via emergency caesarean section (EmCS) which are accompanied by risks to the mother

and child (Chandraharan & Arulkumaran, 2007; East et al., 2015; Sandall et al., 2018) as well as significant psychosocial sequalae (Benton et al., 2019).

CTG monitors the fetal heart rate by one of two methods: external CTG utilises a Doppler ultrasound transducer which is held to the mother's abdomen by an elastic strap; whilst internal CTG utilises a fetal scalp electrode (FSE) attached to the baby's presenting part to calculate the fetal heart rate from the R-R' interval of the fetal electrocardiogram (Symonds et al., 1999). An external pressure transducer is also utilised regardless of external or internal means of detecting the fetal heart rate and is also held by an elastic strap to the woman's abdomen, typically in proximity to the top of the uterus in order to monitor the timing of the mother's contractions. Whilst an internal pressure transducer is also an option (Hautakangas et al., 2020), this is rarely used in Australia (RANZCOG, 2019).

An alternative to CTG alone, is monitoring which also undertakes ST analysis (STan) of the fetal electrocardiogram (Rosén & Lindecrantz, 1989) in addition to CTG. STan is used in conjunction with standard CTG monitoring and provides clinicians with additional information regarding fetal wellbeing during labour relative to CTG alone, allowing for a more definitive diagnosis of fetal distress (Sacco et al., 2015; Timonen & Holmberg, 2018). Similar to the internal CTG monitoring, STan monitoring requires the placement of an FSE to detect the fetal ECG (Belfort et al., 2015; Sacco et al., 2015). As a result, unlike CTG, the FSE is always required when using STan monitoring (Sacco et al., 2015).

Overall, six international randomised controlled trials (RCTs) comparing STan+CTG with CTG alone have been conducted (Amer-Wahlin et al., 2001; Belfort et al., 2015; Ojala et al., 2006; Vayssiere et al., 2007; Westerhuis et al., 2010; Westgate et al., 1992). Additionally, a number of meta-analyses have been conducted which include

some or all of these RCTs (Becker et al., 2012; Blix et al., 2016; Neilson, 2015; Potti & Berghella, 2012; Salmelin et al., 2013; Schuit et al., 2013). Despite this relatively large evidence base comparing these two forms of intrapartum fetal surveillance, the focus has been on clinical outcomes with psychosocial aspects largely overlooked. Furthermore, STan monitoring has not been examined in the Australian context, which is arguably quite different (with regard to health care systems, organisation and professional responsibilities, background intervention rates and clinical guidelines) to that of the European and US settings of previous trials. As such, an Australian-first RCT has been designed to compare STan+CTG (referred to from here on as STan) versus CTG alone with the aim of determining if STan results in reduced emergency caesarean section rates (Turnbull et al., 2019). In line with the potential reduction of EmCS with STan (Wilkinson et al., 2017), a secondary hypothesis of the trial is that STan monitoring will result in improved psychosocial outcomes (Turnbull et al., 2019). Overall, the trial comprehensively compares clinical, economic, and psychosocial outcomes. The study reported here compares satisfaction with monitoring and the birth experience more broadly in women allocated to STan relative to those allocated to CTG alone.

## 5.5 Method

### 5.5.1 Participants and setting

The trial was conducted at the Women's and Children's Hospital in South Australia, a level 6 tertiary maternity care facility with approximately 5000 deliveries per annum (Women's and Children's Health Network, 2019). Consenting participants were deemed to require, or were currently receiving, continuous CTG monitoring, per the RANZCOG guidelines (RANZCOG, 2019) prior to randomisation. At which point they were randomised to receive either STan or CTG

alone, according to an allocation ratio of 1:1 with stratification for parity, using a remote phone-based randomisation procedure (Turnbull et al., 2019).

### 5.5.2 Procedure

Between March 2018 and January 2020, a cohort of consecutively recruited women were sent a precursor invitation letter approximately six weeks after giving birth. Two weeks later a study pack, including recruitment and consent material and the questionnaire was sent. Two methods of responding to the questionnaire were offered, a paper questionnaire returned by post or an online questionnaire. Personalised reminders were sent out for non-responders: another study pack approximately ten weeks after birth, and an SMS approximately three weeks after that. It should be noted here that a sample size calculation was not conducted. This was a pragmatic decision based on feasibility and the fact that the study was exploratory and not powered on a particular outcome.

The questionnaire included questions relating to women's psychosocial outcomes following monitoring and birth and included three measures to examine women's satisfaction with various elements of their labour experience. These measures included the Birth Satisfaction Scale – Revised (BSS-R); Satisfaction with Electronic Fetal Monitoring Questionnaire (S-EFM); and two questions with open-ended response formats that asked women to comment on the positives and negatives of the fetal monitoring that they received.

The BSS-R is a 10-item, self-report scale that was developed as a shorter form of the original 30-item BSS (Hollins-Martin & Martin, 2014). The BSS-R is an instrument used to measure satisfaction with maternal birth experience (Hollins-Martin & Fleming, 2011; Hollins-Martin & Martin, 2014; Hollins-Martin et al., 2012). Findings from a recent study have reported that the BSS-R is a robust, valid and reliable

multidimensional psychometric instrument for measuring women's birth satisfaction in the postnatal period (Hollins-Martin & Martin, 2014). Following recommendations (Celestina Barbosa-Leiker et al., 2015), one item ('I came through childbirth virtually unscathed') was altered to be more culturally appropriate as follows: "I came through childbirth virtually unharmed".

The S-EFM is a purpose-designed scale to measure women's satisfaction with fetal surveillance. The measure was developed on the basis of previous research about electronic fetal monitoring, in particular CTG (Garcia et al., 1985; Hindley et al., 2008; Killien & Shy, 1989; Starkman, 1976) and from limited research conducted on STan technology (Bryson et al., 2017; Parisaei et al., 2011). The S-EFM includes 11-items and requires participants to respond on a 5-point Likert scale ranging from 'strongly disagree' to 'strongly agree'. The item 'I was concerned about the attachment of the scalp clip' includes a 'not applicable' option as not all participants were expected to receive the scalp clip. Higher scores indicate greater satisfaction with the monitoring received.

### 5.5.3 Analysis

Analyses were conducted using the Statistical package for the Social Sciences 11(SPSS.11, SPSS Inc., Chicago, IL, USA). Data were analysed according to the intention to treat principle where women are grouped according to the treatment to which they were randomised. Analysis of the data was blinded to the specific treatment group. The overall scores of the S-EFM and BSS-R were analysed using independent-samples t-tests. The subscales scores of both measures were analysed using Mann-Whitney U tests. A p-value of $<0.05$ was considered to be statistically significant. Overall, there was considered to be adequate power to detect meaningful differences in

pre-specified psychosocial outcomes, but no correction was made for multiple comparisons.

Content analysis was conducted to quantify the qualitative data obtained through the open-ended response questions. Data in the form of a single word, complete answer or direct quotation was coded and assigned into themes. Once all responses had been coded, themes of similar or identical content were merged and reduced to present a succinct number of categories (Mayring, 2000), with the presentation of findings following a format informed by previous research (Vogel et al., 2019).

### 5.5.4 Ethical considerations

Human Research ethics approval was gained from the Women's and Children's Hospital Network Human Research Ethics Committee and the University of Adelaide Human Research Ethics Committee (HREC/17/WCHN/14).

## 5.6 Results

The questionnaire was sent to 527 women after excluding 2 women whose infants had extended neonatal intensive care (NICU) or special care admissions and were only recently discharged from hospital when the questionnaire was due for mailing and one woman who withdrew consent for participation after randomisation. Overall, 263 of the invited women were allocated to STan and 264 to CTG alone. 207 women returned a completed questionnaire (response rate: STan, 43%; CTG, 36%) (See participant flow, Figure 4). The median time from birth to completion of questionnaire was similar in both groups (STan, 8.71 weeks; CTG, 8.14 weeks). Similar demographic characteristics relating to age and parity were observed for women who responded to the questionnaire (responders) relative to those who did not (non-responders). The mean age of responders (vs non-responders) was 31.80 (vs 30.29) years for those randomised to STan and 32.00 (vs 30.61) for those randomised to CTG alone. The median parity

for responders and non-responders in each randomised treatment arm was one. Of the responders 54.9% were randomised to STan and 45.4% were randomised to CTG alone. Baseline characteristics were similar in the two randomised groups (Table 5). Clinical characteristics summarised in Table 6 indicate that 96.5% of women in the STan arm of the trial had an FSE and 71.3% of women in the CTG arm had an FSE.

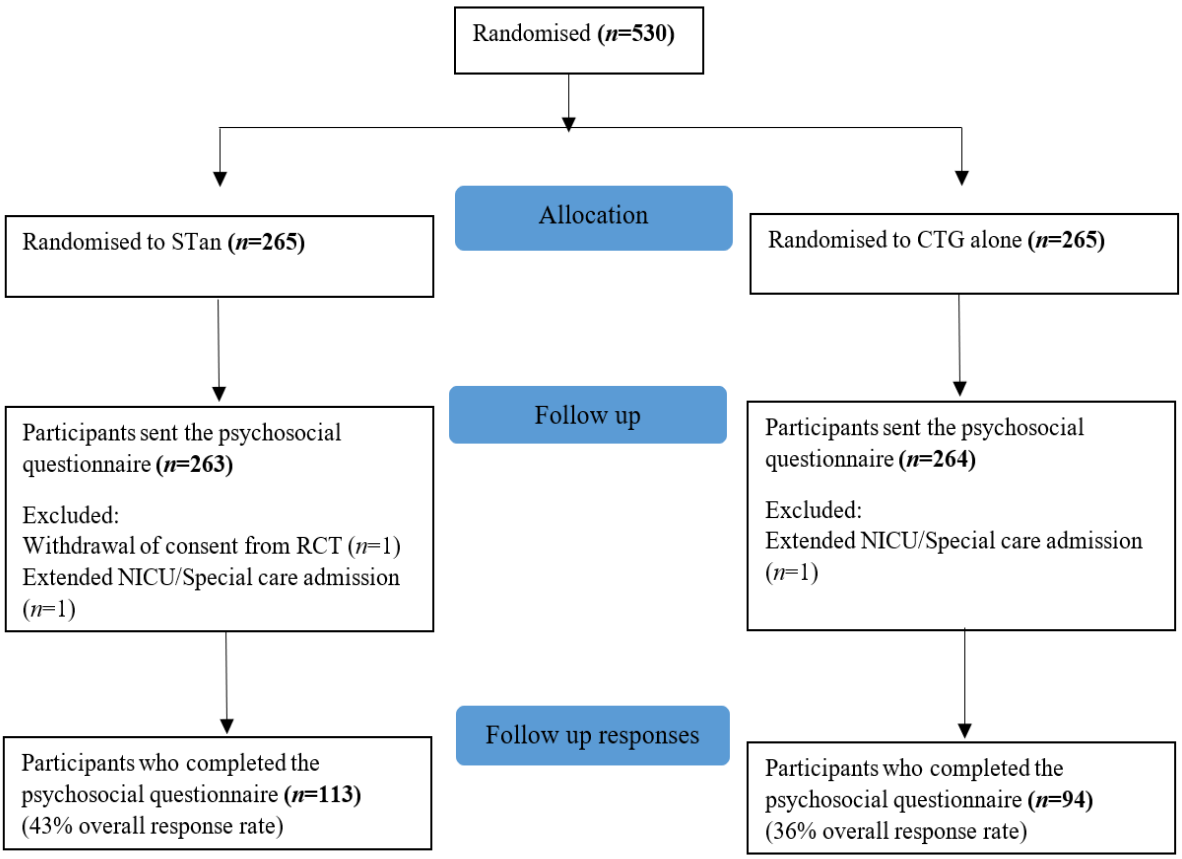


*Figure 4.* Flow of the subset of women from the START RCT eligible to participate in the psychosocial study.

Table 5

*Baseline Characteristics: Women Randomised to STan versus CTG Alone*

| **Characteristics** | **STan (N=113)** n (%) | **CTG alone (N=94)** n (%) |
|---|---|---|
| Marital status | | |
| Married /de facto | 102 (90.3%) | 86 (91.5%) |
| Single (family supported) | 6 (5.3%) | 1 (1.1%) |
| Single (unsupported) | 4 (3.5%) | 6 (6.4%) |
| Language spoken at home | | |
| English | 83 (73.5%) | 65 (69.1%) |
| Other language | 30 (26.5%) | 28 (29.8%) |
| Education | | |
| Bachelor's degree or higher | 61 (54%) | 49 (52.2%) |
| Post high school training | 36 (31.9%) | 30 (31.9%) |
| High school only | 15 (13.3%) | 13 (13.8%) |
| Other | 1 (.9%) | 2 (2.2%) |
| Employment | | |
| Full time | 53 (46.9%) | 42 (44.7%) |
| Part time | 25 (22.1%) | 17 (18.1%) |
| Casual | 14 (12.4%) | 7 (7.4%) |
| Not employed | 21 (18.6%) | 28 (29.8%) |
| Parity | | |
| 1 | 77 (68.1) | 60 (63.8%) |

| Characteristics | STan (N=113) n (%) | CTG alone (N=94) n (%) |
|---|---|---|
| 2 | 25 (22.1%) | 23 (24.5%) |
| 3 or more | 11 (9.7%) | 11 (11.7%) |
| Age | *Mean*=31.80 (*SD*=4.80) | *Mean*=32 (*SD*=4.62) |

Table 6

*Clinical Characteristics: Women Allocated to STan versus CTG Alone*

| Characteristics | STan (N=113) n (%) | CTG alone (N= 94) n (%) |
|---|---|---|
| Epidural | | |
| Yes | 94 (83.3%) | 76 (80.9%) |
| Onset of labour | | |
| Spontaneous | 16 (14.2%) | 14 (14.9%) |
| Induced | 90 (79.6%) | 71 (75.5%) |
| Augmented | 7 (6.2%) | 9 (9.6%) |
| FSE | | |
| Yes | 109 (96.5%) | 67 (71.3%) |

### 5.6.1 Birth satisfaction

No statistically significant differences were found in overall mean birth satisfaction score for women randomised to STan versus CTG alone ($p$ = 0.14) or in subscale scores.

Table 7

*Birth Satisfaction: Women Allocated to STan versus CTG Alone*

| **Birth Satisfaction Scores** | **STan (N=113)**<br>**n***<br>**Mean score *(SD)*** | **CTG (N=94)**<br>**n***<br>**Mean score *(SD)*** | **Difference in means (95% CI)** |
|---|---|---|---|
| BSS-R total | n=113<br>29.35*(5.87)* | n=91<br>28.01*(6.81)* | 1.33 (-3.08 to 0.42) |
| Subscales | | | |
| BSS-R-QC[a] | n=113<br>14.45*(1.78)* | n=93<br>14.03*(2.26)* | 0.42 (-0.97 to 0.14) |
| BSS-R-PA[b] | n=113<br>5.12*(1.97)* | n=93<br>4.88*(1.98)* | 0.23 (-0.78 to 0.31) |
| BSS-R-SE[c] | n=113<br>9.78*(3.76)* | n=93<br>9.00*(4.06)* | 0.78 (-1.86 to 0.30) |

[a] Birth Satisfaction Scale – Revised - Quality of care sub dimension

[b] Birth Satisfaction Scale – Revised - Personal attributes sub dimension

[c] Birth Satisfaction Scale – Revised - Stress experienced sub dimension

*Numbers vary with missing data for one or more of the subscale questions.

**5.6.2 Satisfaction with fetal surveillance**

The scale had a high level of internal consistency, with a Cronbach's alpha of 0.87. No statistically significant differences were found in mean satisfaction with fetal surveillance scores for women randomised to STan (*mean*=42.56, *SD*=6.81) versus CTG alone (*mean*=41.04, *SD*=7.32) (see Table 8).

Of the eleven dimensions on the S-EFM, there was a consistent pattern of responses that favoured women who were randomised to STan however, these were not statistically significant with the exception of the subscales examining staff competency and future monitoring preference. The median perceived staff competency score was significantly higher in the STan group relative to the CTG alone group, U = 4436, z= -2.22, *p*=0.03. Women randomised to STan were also significantly more likely to disagree with the statement that they would prefer a different type of monitoring than those randomised to CTG, U=4271, z=-2.53, *p*=0.01.

Table 8

*Satisfaction with Fetal Monitoring: Women Randomised to STan versus CTG alone*

| **S-EFM[1] Scores** | **STan N=113**<br>**n[#]**<br>**Mean (SD)** | **CTG alone N=94**<br>**n[#]**<br>**Mean (SD)** | **Difference in means (95% CI)** |
|---|---|---|---|
| **Total** | n=105<br>42.56(6.81) | n=82<br>41.04(7.33) | 1.53 (-3.57 to 0.53) |
| **Sub dimensions** | | | |
| Trust | n=113<br>4.26(0.66) | n=93<br>4.09(0.89) | 0.17 (-0.39 to 0.04) |
| Staff competency* | n=113<br>4.27(0.78) | n=94<br>3.94(1.05) | 0.33 (-0.58 to -0.08) |
| Recommend | n=113<br>4.09(0.88) | n=94<br>3.87(1.04) | 0.22 (-0.49 to 0.05) |
| Comfort | n=112<br>3.94(0.96) | n=94<br>3.85(1.07) | 0.08 (-0.37 to 0.19) |
| Positive experiences | n=112<br>4.15(0.76) | n=94<br>3.99(0.96) | 0.16 (-0.40 to 0.07) |
| Movement | n=113<br>3.19(1.25) | n=94<br>3.12(1.11) | 0.08 (-0.37 to 0.19) |

| S-EFM[1] Scores | STan N=113<br>n[#]<br>Mean (SD) | CTG alone N=94<br>n[#]<br>Mean (SD) | Difference in means<br>(95% CI) |
|---|---|---|---|
| Choice | n=113<br>4.24(0.83) | n=94<br>4.07(0.92) | 0.16 (-0.40 to 0.08) |
| Non-invasive | n=113<br>3.65(0.98) | n=94<br>3.48(1.24) | 0.17 (-0.46 to 0.12) |
| Acceptable | n=113<br>4.33(0.67) | n=94<br>4.10(0.84) | 0.23 (-0.44 to -0.02) |
| Future preference* | n=113<br>3.54(0.99) | n=94<br>3.17(1.11) | 0.37 (-0.66 to -0.08) |
| FSE concerns | n=107<br>3.12(1.24) | n=83<br>3.04(1.27) | 0.09 (-0.45 to 0.28) |

[#] Numbers vary with missing data for one or more of the subscale questions.

* Subscales with statistically significant differences in mean outcomes

[1] Satisfaction with electronic fetal monitoring

### 5.6.3 Women's experiences with fetal monitoring

#### *5.6.3.1 Positive experiences with fetal monitoring (STan versus CTG alone)*

Results from the qualitative analysis comparing positive experiences of women randomised to STan versus CTG alone, highlighted that the primary difference in their birthing experience appeared to be differentiated by the utilisation (or not) of the FSE (the FSE is always utilised with STan and when clinically necessary with CTG). The most prevalent theme identified by women regardless of trial arm was reassurance, this was related to hearing the baby's heart rate and knowing the baby was safe (STan P1; CTG P1). Another common theme in both trial arms was that monitoring provided additional information to staff about the baby's wellbeing which subsequently increased women's feelings of reassurance and safety (CTG P2; STan P3). Women randomised to STan described the monitoring to be a more accurate and consistent form of fetal surveillance, and this was typically explained in the context of other monitoring experienced earlier in their labour prior to randomisation, which could have included external CTG (STan P2).

Women in the CTG alone arm who received an FSE reported that the addition of the FSE was a more accurate form of fetal surveillance and this was commonly discussed in comparison to their experiences with the CTG external transducer belts alone at earlier stages of their labour (CTG P3). The same women described that the addition of the FSE increased their mobility, in comparison to the CTG external transducer belts alone (CTG P4). Mobility was also described by women in the STan arm; in particular, they reported increased mobility with the use of STan as a result of the constant monitoring it was able to provide without [a CTG monitor] moving on the abdomen and losing contact with the baby's heartrate (STan P5). For women in the CTG arm who required an FSE, the FSE was discussed as a favored addition to the

external CTG alone (CTG theme P5) and was described as improving overall comfort (CTG theme P6). A few women specifically stated that the FSE reduced invasiveness of monitoring as once applied, the staff did not need to continue to move the external bands to find the baby's heart rate (CTG theme P7). Similar to this, women in the STan arm were more likely to report increased comfort provided by the monitoring which related to not having to adjust external monitoring belts (experienced prior to randomisation with CTG) as well as to having one less strap around their abdomen (STan theme P4).

Table 9

*Content Analysis of Positive Experiences: Women Randomised to CTG alone (N=75)*

| **Code** | **Theme** | **Direct quote example** | ***n* (%) of participants** |
|---|---|---|---|
| CTG P1 | Reassurance provided my monitoring | "I was reassured my baby was being well during the labour which also made me feel more relaxed knowing there were no complications". | 27 (36%) |
| CTG P2 | Providing information to staff about baby's wellbeing | "Providing a clearer picture to the healthcare team of the health of my baby". | 13 (17%) |
| CTG P3 | Increased accuracy, particularly with the addition of the FSE | "The monitoring around my belly was not working to detect baby heart rate, so the FSE gave accurate detection". | 10 (13%) |
| | | | 8 (11%) |

| Code | Theme | Direct quote example | *n* (%) of participants |
|---|---|---|---|
| CTG P4 | Increased mobility with the use of the FSE | "I was able to move around more easily knowing we would still be tracking my baby without any hassle of the monitors coming off or bub moving around and having to always move monitors around" | |
| CTG P5 | Improved monitoring with the inclusion of the FSE | "I had difficulty being able to move freely with the other monitors [CTG external] and they kept losing my baby as I moved around with labour. The FSE meant I could just concentrate on contractions rather than being concerned with constantly adjusting the monitoring". | 8 (11%) |
| CTG P6 | Increased and improved comfort with the FSE | "Didn't have to hold the monitor [CTG transducer belts] on my belly" | 5 (7%) |

Note: (%) does not sum to 100 as women's responses may have been classified under numerous themes or may not have contributed to a theme.

Table 10

*Content Analysis of Positive Experiences: Women Randomised to STan (N=102)*

| Code | Theme | Direct quote example | *n* (%) of participants |
|---|---|---|---|
| STan P1 | Reassurance – increase in knowledge, sight and sounds of baby's heart rate | "The positive was that I knew my baby was being monitored as well as possible". | 47 (46%) |
| | | | 21 (21%) |

| Code | Theme | Direct quote example | *n* (%) of participants |
|---|---|---|---|
| STan P2 | Accurate and consistent monitoring | "Unlike the CTG, the STan monitor moved with my child, meaning her heartbeat was never lost and I never found myself worrying unnecessarily". | |
| STan P3 | Increased information for staff about baby's wellbeing | "Recording to staff better monitoring covering more aspects, which made me feel secure". | 13 (13%) |
| STan P4 | Increased comfort - not having to adjust external CTG monitoring, one less strap | "Not having to readjust the monitors on my belly all the time to check vitals". | 6 (6%) |
| STan P5 | Increased mobility | "Being able to move around as required without stressing that the monitor would lose babies heart rate". | 5 (5%) |

Note: (%) does not sum to 100 as women's responses may have been classified under numerous themes or may not have contributed to a theme.

*5.6.3.2 Negative experiences with fetal monitoring (STan versus CTG alone)*

Women's negative experiences were similar across both arms of the trial. The majority of women in both treatment arms described the monitoring they received as restricting their movement. In the CTG arm, this restriction was described in relation to the external form of CTG losing contact upon movement, which in turn discouraged further movement (CTG N1). In comparison, for women in the STan arm this was related to concerns of the FSE detaching from the baby's head (STan N1). Many women in the STan arm described visible marks left on their baby's head from the FSE

and their concerns and worries about this. Such marks were often unexpected as women felt that they were not made aware of the potential of this occurring (STan N2).

This theme was also evident in reports by women in the CTG alone group who required an FSE (CTG N3); these women described concerns about it causing harm to the baby or discomfort with the application (STan N4; CTG N4). This was a more prevalent theme in reports from women in the STan arm (STan N3) compared to the CTG alone arm (CTG N5), most likely due to fewer women in the CTG arm requiring an FSE. Some women in the CTG group who required an FSE described several attempts having to be made by staff to attach the FSE, causing discomfort and distress (CTG N2). This was also described by women in the STan arm, however, it appeared to be less of a concern (STan N6). A small number of women in both arms of the trial described the technologies as invasive (STan N5; CTG N6).

Table 11

*Content Analysis of Negative Experiences: Women Randomised to CTG alone (N=56)*

| **Code** | **Theme** | **Direct quote example** | ***n* (%) of participants** |
|---|---|---|---|
| CTG N1 | Restricted movement | "Very restrictive with movement. Wanted to sit up and lean forward but kept losing contact". | 21 (38%) |
| CTG N2 | Issues with application of FSE when required | "Required 3 different people to attempt to attach head clip before it was successful. Insertion of clip was very distressing". | 8 (14%) |

| Code | Theme | Direct quote example | *n* (%) of participants |
|---|---|---|---|
| CTG N3 | Marks left of baby's head from FSE | "My son has permanent scaring on his head. I have been told the clip was put in far too deep" | 6 (11%) |
| CTG N4 | Idea of FSE, confronting | "I didn't like the idea that it was inserted, and something attached to my babies scalp". | 5 (9%) |
| CTG N5 | Discomfort generally and with insertion of FSE | "Putting the monitor on baby's head is uncomfortable but only during placement not after". | 6 (11%) |
| CTG N6 | FSE invasive | "Initial invasion to attach the FSE". | 4 (7%) |

Note: (%) does not sum to 100 as women's responses may have been classified under numerous themes or may not have contributed to a theme.

Table 12

*Content Analysis of Negative Experiences: Women Randomised to STan (N=66)*

| Code | Theme | Direct quote example | *n* (%) of participants |
|---|---|---|---|
| STan N1 | Restricted movement | "Restricted movement. I was concerned it would 'rip out' if I pulled it when moving around. In the peak of the contractions it was distracting and a bit frustrating'. | 17 (26%) |
| STan N2 | FSE left visible markings | "My little girls has a scar on her head". | 13(20%) |
| STan N3 | Discomfort of application with FSE | "Insertion of monitoring was uncomfortable just like all the other internal examinations". | 10 (15%) |
| STan N4 | Concerns with the FSE | "Worried about baby being in pain when inserted". | 8 (12%) |
| STan N5 | Invasive | "Having a device/cord attached to baby is a bit invasive". | 6 (9%) |
| STan N6 | Staff having issues with application the FSE | "Had to have it done a few times one midwife was not confident with her placement'. | 4 (6%) |

Note: (%) does not sum to 100 as women's responses may have been classified under numerous themes or may not have contributed to a theme.

### 5.6.4 Post hoc subgroup analysis

As a consequence of our findings highlighting the importance of the FSE as a differentiating factor of birthing experience it was decided (post hoc) that comparisons of satisfaction with fetal monitoring would be made between women who had an FSE ($n$=176) versus those who did not ($n$=31), regardless of randomisation arm. Interestingly, the only statistically significant difference among the subscales for satisfaction related to movement. Women who had an FSE were more likely to disagree with the statement that the fetal monitoring restricted their movement, U=2054, z=-2.25, $p$=0.03.

## 5.7 Discussion

Against a backdrop of several RCTs worldwide examining the clinical outcomes of STan, this is the first comprehensive trial to include women's perspectives, with our hypothesis being that STan will be clinically advantageous, thus resulting in improved psychosocial outcomes (Turnbull et al., 2019). This paper focussed on satisfaction with the birth experience overall as well as that with the fetal surveillance methods. Our findings show that while there were no clear statistically significant differences between the two groups in satisfaction with the overall birth, responses about experiences with fetal monitoring tended to favour women randomised to the STan group.

In particular women randomised to STan were statistically significantly more likely to perceive staff as competent when facilitating the monitoring compared to women randomised to CTG alone. They were also were statistically significantly more likely to disagree with the statement that they would prefer a different type of monitoring in future labours. A similar homogeneity of effect in favour of STan, albeit non-statistically significant, was observed for the other nine items in the purpose-designed scale measuring satisfaction with fetal surveillance. Considered together, these

findings indicate that STan is at least acceptable as CTG alone from women's perspectives and preferable in some specific respects.

The results on perceived staff competency are noteworthy and warrant some comment. It is the case that STan provides additional information to staff (relative to CTG alone) and the accompanying protocols require them to respond to these signals in a systematic way, for example by moving and repositioning women in their bed. It may be that this interaction between staff and women, which includes extra attention, prompt responsiveness to the clinical situation and staff involvement, leads to a perception by women that they are receiving higher quality care. These views could also account for the greater likelihood by women allocated to STan that they would not prefer a different type of monitoring in future labours. At the same time, a somewhat surprising and reassuring finding was that STan was not perceived as a more invasive form of fetal surveillance. This is especially so given that staff have consistently expressed concerns about the invasiveness of the FSE and have viewed this as a potential barrier to recruitment to the trial. Certainly, some thought into the dissemination of these findings reported by the consumers themselves should be considered and incorporated into an information booklet on monitoring designed to inform women on options for fetal surveillance.

A key strength of our research was the inclusion of quantitative and qualitative analyses permitting us to triangulate our findings. The qualitative data provides some insights into the key positive and negative aspects of both forms of fetal surveillance and interestingly, shows similar results in so far as both forms of monitoring afford women the same benefits, notably reassurance and the same drawback, some restriction in movement. Analysis shows that women in the CTG arm who had an FSE, reported very similar experiences to women in the STan arm (an FSE is not always required with

CTG, however is always required with STan). These findings are in line with our previous qualitative study of a thematic analysis of the reports of thirty-two women about their experiences with the fetal surveillance received in the current trial (Benton et al., 2019).

While our post hoc subgroup analysis should be considered with some caution, it does shed some extra insight into women's experiences. Of note is the finding that women who had an FSE, irrespective of monitoring type were more likely to disagree that they had restricted movement. By comparing in this trial, women who had an FSE with those who did not (regardless of monitoring type), we have been able to provide some validation of the earlier findings suggesting that the application of the FSE is not as detrimental as originally thought and indeed might confer some benefit. This benefit in terms of CTG is related to improved opportunities for movement when compared with having to minimise changes to position in order to keep the CTG belt in place.

Despite providing women with different options for completing questionnaires, including post and online options, as well as making multiple personalised contacts through mail and mobile reminders, the response rate to the survey was lower than anticipated. Research has shown a significant decline in response rates to surveys in the last thirty years (National Research Council, 2013) particularly in the field of maternal and infant health (Harrison et al., 2019). Despite this low response rate, characteristics of questionnaire responders appeared to be similar to those for non-responders. Furthermore, while all significant results must be duly noted, we acknowledge that no corrections for multiple testing were made for our many tests of comparison.

## 5.8 Conclusion

This study is the first to comprehensively examine women's satisfaction with STan as part of a RCT. While ultimately the decision to implement STan in Australia

will likely be based on considerations of clinical efficacy and cost effectiveness, policy makers can be assured that STan results in, at the very least, comparable outcomes in terms of general satisfaction with the experience of labour as well as monitoring. Furthermore, results of the current study challenge the myths and concerns that both women and care providers may have in relation to STan about the use of the FSE. Ultimately the findings from this trial should be incorporated when developing consumer-based information about intrapartum fetal surveillance.

# CHAPTER 6. PSYCHOSOCIAL OUTCOMES OF A COHORT OF WOMEN PARTICIPATING IN THE STAN AUSTRALIAN RANDOMISED CONTROLLED TRIAL

## 6.1 Statement of Authorship

*Title of paper:* Psychosocial outcomes of a cohort of women participating in the STan Australian Randomised Controlled Trial.

*Publication status: Unpublished work* written in manuscript style

*Publication details:* N/A

### 6.1.1 Principal author

*Name of principal author (candidate):* Madeleine Benton

*Contribution to the paper:* Devised study aims with supervisors. Planned and carried out data collection and analysis. Wrote manuscript and acted as corresponding author.

*Overall percentage (%):* 85%

*Certification:* This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.

*Signature:* *Date:17.7.20*

### 6.1.2 Co-author contributions

By signing the Statement of Authorship, each author certifies that:

x. the candidate's stated contribution to the publication is accurate (as detailed above);

xi. permission is granted for the candidate in include the publication in the thesis; and

xii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

*Name of co-author:* Prof. Deborah Turnbull

*Contribution to the paper:* Supervised development of the work. Provided guidance on the preparation of manuscript and editorial and structural feedback on the paper.

*Signature:* *Date:17.7.20*

*Name of co-author:* Dr. Amy Salter

*Contribution to the paper:* Supervised development of the work and input regarding analysis of data. Provided guidance on the preparation of manuscript and editorial and structural feedback on the paper.

*Signature:* *Date: 17.7.20*

*Name of co-author:* Dr. Bronni Simpson

*Contribution to the paper:* Assisted with participant recruitment. Provided guidance on the preparation of manuscript and editorial and structural feedback on the paper.

*Signature:* *Date:17.7.20*

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*Contribution to the paper:* Provided guidance on the preparation of manuscript and editorial and structural feedback on the paper.

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## 6.2 Paper

# Psychosocial outcomes of a cohort of women participating in the STan Australian Randomised Controlled Trial.

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## 6.3 Abstract

Background: In an Australian-first randomised controlled trial (RCT), two techniques for intrapartum fetal surveillance are being compared; ST analysis (STan) monitoring (cardiotocographic plus STan) compared to cardiotocographic (CTG) monitoring alone. The aim is to determine if STan can reduce emergency caesarean section rates whilst maintaining or improving neonatal outcomes. We also plan to compare clinical, economic, and psychosocial outcomes, with this article presenting results of psychosocial outcomes from a cohort of women enrolled in the trial.

Methods: The study was conducted at one tertiary referral hospital. Women who had taken part in the trial from the outset were invited to complete a questionnaire between March 2018 and January 2020 approximately eight weeks after giving birth to examine depression, psychological distress, health related quality of life, and infant feeding practices. Analysis was by intention to treat.

Results: 207/527 participants completed the questionnaire (*n*=113, STan; *n*=94, CTG alone). Overall, no statistically significant or clinically meaningful differences were found in the two groups for measures of depression, psychological distress, quality of life, and infant feeding. The only statistically significant difference was for the sub-scale of pain-discomfort where scores were higher on average in the CTG alone arm relative to than in the STan arm.

Conclusions: Despite STan and CTG alone constituting different clinical technologies, both monitoring types appeared to produce similar results in terms of psychosocial outcomes for women. The findings will contribute to providing women and staff with a comprehensive assessment of STan monitoring upon which they can make evidence – based decisions about monitoring options should STan become more widely available.

*Keywords:* Fetal surveillance, psychosocial, women's health; randomised controlled trial

## 6.4 Introduction

Cardiotocography (CTG) is one of the most common procedures undertaken during labour, and has been reported in some settings to be applied in 70% of all labours (East et al., 2015). Despite being a ubiquitous method of monitoring, significant short comings of the technology exist (Paterno et al., 2016). In particular, CTG has a high false positive rate (i.e. low specificity) of up to 60% which means that more often than not, it will indicate fetal compromise in cases when it is not present, which can potentially lead to unnecessary interventions such as delivery via emergency caesarean section (Chandraharan & Arulkumaran, 2007). One-third of Australian women now deliver via caesarean section (Australian Institute of Health Welfare, 2019), with emergency caesarean section rates in some Australian hospitals of approximately 18% (Pregnancy Outcome Unit, 2019).

In order to increase specificity and reduce unnecessary interventions, extensive clinical research has led to the development of ST analysis (STan) monitoring technology (Rosén & Lindecrantz, 1989). STan is used in conjunction with standard CTG monitoring and includes analysis of the ST segment of the fetal electrocardiogram. As such, it may provide additional information regarding fetal wellbeing during labour relative to CTG alone, allowing for a more definitive diagnosis of fetal distress and considerable potential to reduce unnecessary operative births (Sacco et al., 2015; Timonen & Holmberg, 2018).

CTG can be carried out both externally and internally. The external method collects and records information about the fetal heart rate and mother's contractions using a belt-mounted doppler transducer worn around the woman's abdomen (Alfirevic

et al., 2013; Chandraharan & Arulkumaran, 2007). When the signal from this external method of CTG is of insufficient quality or is difficult to interpret from poor signal quality, an internal method can be used which involves the attachment of a fetal scalp electrode (FSE) directly to the unborn baby. Similar to internal CTG monitoring, STan monitoring requires the placement of the FSE to detect and allow interpretation of the fetal ECG (Belfort et al., 2015; Sacco et al., 2015). However, unlike CTG, the FSE is always required when using STan monitoring (Sacco et al., 2015).

In an Australian-first randomised controlled trial (RCT), STan monitoring (cardiotocographic plus STan), referred to from here on as STan, is being compared with cardiotocographic (CTG) monitoring alone to determine if STan can reduce emergency caesarean section rates whilst maintaining or improving neonatal outcomes (Turnbull et al., 2019). In line with the hypothesised reduction of emergency caesarean section with STan, a secondary hypothesis was that STan monitoring will result in improved psychosocial outcomes for women (Turnbull et al., 2019). In this article we present the findings of the psychosocial outcomes for a cohort of women who participated in the trial from the outset.

## 6.5 Methods

### 6.5.1 Participants and setting

The trial was conducted at the Women's and Children's Hospital, a high-risk specialty facility with approximately 5000 deliveries per annum (Women's and Children's Health Network, 2019). Women were eligible for the trial if they were: eighteen years or older; capable of informed consent; literate in English; had a singleton fetus in cephalic presentation. Women were excluded from participating if they: were less than thirty-six weeks gestation; were planning a caesarean birth or required a caesarean due to, for example placenta previa or vasa previa; had contraindications for

use of a fetal scalp electrode; did not require continuous electronic fetal monitoring; had participated in the study in a previous pregnancy; or if there were known fetal structural or functional cardiac conditions. Consenting participants received fetal monitoring if it was deemed clinically necessary, at which point they were randomised to receive either STan or CTG alone, on an allocation ratio of 1:1 with stratification for parity using a remote phone-based randomisation procedure (Turnbull et al., 2019). It should be noted that a sample size calculation was not conducted. This was a pragmatic decision based on feasibility and the fact that the study was exploratory and not powered on a particular outcome.

### 6.5.2 Psychosocial outcomes questionnaire

Between March 2018 and January 2020, women who had taken part in the trial from the outset were sent a precursor invitation letter six weeks after giving birth. One week later, a study pack, including a questionnaire was sent to women. Two methods of responding were offered including a paper questionnaire to be returned by post or access to an online questionnaire. Tailored reminders (i.e. addressing the woman by her name) were sent to non-responders including another study pack approximately ten weeks after birth, and an SMS approximately three weeks after that.

The questionnaire examined a number of psychological and health outcomes of which postnatal depression, psychological distress, health related quality of life, and infant feeding are examined in this paper. Scales included: Edinburgh Postnatal Depression Scale (EPDS) (Cox et al., 1987); General Health Questionnaire-12 (GHQ-12) (Golderberg & Williams, 1988); EuroQol-5 dimensions (EuroQol, 1990); and Infant Feeding Practices (Noel-Weiss et al., 2014). The questionnaire also included demographic questions.

### 6.5.3 Data analysis

Data were analysed with the researcher blinded to the identity of treatment group (rather ‘apples’ versus ‘oranges’) and according to the intention to treat principle. Group differences in means for the following scales were examined by independent-samples *t*-tests: EPDS; EQ-5D (measured using a continuous visual analogue scale), and GHQ-12 overall scores. Mann-Whitney U tests were run to examine group differences in medians for ordinal data in the GHQ-12 and subscales of the EQ-5D. A chi-square test for association was conducted between categorical variables randomised group and type of infant feeding. A $p$-value of $\leq 0.05$ was considered statistically significant. Statistical analyses were conducted with SPSS version 19.0 (SPSS Inc., Chicago).

### 6.5.4 Ethical considerations

Human Research ethics approval was gained from both Women's and Children's Hospital Network Human Research Ethics Committee and the University of Adelaide Human Research Ethics Committee (HREC/17/WCHN/14).

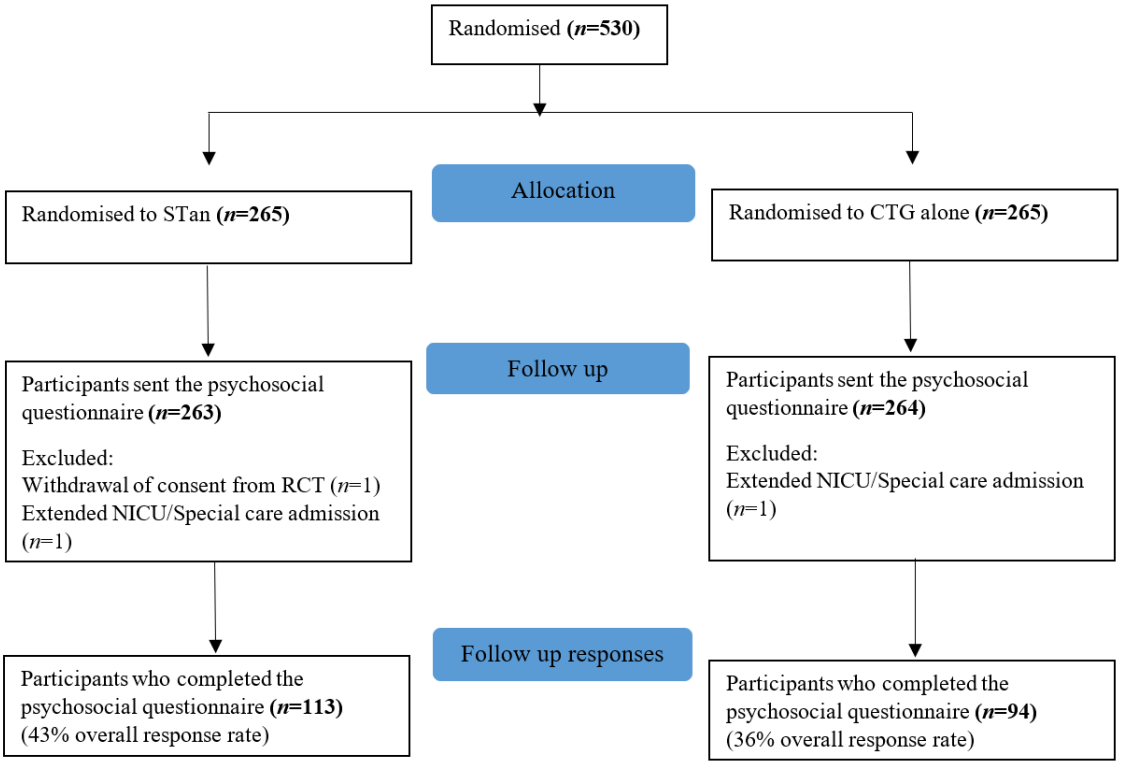
## 6.6 Results

### 6.6.1 Participants

The questionnaire was sent to 527 women (STan: 263, response rate: 43%; CTG alone: 264, response rate: 36%), after excluding invitations to two women whose infants had extended neonatal intensive care (NICU) or special care admissions and were only recently discharged from hospital when the questionnaire was due for mailing and to one woman who withdrew consent for trial participation after randomisation (Figure 5). Of the cohort of participants who completed the questionnaire, 113 were randomised to STan (54.9%) and 94 were randomised to CTG alone (45.4%). 149 women completed the questionnaire on paper and 57 women utilised the online option. Similar

demographic characteristics were observed for women who responded to the questionnaire compared with those who did not. The mean age of responders was 31.80 years (vs 30.29 years for non-responders). The median parity for responders and non-responders in each randomised treatment arm was one. The demographic and clinical characteristics of women were similar in both arms of the trial and 96.5% of women randomised to STan compared with 71.3% randomised to CTG alone had an FSE (Table 13 and 14).

*Figure 5.* Flow of the subset of women from the START RCT eligible to participate in the psychosocial study.




*Note:* While non-compliance is anecdotally known to be present, this is not reported in the flow diagram as an intention to treat analysis is intended and participant data will remain blind to researchers until the trial concludes and the main analysis is conducted.

Table 13

*Demographic Characteristics of Women Allocated to STan versus CTG alone*

| **Characteristics** | **STan (N=113)** n (%) | **CTG alone (N=94)** n (%) |
|---|---|---|
| Marital status | | |
| Married /de facto | 102 (90.3%) | 86 (91.5%) |
| Single (family supported) | 6 (5.3%) | 1 (1.1%) |
| Single (unsupported) | 4 (3.5%) | 6 (6.4%) |
| Language spoken at home | | |
| English | 83 (73.5%) | 65 (69.1%) |
| Other language | 30 (26.5%) | 28 (29.8%) |
| Education | | |
| Bachelor's degree or higher | 61 (54%) | 49 (52.2%) |
| Post high school training | 36 (31.9%) | 30 (31.9%) |
| High school only | 15 (13.3%) | 13 (13.8%) |
| Other | 1 (.9%) | 2 (2.2%) |
| Employment | | |
| Full time | 53 (46.9%) | 42 (44.7%) |
| Part time | 25 (22.1%) | 17 (18.1%) |
| Casual | 14 (12.4%) | 7 (7.4%) |
| Not employed | 21 (18.6%) | 28 (29.8%) |
| Parity | | |
| 1 | 77 (68.1) | 60 (63.8%) |
| 2 | 25 (22.1%) | 23 (24.5%) |

| Characteristics | STan (N=113) n (%) | CTG alone (N=94) n (%) |
|---|---|---|
| 3 or more | 11 (9.7%) | 11 (11.7%) |
| Age | *Mean*=31.80 (*SD*=4.80) | *Mean*=32 (*SD*=4.62) |

Table 14

*Clinical Characteristics of Women Allocated to STan versus CTG Alone*

| Characteristics | STan (N=113) n (%) | CTG alone (N= 94) n (%) |
|---|---|---|
| Epidural | | |
| Yes | 94 (83.3%) | 76 (80.9%) |
| Onset of labour | | |
| Spontaneous | 16 (14.2%) | 14 (14.9%) |
| Induced | 90 (79.6%) | 71 (75.5%) |
| Augmented | 7 (6.2%) | 9 (9.6%) |
| FSE | | |
| Yes | 109 (96.5%) | 67 (71.3%) |

### 6.6.2 Psychological outcomes

No statistically significant or clinically relevant differences in mean participant scores for women's psychological outcomes were found between the two groups on the EPDS, measuring postnatal depression (Table 15), or the GHQ-12, measuring psychological distress, or any of the subscales of the GHQ-12 (Table 16).

Table 15

*Postpartum Depression Scores of Women Allocated to STan And CTG Alone*

| **Edinburgh Postnatal Depression Scale** | **STan (N=113) n (%)** | **CTG alone (N=93) n (%)** |
|---|---|---|
| **Score** | | |
| <9 | 93 (82.3%) | 76 (80.9%) |
| 10-12 (distress) | 13 (11.5%) | 9 (9.6%) |
| 13 + (major depression) | 7 (6.2%) | 8 (8.5%) |
| Item 10 (suicidal ideation) | 5 (4.5%) | 9 (9.5%) |
| Mean score (SD) | 5.55 (*SD*= 4.45) | 5.58 (*SD*= 4.84) |

Table 16

*Results of the General Health Questionnaire Measuring Psychological Distress of Women*

| **GHQ-12** | **STan (N=113)** n* mean *(SD)* | **CTG alone (N=94)** n* mean *(SD)* |
|---|---|---|
| **Total score** | *n* = 107 10.60*(4.1)* | *n* = 92 10.40*(5.07)* |
| **Subscales** | | |
| Social dysfunction | *n* = 111 5.67*(2.20)* | *n* = 94 5.81*(2.69)* |

| | | |
|---|---|---|
| Anxiety | *n* = 111<br>3.80*(1.81)* | *n* = 92<br>3.53*(1.91)* |
| Loss of confidence | *n* = 111<br>1.17*(85)* | *n* = 94<br>1.14*(1.23)* |

*Numbers vary with missing data for one or more of the subscales.

Note: Higher scores indicate lower levels of psychological health.

### 6.6.3 Physical outcomes

No statistically significant or clinically meaningful differences were found in mean participant scores (measured using a visual analogue scale) on the EQ-5D for the two groups (see Table 17). The same was found for subscales of this measure with the exception of the pain-discomfort subscale reported on around eight weeks postpartum (see Table 18). The median score on this subscale was statistically significantly higher in the CTG alone arm than in the STan arm $U$ = 3982.5, z= -3.49, $p$=0.00. Over 50% of women in both groups were primarily breastfeeding, while 23% of women in the STan group, compared to 33% of women in the CTG alone group were primarily bottle feeding. Overall, no statistically significant differences were found between the two groups in relation to infant feeding (Table 19).

Table 17

*EQ-5D Scores Measuring Quality of Life of Women Allocated to STan and CTG Alone*

| **Health Status** | **STan (N=112)**<br>mean *(SD)* | **CTG alone (N=92)**<br>mean *(SD)* |
|---|---|---|
| EQ-VAS Score | 79.61*(11.90)* | 79.04*(14.34)* |

*Note:* Higher scores indicate higher self-reported health status.

Table 18

*EQ-5D Scores Measuring Quality of Life of Women Allocated to STan and CTG Alone*

| **Health Status** | **STan (N=113)** n (%) | **CTG alone (N=94)** n (%) |
|---|---|---|
| Mobility | | |
| Level 1 (No problems) | 101 (89.4) | 78 (83%) |
| Level 2 (Slight problems) | 10 (8.8%) | 14 (14.9%) |
| Level 3 (Moderate problems) | 1 (0.9%) | 1 (1.1%) |
| Level 4 (Severe problems) | 0 | 1 (1.1%) |
| Level 5 (Extreme problems) | 1 (0.9%) | 0 |
| Self-care problems | | |
| Level 1 (None) | 111 (98.2%) | 88 (93.6%) |
| Level 2 (Slight) | 2 (1.8%) | 5 (5.3%) |
| Level 3 (Moderate) | 0 | 0 |
| Level 4 (Severe) | 0 | 1 (1.1%) |
| Level 5 (Extreme) | 0 | 0 |
| Usual activities | | |
| Level 1 (None) | 88 (77.9) | 67 (71.3%) |

| Health Status | STan (N=113) n (%) | CTG alone (N=94) n (%) |
|---|---|---|
| Level 2 (Slight) | 22 (19.5%) | 19 (20.2) |
| Level 3 (Moderate) | 2 (1.8%) | 4 (4.3%) |
| Level 4 (Severe problems) | 1 (0.9%) | 3 (3.2%) |
| Level 5 (Extreme problems) | 0 | 1 (1.1%) |
| Pain-discomfort | | |
| Level 1 (No problems) | 71 (62.8%) | 37 (39.45) |
| Level 2 (Slight problems) | 38 (33.6%) | 48 (51.15) |
| Level 3 (Moderate problems | 3 (2.7%) | 4 (4.3%) |
| Level 4 (Severe problems) | 1 (0.9%) | 2 (2.1%) |
| Level 5 (Extreme problems) | 0 | 3 (3.2%) |
| Anxiety/Depression | | |
| Level 1 (No problems) | 73 (64.6%) | 59 (62.8%) |
| Level 2 (Slight problems) | 28 (24.8%) | 26 (27.7%) |
| Level 3 (Moderate problems | 12 (10.6%) | 7 (7.4%) |
| Level 4 (Severe problems) | 0 | 1 (1.1%) |
| Level 5 (Extreme problems) | 0 | 1 (1.1%) |

Table 19

*Infant feeding of women allocated to STan versus CTG alone.*

| Type of infant feeding | STan (N=112) n (%) | CTG alone (N=93) n (%) |
|---|---|---|
| Primarily breastfeeding | 66 (58.4%) | 52 (55.3%) |
| Mixed feeding | 20 (17.7%) | 10 (10.6%) |
| Primarily bottle feeding | 26 (23%) | 31 (33%) |

## 6.7 Discussion

This Australian randomised trial compares the psychosocial outcomes associated with two forms of intrapartum fetal surveillance, specifically STan monitoring and CTG monitoring alone. Despite clinical data indicating the benefit of STan (Amer-Wahlin et al., 2001; Belfort et al., 2015; Ojala et al., 2006; Vayssiere et al., 2007; Westerhuis et al., 2010; Westgate et al., 1992), no studies have comprehensively examined the psychosocial outcomes resulting from this mode of monitoring. The trial (Turnbull et al., 2019) was conducted to address the proposition that a hypothesised reduction in emergency caesarean section, the primary outcome, would be accompanied by improved secondary outcomes in the form of the psychosocial outcomes reported here. Subsequent to the conceptualisation of the trial's hypotheses and prior to finding the current results, we conducted a systematic review which indicates that the relationships between EmCS and psychological sequalae is largely confined to outcomes such as posttraumatic stress disorder (Benton et al., 2019). This, along with the anecdotal non-compliance in the current trial may in part explain our results which indicate largely null results, with the exception of increased pain reported by women in the CTG alone arm.

The results of this study show that women in both arms experienced very similar outcomes on both psychological measures (postnatal depression and psychological distress) and health measures (health related quality of life and infant feeding). Findings demonstrated that there was not only similarity between the two groups but women appeared to be doing relatively well at around eight weeks postpartum. For example, in both groups over 50% of women were primarily breastfeeding and rated their overall health above 79/100 on the EQ-VAS where a score of 100 aligns with the best imaginable health state.

At the same time and notwithstanding the similar group scores for postnatal depression, our participants who were deemed at higher clinical risk, are likely more prone to postnatal depression. In a recent retrospective Australian cohort study of over 50, 000 participants (Khanlari et al., 2019), 3.3% of women had probable postnatal depression (scores of 13 or more on the EPDS) when assessed before six weeks postpartum, two weeks earlier than in the present study. Using the same measure and cut-off scores, this compares with 6.2% of women in the STan group and 8.5% of the CTG alone group. Similarly, about 10% of women in our study (STan: 11.5%; CTG: 9.6%) scored as experiencing postnatal distress (a score of 10-12 on the EPDS), compared with 5.3% of women in the retrospective study (Khanlari et al., 2019).

One of the main strengths of the current study is the use of validated measures including the EPDS, GHQ-12, and EQ-5D. At the same time, despite providing women with different options for completing questionnaires, including post and online versions, as well as making multiple personalised contacts through mail and mobile reminders, response rates were lower than anticipated. In keeping with our experience, research has shown a significant decline in response rates to surveys over the last few decades (National Research Council, 2013), particularly in the field of maternal and infant

health (Harrison et al., 2019). Despite this low response rate, selected characteristics of questionnaire responders appeared to be similar to those for non-responders, suggesting that while generalisability may have been impacted, internal validity was probably reasonable. Furthermore, while the single statistically significant finding is to be duly noted, we acknowledge that no corrections for multiple testing were made for our many tests of comparison.

## 6.8 Conclusion

This study has presented the psychosocial outcomes for a cohort of women who participated in a RCT comparing two techniques for intrapartum fetal surveillance, one of which is new to Australian maternity care. STan and CTG alone appear to produce similar psychological and health outcomes for women on measures of postnatal depression, psychological distress, health related quality of life, and infant feeding. These findings will subsequently be interpreted in conjunction with the clinical outcomes of the trial once it has concluded. If STan is to be implemented in the Australian context, policy makers can be assured that this type of monitoring results in, at the very least, comparable psychosocial outcomes for women.

# CHAPTER 7. DISCUSSION

## 7.1 Preamble

This thesis was conducted alongside the STan Australian Randomised Controlled Trial (START), designed to compare two techniques of intrapartum fetal surveillance: STan versus CTG alone. The aim of START, the first trial of its kind in Australia, is to determine if STan reduces the proportion of Emergency Caesarean Section (EmCS) relative to CTG alone (Turnbull et al., 2019). The START trial is the first comprehensive trial of intrapartum fetal surveillance to include the examination of clinical, economic, and psychosocial outcomes. In line with the potential reduction of EmCS with STan (Wilkinson et al., 2017), a secondary hypothesis of the trial is that STan monitoring will result in improved psychosocial outcomes (Turnbull et al., 2019). A number of associated studies were conducted alongside the trial, with the aim to integrate the perspectives of women and add important contextual value to the clinical results.

At the of time of writing, data collection for the trial is still being undertaken and therefore the clinical outcomes are not discussed in the context of the psychosocial outcomes. Furthermore, an embargo has been placed on this thesis which will be lifted once data analysis of the clinical findings of the trial have been conducted.

As the primary aim of the trial is to see if the proportion of EmCSs can be reduced with STan (relative to CTG alone), it was viewed to be beneficial to first examine EmCS from a psychosocial perspective. Thus, the primary purpose of Study One (Chapter Three) was to identify, collate, and examine the global evidence surrounding women's psychosocial outcomes of EmCS. Following this, two studies were undertaken to examine women's experiences and psychosocial outcomes in the context of the trial. The aim of Study Two (Chapter Four) was to qualitatively examine

women's experiences with the intrapartum fetal surveillance technique they received in the RCT. The primary aim of Study Three was to examine a number of aspects of women's psychosocial outcomes of the RCT approximately eight weeks postpartum. This study provided data for two papers. The first examined satisfaction with monitoring and the birth experience more broadly for women allocated to STan relative to those allocated to CTG alone (Chapter Five) and the second examined a number of psychological and health outcomes for women after the trial (Chapter Six). The following chapter synthesises the major findings across the three studies, summarises the methodological limitations and strengths, discusses the implications of the research, and proposes ideas for future research.

## 7.2 Summary and synthesis of findings

### 7.2.1 Psychosocial outcomes associated with emergency caesarean section

Through the identification, collation, and examination of literature published worldwide, the first study in this thesis (Chapter Three), a systematic review, highlighted the diverse impact that EmCS has on women. The study identified a number of psychosocial outcomes that were consistently reported to be negatively associated with EmCS including post-traumatic stress, health related quality of life, infant feeding, overall experiences, satisfaction, and self-esteem. In particular, there was strong consensus across studies that EmCS contributes to symptoms and diagnosis of post-traumatic stress. Psychosocial outcomes including depression, mother-infant bonding, sexual function, fear, and distress were also identified within individual studies. However, studies examining these particular outcomes reported either mixed findings or only limited evidence of an association between outcome and EmCS.

### 7.2.2 Women's experiences of intrapartum fetal surveillance in the context of the START study

Study Two (Chapter Four), utilised a qualitative methodology involving thirty-two women, and aimed to examine women's experiences with the fetal surveillance they received as part of the trial. Overall, the study found women were very accepting of STan as it was generally perceived and experienced by women as a more accurate form of monitoring than CTG alone. Furthermore, women who experienced STan expressed that knowing they were using newer technology, that had the potential to reduce their chance of intervention, subsequently provided them with additional feelings of safety.

Overall, the FSE was found to be used more frequently than anticipated at the outset of the START RCT, due to clinical indication of need rather than solely to facilitate STan, which led to findings that were not originally expected. Whilst START aims to primarily compare two forms of fetal surveillance from a clinical perspective, this study found that women's lived experiences were not primarily determined by their trial arm allocation, but by whether the FSE was used. Interestingly, it was found that women who had an FSE in the CTG alone arm reported very similar experiences to women in the STan arm of the trial.

In terms of the FSE (which is always used with STan and more often than not used with CTG in START), women described it as reassuring, proving more accurate monitoring, and enabling increased mobility when compared to the belt-mounted ultrasound transducer (utilised for CTG without the FSE) alone. In contrast, the belt-mounted ultrasound transducers were described as reducing mobility, providing less accurate monitoring, causing anxiety, and distracting women. Further insights into the FSE were afforded with women describing initial concerns when the FSE was

introduced to them by midwifery and medical staff. Concerns typically centred around the impact the FSE may have on their baby and women described a lack of adequate information provided in relation to this.

### 7.2.3 Women's psychosocial outcomes of intrapartum fetal surveillance in the context of the START study

Study Three was conducted over a two-year period with a cohort of consecutively recruited women participating in the RCT from March 2018 to January 2020. The mixed-method questionnaire was completed by women approximately eight weeks postpartum and incorporated a number of measures to examine: satisfaction with monitoring and the birth experience, postpartum depression, psychological distress, health related quality of life, infant feeding practices, and open-ended response questions to examine women's positive and negative experiences with the monitoring. The questionnaire was sent to 527 participants and was completed by 207 women (*n*=113/265, STan; *n*=94/265, CTG alone).

This questionnaire provided data for the two subsequent papers. The first paper offers insight into women's satisfaction with birth and monitoring, and the second paper presents findings regarding women's psychological and health outcomes. In the first paper (Chapter Five), findings demonstrate that while there were no clear statistically significant differences between the two randomised groups in satisfaction with the overall birth, responses about women's experiences with fetal monitoring tended to favour women randomised to the STan group. In particular, women randomised to STan were statistically significantly more likely to perceive staff as competent when facilitating the monitoring compared to women randomised to CTG alone. They were also statistically significantly more likely to disagree with the statement that they would prefer a different type of monitoring in future labours. A

similar homogeneity of effect in favour of STan, albeit non-statistically significant, was observed for the other nine items in the purpose-designed scale measuring satisfaction with fetal surveillance. Results from the qualitative component of the questionnaire provide insights into the key positive and negative aspects of both forms of fetal surveillance and interestingly, show similar results in so far as both forms of monitoring afford women the same benefits, notably reassurance and the same drawback, restricted movement. Women in the CTG alone arm who had an FSE reported very similar experiences to women in the STan arm (an FSE is not always required with CTG, however is always required with STan). These findings support those in our previous qualitative study (Chapter Four) examining women's experiences with the fetal surveillance received in the current trial (Benton et al., 2020). As a consequence of our findings highlighting the importance of the FSE as a differentiating factor of the birthing experience, it was decided (post hoc) that comparisons of satisfaction with fetal monitoring would be made between women who had an FSE (*n*=176) versus those who did not (*n*=31), regardless of randomisation arm. Interestingly, the only statistically significant finding among the subscales for satisfaction related to movement. Women who had an FSE were more likely to disagree with the statement that the fetal monitoring restricted their movement. These findings again support the results of the previous qualitative study (Chapter Four).

The second paper derived from Study Three data demonstrated that both monitoring types appeared to produce similar results in terms of psychological and health outcomes for women. However, pain and discomfort scores for women around eight weeks postpartum in the CTG alone arm of the trial were reported to be statistically significantly higher on average compared with women in the STan arm.

Potential reasons for this difference will be further examined once the clinical findings of the START RCT have been reported.

### 7.3 Methodological limitations

A number of potential limitations have been identified, most of which have already been outlined in the four papers. In Study One, methodological limitations included the fact that potentially relevant articles could have been missed if written in languages other than English or indexed in databases other than those chosen. Study One also corroborated previously identified methodological limitations of research into psychosocial outcomes of CS more broadly (DiMatteo et al., 1996). These methodological limitations include reliance on small sample sizes, use of measures of unknown reliability and validity, and the lack of a comparison group or varying comparison groups. Within this systematic review, one of the primary reasons for excluding articles was the failure to specify or differentiate between type of CS for women in a study. As a result of the heterogeneity of these factors, meaningful pooled quantitative analysis of study findings was unable to take place, even for subsets of studies. Overall, this study was able to highlight extensive methodological limitations within existing studies and corroborates the methodological shortcomings in research about CS more generally (DiMatteo et al., 1996). Largely, there appears a paucity of published evidence with consistent measures and adherence to guidelines for reporting (e.g. for cut-scores) which is crucial to rectify in future studies so that future systematic reviews can meaningfully pool data in a quantitative manner to achieve the highest level of evidence.

Methodological limitations in Study Two included its restriction to women expressing an interest in the interview by stating this in the psychosocial questionnaire (Study Three). It is thus possible that women may have been more inclined to

participate when having criticisms they wanted to share and it is also possible that women experiencing an overwhelming amount stress may have been less inclined to participate.

A number of potential limitations have been identified in relation to Study Three, constituting the two papers presented in Chapters Four and Five. Despite utilising a mixed-mode response option (including post and online options), multiple contact points via mail and mobile, and personalisation of information, the response rate to the survey was lower than anticipated (response rate: STan, 43%; CTG, 36%). Reassuringly however, similar baseline characteristics were observed between the responders and non-responders. In keeping with this experience, research has shown a significant decline in response rates to surveys over the last few decades (National Research Council, 2013) particularly in the field of maternal and infant health (Harrison et al., 2019). Possible explanations for this decline in response rates have been proposed including greater time pressures, the increasing number of surveys in circulation, survey fatigue, and privacy concerns (Galea & Tracy, 2007). Recently giving birth and adjusting to life as a new mother may have potentially added additional reasons for low observed response rate in this sample. Overall, the online version of the questionnaire was included to possibly reduce participant burden and increase response rate. It has been suggested that in our technology driven world, online versions of surveys should be included to reduce completion burden, increase reach and to cater for individuals who prefer one option to another (Dillman et al., 2014). Unexpectedly, only 57 participants of 207 utilised the online option. While Dillman et al. (2014) suggest that in this era, a mix-mode response option is favourable, including both a post and online option, it should also be acknowledged that this could complicate decision-

making and lead to individuals taking no action. It is possible this too may have contributed to the low response rate in the current sample.

### 7.4 Consideration of results in the context of the START RCT

In addition to the limitations discussed in relation to each study, some overarching methodological issues warrant further discussion. An important consideration to acknowledge is that at the conclusion of this thesis, enrolment and clinical data collection for the RCT is still in progress; therefore, potentially relevant clinical data was not able to be included within studies such as women's mode of birth (constituting the primary clinical outcome of the RCT). Once the clinical findings of the RCT have been examined and the embargo on this thesis lifted, clinical data where necessary will be interpreted in the context of the findings relating to psychosocial outcomes (Chapter Five and Chapter Six).

Furthermore, despite women in studies Three and Four having diverse demographic characteristics, women were only sampled from one hospital (the START RCT site), thus inevitably affecting generalisability of the findings beyond this setting. Additionally, many of the birthing women at Women's and Children's Hospital have risk factors that may have necessitated periods of continuous CTG monitoring during the antenatal period and thus women may be exposed to more than one monitoring experience during that pregnancy episode which could shape their experience and perception beyond what was directly experienced within the RCT setting.

### 7.5 Strengths of this research

Despite the aforementioned limitations and broader considerations of this work, this research has a number of important methodological strengths.

A key strength of the research was the utilisation of diverse methodologies. Study One comprised a systematic review constituting a rigorous method of research

for summarising evidence from multiple studies on a specific topic (Liberati et al., 2009). The study was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) recommendations (Moher et al., 2009), used an a priori designed study protocol and was registered in the international prospective register of systematic reviews (PROSPERO) database. This approach to data collection ensured that the research was rigorous with relevant literature methodologically identified and summarised, allowing for the study to be easily replicated.

Study Two involved a qualitative study design which followed Tracy's (2010) model for quality and excellence in qualitative research which lends additional credibility to its findings. Furthermore, at a broader level, the importance of incorporating qualitative research alongside RCTs is increasingly acknowledged (Cooper et al., 2014; Snowdon, 2015). Benefits of utilising qualitative methodology in this context include a more comprehensive interpretation of trial findings and exploration of perceptions, feasibility, and acceptability of an intervention (Russell et al., 2016). In this sense it is expected that once the START trial is complete, the qualitative findings will continue to enhance the interpretation, dissemination of the results as well as the necessary action aimed at informing women.

Study Three employed a mixed-method questionnaire, which is ideal for a comprehensive understanding of large cohorts, allows for various methods of instrumentation, and can include different methods of recruitment (Jones et al., 2013; Ponto, 2015). In our case, we were able to target a large group of women, provide different completion options (online or mail), include a number of different measures, open-ended qualitative response options, and collect expressions of interest for the qualitative study (Study Two). Another strength of this study was sending the

psychosocial questionnaire at the specified time of seven weeks and receiving them at approximately eight weeks post birth. This timing was chosen as it has been acknowledged that women could be susceptible to a ‘halo effect’ before this time (Bennett, 1985). The ‘halo effect’ refers to the initial relief and euphoria that women may experience which can result in women being less likely to report negatively about their experiences (Soet et al., 2003).

Incorporating these diverse methodologies alongside the RCT, with a primary focus on clinical outcomes, has provided an exciting opportunity to demonstrate the equally important examination of women's views, experiences, and psychosocial outcomes. Overall, the varied methods of data collection employed in these studies were robust and carefully chosen to result in the production of relevant data to address the research question in each study as well as highlighting the importance of including such methodologies alongside RCTs. Furthermore, the fact that a range of methods were utilised, permitted triangulation of findings of and between studies. The current studies have additionally assisted in responding to recommendations presented in a recent systematic review which explored women’s views and experiences of electronic fetal monitoring during labour (Smith et al., 2017). The review strongly recommended that additional and contemporary research on women’s views of fetal monitoring during labour be urgently undertaken. This systematic review, to our knowledge, is the most recent systematic review that has explored women’s view and experiences of intrapartum fetal surveillance. However, while the review did not include any studies that examined STan as a form of intrapartum fetal surveillance, our future publications aim to address this.

### 7.5.1 Research translation

There is universal acknowledgement that the clinical care provided to individuals should be based on the best available evidence (Curtis et al., 2017). Furthermore, it has been widely affirmed that translating research evidence including views, perceptions, and experiences to clinical practice is essential to safe, transparent, effective healthcare provision and meeting the expectations of individuals, their families, and broader society (Curtis et al., 2017). To date, in addition to research dissemination through conference presentations, findings from Study Two have been presented by the PhD candidate to Midwives at the study institution. These presentations have elicited discussion about concerns Midwives have held about the impact of monitoring on women, and particularly about the invasiveness of the FSE, its perceived consequences on mobility, and the potential for these to be a barrier to recruitment to the trial. Indeed, the results of this study were elicited to challenge the myths and concerns held by some Midwives in relation to the FSE and STan. These talks were both informative for the clinical staff as well as the researcher in how to focus discussions when presenting the research and the most useful and appropriate modes to birth consumer-based information from women's first-hand experiences.

## 7.6 Implications

### 7.6.1 Improving psychosocial outcomes for women after emergency caesarean section

Study One has significant implications for the provision of evidence-based strategies to provide psychosocial support and information about EmCS for women in the context of routine antenatal and postnatal care. The findings highlighted the diverse impact EmCS can have on women's psychosocial outcomes, particularly in relation to traumatic stress with a strong consensus that EmCS contributes to both symptoms and

diagnosis. Broadly, the review underscored implications for clinical practice and research in relation to need for further development of technologies and clinical practices to reduce the number of unnecessary EmCSs, the main aim of the RCT. Findings also highlight the need for appropriate support for women who have experienced EmCS. While high-level research currently exists in this area, for example in the form of routine debriefing to prevent psychological trauma after childbirth (Bastos et al., 2015), it currently fails to show significant evidence of benefit.

While programs for postnatal psychosocial support have been promoted in many countries to improve maternal knowledge about parenting, mental health, quality of life, and physical health, it has been concluded in a systematic review that the most effective strategies remain unclear (Shaw et al., 2006). Overall, Study One provides an imperative step towards implementing targeted and effective strategies to improve women's health and well-being following EmCS.

### 7.6.2 Insights into the fetal scalp electrode

The research also sheds important light on the significance of the FSE and its impact of women's experiences. Overall, the FSE was found to be utilised more frequently than anticipated, due to clinical indication of need rather than solely to facilitate STan. This led to findings that were not originally anticipated within Study Two and motivated a post hoc analysis in Study Three to further examine the FSE. Within Study Two, it was found that women who had an FSE in the CTG alone arm of the trial reported very similar experiences to women in the STan arm of the trial. This Study outlined that women's lived experiences did not appear to be differentiated enormously by trial arm, but by whether the FSE was used.

Overall, benefits of the FSE reported by women included: increased mobility during labour; providing further reassurance; providing increased information for staff,

which lead to increased feelings of safety, allowing women to relax and concentrate on labour. Contrary to these findings, in the previous pilot study conducted by the research group examining pregnant women's hypothetical views about STan monitoring, it was reported that women described feelings of uncertainty and concern in relation to the FSE (Bryson et al., 2017).

Several of the findings from Study Two in terms of the FSE were corroborated in Study Three. The post hoc subgroup analysis within Study Three reveals some extra insight into women's experiences with the fetal surveillance. Of note is the finding that women who had an FSE, irrespective of trial arm were more likely to disagree that they had restricted movement. This post hoc comparison of women who had an FSE versus those who did not (regardless of monitoring type), provides some validation for the findings in Study Two suggesting that the application of the FSE is not as detrimental as originally thought and indeed might confer some benefit. This benefit in terms of CTG appears to be related to improved opportunities for movement when compared with having to minimise changes to position in order to keep the CTG belt in place.

The results of these studies challenge the myths and concerns that both women and care providers may have in relation to STan, about the use of the FSE, in addition to concerns around mobility. Overall, these findings highlight the need for updated consumer information from women's perspectives to elucidate the experience of different monitoring types.

### 7.6.3 Acceptability of STan from women's perspectives and its future use in Australia

Against a backdrop of several RCTs worldwide examining the clinical outcomes of STan alone (Amer-Wahlin et al., 2001; Belfort et al., 2015; Ojala et al.,

2006; Vayssiere et al., 2007; Westerhuis et al., 2010; Westgate et al., 1993), START is the first comprehensive trial to include women's perspectives through the incorporation of Study Two and Three. Despite a large evidence base comparing these two forms of intrapartum fetal surveillance, the focus up until now has been on clinical outcomes, with psychosocial aspects largely overlooked. Furthermore, this is the first time STan has been trialled in Australia, with the Women's and Children's hospital being the only hospital in Australia to have STan technology. Overall, Studies Two and Three indicate that STan is at the very least acceptable from women's perspectives and preferable in some specific respects.

Findings of these studies have significant implications for policy makers and health professionals, as well as implications for standard practice and care. If STan is to be implemented in the Australian context, policy makers can be assured that this type of monitoring results in, at the very least, comparable psychosocial outcomes. Furthermore, these findings may therefore be used to inform staff perspectives and the development of consumer information to best support women to make informed and value-based choices about monitoring methods in labour.

## 7.7 Future research

Some of the issues discussed in the Limitations section give rise to suggestions for future research. For instance, future research in the area of CS and women's psychosocial outcomes will be more robust if there is use of consistent, valid and reliable measures with use of guidelines for appropriate cut-off scores, appropriate comparison groups, adequately powered studies, and differentiation between types of CS. This is crucial to rectify in future studies so that (gold standard) systematic reviews can meaningfully pool data in a quantitative manner. Furthermore,

investigation is needed to develop effective strategies to prepare and support women who experience EmCS.

The research conducted alongside the RCT has produced many directions for future research. Whilst Study Two and Three have provided significant contributions to the examination of women's experiences and outcomes of fetal surveillance, future research of a similar nature should be conducted in other hospital settings to ensure generalisability. This research has also shed light on the importance and value of incorporating a psychosocial perspective to RCTs that very often have an entirely clinical focus. As shown, the benefits gained clearly outweigh any additional effort expended, and therefore it is important that future RCTs consider the inclusion of such methodologies.

An issue that emerged in Study Three that warrants further investigation is the response rate of the questionnaire. Varying completion options (post and online), contact points, and personalisation of information were used however in future, it may also be beneficial if women had the option to consent and complete the questionnaire over the phone. If postal and online questionnaire surveys are to continue to be used to collect vital data on population health, the issue of declining response rates needs to be addressed. In light of this, high quality research is emerging on methods to increase response rates to surveys (Harrison et al., 2019). Additional investigation is required to identify novel strategies for participant engagement, and to offer clear direction on which methods are most effective for maximising questionnaire completions.

## 7.8 Conclusion

The research in this thesis, conducted alongside an Australian-first RCT comparing two forms of intrapartum fetal surveillance, has been the first of its kind to provide insight into women's psychosocial outcomes. While ultimately the decision to

implement STan in Australia will likely be based on considerations of clinical efficacy and cost effectiveness, policy makers can be assured that STan results in, at the very least, comparable outcomes from a psychosocial perspective. The findings of this research should be incorporated when developing consumer-based information about intrapartum fetal surveillance. Furthermore, regular education for all staff that incorporates experiences of women, as identified within the research, will provide a useful opportunity to engage in effective evidence-based practice informed not only by clinical outcomes, but also by views of women receiving this care.

# APPENDIX A. STUDY TWO: PRECURSOR LETTER

Dear

We are writing to you because you recently took part in the START trial (ST-analysis randomised control trial) at the Women's and Children's Hospital.

We would like to thank you for completing the questionnaire in relation to women's psychosocial outcomes of the fetal monitoring received. You expressed interest in being involved in a subsequent study involving a face-to-face individual interview in relation to your experience with the monitoring.

This letter is to inform you that we will be contacting you in the coming weeks in relation to participating in an interview.

We look forward to your potential involvement in this study.

Yours sincerely,

A/Prof. Chris Wilkinson Prof. Deborah Turnbull Miss Madeleine Benton Dr Bronni Simpson

Version 1 29/3/17

# APPENDIX B. STUDY TWO: CONSENT FORM

**WOMEN'S AND CHILDREN'S HEALTH NETWORK (WCHN)**
**HUMAN RESEARCH ETHICS COMMITTEE**

## CONSENT FORM

**Women's Perceptions and Experiences with ST-Analysis for Intrapartum Fetal Monitoring: a Qualitative Study**

**I** _____

**hereby consent to my involvement in the research project entitled: Women's Perceptions and Experiences with ST-Analysis for Intrapartum Fetal Monitoring: a Qualitative Study**

1. The nature and purpose of the research project described on the Information Sheet has been explained to me. I understand it and agree to taking part.
2. I understand that I may not directly benefit by taking part in this study.
3. I acknowledge that the possible risks and inconveniences as outlined in the Information Sheet, have been explained to me.
4. I understand that I can withdraw from the study at any stage and that this will not affect medical care or any other aspects of my relationship with this healthcare service.
5. I understand that there will be no payment to me for taking part in this study. However, I understand I will be reimbursed for any food/drink during the interview.
6. I have had the opportunity to discuss taking part in this research project with a family member or friend.
7. I am aware that I should retain a copy of the Consent Form, when completed, and the Information Sheet.
8. I understand that my information will be kept confidential as explained in the information sheet except where there is a requirement by law for it to be divulged.

   *Your information will remain confidential except in the case of a legal requirement to pass on personal information to authorised third parties. This requirement is standard and applies to information collected both in research and non-research situations. Such requests to access information are rare; however we have an obligation to inform you of this possibility*
9. I understand that the alternate contacts I have provided may be used to contact me as explained in the information sheet for study related purposes.

Concerns and complaints may be directed to the Executive Officer of the Human Research Ethics Committee, Mr Luke Fraser, Research Secretariat, ph: 08 8161 6521.

Signed: .....

Full name of woman: .....

Dated: .....

I certify that I have explained the study to the woman and consider that she understands what is involved.

Signed: ..... Title and name: .....

Dated: .....

# APPENDIX C. STUDY TWO: INFORMATION SHEET

**PARTICIPANT INFORMATION SHEET**

**PROJECT TITLE:** Women's Perceptions and Experiences with ST-Analysis compared to CTG for Intrapartum Fetal Monitoring: a Qualitative Study.
**HUMAN RESEARCH ETHICS COMMITTEE APPROVAL NUMBER:** HREC/17/WCHN/14
**PRINCIPAL INVESTIGATORs:** Associate Professor Chris Wilkinson and Professor Deborah Turnbull
**STUDENT RESEARCHER:** Miss Madeleine Benton
**STUDENT'S DEGREE**: PhD Psychology

**What is the study about?**
You are invited to take part in an individual face-to-face interview in relation to your experiences with the fetal monitoring you received during labour.

**Who is undertaking the study?**
The study is being undertaken by The University of Adelaide in conjunction with the Women's and Children's Hospital. The study is being led by Associate Professor Chris Wilkinson from the Women's and Children's Hospital and Professor Deborah Turnbull from The University of Adelaide. This research will form the basis of PhD in psychology undertaken by Madeleine Benton at The University of Adelaide. This research has been approved by the Women's and Children's Health Network Human Research Ethics Committee HREC/17/WCHN/14.

**Procedures**
You have been invited to participate in the study as you recently completed a psychosocial questionnaire in relation to the fetal monitoring you received during labour and expressed interest in undertaking an interview in a subsequent study.

If you wish to participate in the study a time and location convenient to you will be arranged to complete the interview. Informed consent will be gained immediately before the commencement of the interview. All interviews will be conducted by Madeleine Benton and will be tape-recorded with your permission. The interview will include questions in relation to your experience and satisfaction with fetal monitoring. The interview will last for around 30-45 minutes.

**What are the benefits of the research project?**
Whilst you will not receive financial benefit from involvement in this study, it is expected that the findings of the study will contribute to the introduction of new fetal monitoring technology within

Australia. As well as contribute to our knowledge on women's experiences and satisfaction with the fetal monitoring received.

**Are there any risks associated with participating in this project?**
Due to the nature of this study, negligible risk is expected for participants. You may feel inconvenienced by the time taken to complete the interview, which will take approximately 30-45 minutes. Adjusting to having a new baby is a difficult time; if at any point you feel distressed please contact **Lifeline 13 11 14** or any other support network you wish to access.

**Can I withdraw from the study?**
Participation in this study is completely voluntary. If you agree to participate, you can withdraw from the study at any time. If you choose to withdraw from the study you do not have to give reason. Withdrawal or non-completion of this study will in no way impact your relationship with your healthcare provider.

**What will happen to my information?**
No non-Women's and Children's Health Network staff will have access to your names until you consent to participate in the study. After consenting to this study any contact details will be used to keep in touch with participants if necessary. All details will be stored securely and any electronic data will be de-identified and password protected. You will be asked to provide your name when you consent to participation. This information will be confidentially stored in password protected files. Only the project's researchers will have access to this data. Data will be stored for a minimum of 15 years, as per the National Statement on Ethical Conduct in Human Research. Your information will remain confidential except in the case of a legal requirement to pass on personal on personal information to authorised third parties. This requirement is standard and applies to information collected both in research and non-research situations. Such requests to access information are rare; however, we have an obligation to inform you of this possibility. In any work that is published as a result of this study you will not be personally identified; only aggregated data will be published. Information from this research will also be available at the completion of this research in the form of a plain English statement of the summarised finding. If you would like to receive this summary you are required to provide your email address on completion of the questionnaire, the summary will then be sent to the provided email addresses.

**What if I have questions, complaints or any concerns?**
The study has been approved by the Women's & Children's Health Network Human Research Ethics Committee HREC/17/WCHN/14. If you have questions or problems associated with the practical aspects of your participation in the study, or wish to raise a concern or complaint about the study or the care you received, , we encourage you to contact the Women's and Children's Hospital and a consumer feedback form can be completed on your behalf. This form will then be sent to the Consumer Feedback Coordinator and acted on appropriately. You may also contact the trial coordinator if your concerns relate directly to the fetal monitoring you received during

your labour. Bronni Simpson can be reached by contacting the Women's and Children's Hospital switchboard on 8161 7000, and ask for her to be paged on 5863. Alternatively you can contact the Executive Officer of the HREC by contacting Mr Luke Fraser (phone. 08 8161 6521) if you wish to speak with an independent person regarding concerns or a complaint, the policy on research involving human participants, or your rights as a participant. Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

**Further Information**
If you should become distressed at any time, we have attached contact details of Lifeline, a support network which you may wish to access.

Yours sincerely,

A/Prof. Chris Wilkinson  Prof. Deborah Turnbull  Miss Madeleine Benton  Dr Bronni Simpson

**PLEASE KEEP THIS INFORMATION SHEET AS IT CONTAINS IMPORTANT INFORMATION AND CONTACT DETAILS**

If you experience any distress whilst completing the questionnaire, or have concerns or complaints regarding the study, there are processes and support networks in place, including:

**Women's and Children's Hospital Switchboard:** 8161 7000, for completion of a Consumer Feedback form

**START Coordinator/Research Midwife:** Bronni Simpson, 8161 7000, pager 5863, for any concerns regarding the study

**Women's and Children's Health Network Human Research Ethics Committee, Executive Officer:** Luke Fraser, 8161 6521, for any complaint or concerns regarding the conduct of the study

| | | |
|---|---|---|
| **Lifeline** | **13 11 14** | 24-hour crisis support and suicide prevention services |

# APPENDIX D. STUDY TWO: INTERVIEW SCHEDULE

Version 3_ 12/04/2018

## Women's Perceptions and Experiences with ST-Analysis compared with CTG for Intrapartum Fetal Monitoring: a Qualitative Study

Interview Schedule

## Opening

**a. (Establish Rapport)**:
*My name is Madeleine Benton and I am a PhD candidate from the University of Adelaide. Thank you for agreeing to be interviewed for our research in relation to women's experiences with fetal monitoring.*

**b. (Purpose)**:
*I would like to ask you some questions about your overall experience with fetal monitoring including the care you received and your satisfaction.*

**c. (Time):**
*The interview should take around 30-45 minutes.*

(The interviews will be guided by the following key probes)

## Body

**(Transition:** Let me begin by asking you some questions about your overall experience with the fetal monitoring you received)

**1) Overall Experience**

- Overall experience:
  *1. Can you tell me about your experience with fetal monitoring?*
    - Prompt/Probe:

- Impact of experience:
  *2. How did you feel about receiving the fetal monitoring?*
    - Prompt/Probe:

- 3. *How do you think the fetal monitoring impacted on your labour experience?*
    - Prompt/Probe:

(**Transition** to the next topic: I am now going to ask you some questions in relation to the fetal monitoring more specifically.)

**2) Monitoring Specific Questions**

- *4. What was your experience with the application of monitoring – i.e. fetal scalp clip?*
    - Prompt/Probe:

- 5. Can you tell me about your experience with the monitor itself?
    - Prompt/Probe: Monitor Alerts/Noise

(**Transition** to the next topic: I am now going to ask you some questions in relation to the information you received and you prior knowledge of the fetal monitoring).

**3) Information/Understanding/Education:** Women's understanding of the technology, what did women know prior to monitoring.

- *6. Prior to labour, what did you know about the fetal monitoring you received?*
    - Prompt/Probe:

- *7. Can you tell me about the information you received about the fetal monitoring prior to receiving the monitoring?*
    - Prompt/Probe:

(**Transition** to the next topic: _____)

**4) Risk and feelings of safety**

(**Transition** to the next topic: _____)

- 8. What was your experience of safety and the monitoring you received?
  *(Or how did the monitoring impact your feelings of safety whilst in labour)*
    - Prompt/Probe:

*** 5) Previous experiences of monitoring** (if the women has had previous children and monitoring – as determined on the psychosocial questionnaire)

- *9. You mentioned you received fetal monitoring with your previous labour, how did your previous experience with fetal monitoring influence this one?*
    - Prompt/Probe:

(**Transition** to the next topic: I am now going to ask you some questions in relation to the care you received whilst in labour).

**5) Staff and Care received**

- *10. Can you explain to me what your experience with the staff was like during your labour?*

- Prompt/Probe:

- *11. How did the staff impact on your experience with the monitoring you received?*
  - Prompt/Probe: Experience of staff.

**6) Improvements**

- *12. Do you think there is anything that could have improved your experience with the fetal monitoring?*
  - Prompt/Probe:

## Closing

a. **(Maintain rapport)**:
   *I appreciate the time you have taken to complete this interview. (Summary) It sounds like you had a fairly..... experience with the fetal monitoring you received….Is there anything else you would like to share about your experience with fetal monitoring?*
b. **If you feel at all distressed there are several services you are able to contact. Our research midwife is available at any time (Bronni). The hospital also provide a Consumer Feedback Form you are welcome to complete. We have also provided the contact information of Lifeline on the information sheet.**

**b. (Action to be taken):**
I will write up the transcript from today's interview and send you a copy within the next week to make sure you are happy with it.

**c. Thanks again for your time:**

# APPENDIX E. STUDY THREE: PRECURSOR LETTER

Dear

We are writing to you because you recently took part in START (ST-analysis Australian Randomised Trial) at the Women's and Children's Hospital.

We are inviting all women who were part of START to participate in a subsequent study examining women's psychosocial outcomes of the electronic fetal monitoring received during labour.

This letter is to inform you that, in the coming week, we will be sending you an information pack including a questionnaire. We look forward to your potential further involvement in this study.

Yours sincerely,

A/Prof. Chris Wilkinson Prof. Deborah Turnbull Miss Madeleine Benton Dr Bronni Simpson

Version 3 6/3/18

# APPENDIX F. STUDY THREE: LETTER

Dear

We invite you to participate in a study about your experience with the electronic fetal monitoring you received during labour and your current health.

You recently would have received an information package in the mail regarding your participation in this study. If you have not yet returned the consent form and questionnaire, and you would like to participate in the study, you are still able to do so. If you have already completed the questionnaire we thank you for your time and please disregard this letter.

Included with this letter is an information sheet, consent form and questionnaire. If you are interested in participating, please read all the details in the information sheet. There are two options for completion of the questionnaire:
Option 1: complete the consent form and questionnaire included in this pack and return via the included pre-paid envelope.
Option 2: complete the consent form and questionnaire online, either on a computer or your mobile device, via the link provided below. Your Study ID is also provided below.

As we value your opinions and experiences with electronic fetal monitoring, we also invite you to participate in a face-to-face interview which would be conducted at a time and place convenient for you. If you are interested in participating, please complete the section that is located at the end of the questionnaire.

**Link:** https://start.adelaide.edu.au
**Study ID**: 10xxx

Yours sincerely,

A/Prof. Chris Wilkinson Prof. Deborah Turnbull Miss Madeleine Benton Dr Bronni Simpson

Version 1 29/3/17

# APPENDIX G. STUDY THREE: INFORMATION SHEET

**PARTICIPANT INFORMATION SHEET**

**PROJECT TITLE:** Women's Psychosocial Outcomes of STan compared to CTG Electronic Fetal Monitoring.
**HUMAN RESEARCH ETHICS COMMITTEE APPROVAL NUMBER:** HREC/17/WCHN/14
**PRINCIPAL INVESTIGATORS:** Associate Professor Chris Wilkinson and Professor Deborah Turnbull
**STUDENT RESEARCHER:** Miss Madeleine Benton
**STUDENT'S DEGREE**: PhD Psychology

**YOUR Study ID IS**: 10xxx
**Online questionnaire link:** https://start.adelaide.edu.au

**What is the study about?**
You are invited to take part in this study investigating women's experiences in relation to the electronic fetal monitoring you received during labour. We would also like to know about your current health, both physical and mental.

**Who is undertaking the study?**
The study is being led by Associate Professor Chris Wilkinson from the Women's and Children's Hospital and Professor Deborah Turnbull from The University of Adelaide and coordinated at the Women's and Children's Hospital by Dr Bronni Simpson. This research will form the basis of PhD in psychology undertaken by Madeleine Benton at The University of Adelaide.

**How do I participate?**
You are being invited to participate in the study as you received electronic fetal monitoring during labour and we would like to know about your experience with the electronic fetal monitoring. If you wish to participate we would like you to complete a questionnaire in relation to your experience. Questionnaires are designed to be completed 7 or more weeks after the birth of your baby. The questionnaire should take approximately 20 minutes to complete. The questionnaire will include questions about your health, mental health, wellbeing, and satisfaction with care. In addition to general demographic questions.

There are two options for completion of the questionnaire:
Option 1: complete the consent form and questionnaire included in this pack and return via the included pre-paid envelope.
Option 2: complete the consent form and questionnaire online, either on a computer or your mobile device, via the link provided. Your Study ID is also provided at the beginning of this information sheet.

A follow-up pack will be sent out to individuals who have not returned a questionnaire as a reminder that they are still able to participate in the study. In the case that a questionnaire is received by the research team, which suggest the experience of psychological distress, a follow up phone call will be received by the participant.

**What are the benefits of the research project?**
Whilst you will not receive financial benefit from involvement in this study, it is expected that the findings of the study will contribute to our knowledge of maternal health in relation to electronic fetal monitoring during labour and inform the introduction of a new fetal monitoring technology within Australia.

**Are there any risks associated with participating in this project?**
Due to the nature of this study, negligible risk is expected for participants. You may feel inconvenienced by the time taken to complete the questionnaire at around 7-weeks post delivery, which will take approximately 20 minutes. If at any point you feel distressed please contact **Lifeline 13 11 14** or any support network you wish to access.

**What if my questionnaire results show I might need a follow up for mental health care?**
Please know that because we are asking some questions about your mental health, the Women's and Children's Hospital may contact you and offer you support services such as counselling. You will only be contacted if we find you have high levels of depression or psychological distress.

**Can I withdraw from the study?**
Participation in this study is completely voluntary. If you agree to participate, you can withdraw from the study at any time. If you choose to withdraw from the study you do not have to give reason. Withdrawal or non-completion of this study will in no way impact your relationship with your healthcare provider.

**What will happen to my information?**
No non-Women's and Children's Health Network staff will have access to your names until you consent to participate in the study. After consenting to this study any contact details will only be used to keep in touch with participants if necessary. All details will be stored securely and any electronic data will be de-identified and password protected. You will be asked to provide your name when you consent to participation. This information will be confidentially stored in password protected files. Only the project's researchers will have access to this data. Data will be stored for a minimum of 15 years, as per the National Statement on Ethical Conduct in Human Research. Your information will remain confidential except in the case of a legal requirement to pass on personal on personal information to authorised third parties. This requirement is standard and applies to information collected both in research and non-research situations. Such requests to access information are rare; however, we have an obligation to inform you of this possibility.

In any work that is published as a result of this study you will not be personally identified; only aggregated data will be published. Information from this research will also be available at the completion of this research in the form of a plain English statement of the summarised finding. If you would like to receive this summary you are required to provide your email address on completion of the questionnaire, the summary will then be sent to the provided email addresses.

**What if I have questions, complaints or any concerns?**

The study has been approved by the Women's & Children's Health Network Human Research Ethics Committee HREC/17/WCHN/14. If you have questions or problems associated with the practical aspects of your participation in the study or wish to raise a concern or complaint about the study, please contact the Principal Investigator, Associate Professor Chris Wilkinson or the Research Midwife/Trial Coordinator via the Women's and Children's switch board (phone: 08 8161 7000). Alternatively you can contact the Executive Officer of the Human Research Ethics Committee by contacting Mr Luke Fraser (phone. 08 8161 6521) if you wish to speak with an independent person regarding concerns or a complaint, the policy on research involving human participants, or your rights as a participant. Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

**Further Information**

If you should become distressed at any time whilst completing the questionnaire, we have attached contact details of Lifeline, a support network which you may wish to access.

Yours sincerely,

A/Prof. Chris Wilkinson  Prof. Deborah Turnbull  Miss Madeleine Benton  Dr Bronni Simpson

**PLEASE KEEP THIS INFORMATION SHEET AS IT CONTAINS IMPORTANT INFORMATION AND CONTACT DETAILS**

*Organisations offering support and resources*

If you experience any distress whilst completing the questionnaire there are support networks in place.

| | | |
|---|---|---|
| Lifeline | **13 11 14** | 24-hour crisis support and suicide prevention services |

## APPENDIX H. STUDY THREE: CONSENT FORM

**WOMEN'S & CHILDREN'S HEALTH NETWORK (WCHN)**
**HUMAN RESEARCH ETHICS COMMITTEE (HREC)**

**CONSENT FORM**

**I** _____

**hereby consent to my involvement in the research project entitled:**

**Women's Psychosocial Outcomes of ST-Analysis compared to CTG for Electronic Fetal Monitoring**

1. The nature and purpose of the research project has been described on the Information Sheet. I understand it and agree to taking part.
2. I understand that I may not directly benefit by taking part in this study.
3. I acknowledge the possible risks and inconveniences outlined in the Information Sheet.
4. I understand that I can withdraw from the study at any stage and that this will not affect medical care or any other aspects of my relationship with this healthcare service.
5. I understand that there will be no payment to me for taking part in this study.
6. I have had the opportunity to discuss taking part in this research project with a family member or friend.
7. I am aware that I should retain a copy of the Consent Form, when completed, and the Information Sheet.
8. I understand that my information will be kept confidential as explained in the Information Sheet except where there is a requirement by law for it to be divulged.

   *Your information will remain confidential except in the case of a legal requirement to pass on personal information to authorised third parties. This requirement is standard and applies to information collected both in research and non-research situations. Such requests to access information are rare; however we have an obligation to inform you of this possibility*

Signed: .....

Full name: .....

Dated:.....

STUDY ID: 10xxx Version 2 6/3/18

## APPENDIX I. STUDY THREE: PSYCHOSOCIAL QUESTIONNAIRE

STUDY ID: 10xxx

Version 9: 6/3/18

# Women's Psychosocial Outcomes of Electronic Fetal Monitoring
# An Australian Randomised Controlled Trial

A collaboration between

The University of Adelaide

and

The Women's and Children's Hospital

**How to Complete This Questionnaire**

Thank you for taking the time to complete this questionnaire investigating the psychosocial outcomes of electronic fetal monitoring.

To complete this questionnaire:

- Carefully read the instructions at the beginning of each section as well as all questions within each section.
- Please check that you have answered all questions in each section before moving onto the next section.
- Do not spend too long on any one question; your initial opinion is all we need.
- Please remember that there are no right or wrong answers.
- If you wish to receive more information in regards to an interview about your experience with fetal monitoring please provide your contact details at the end of this questionnaire.
- If you wish to receive a brief summary of the study findings please provide your email address at the end of the questionnaire, the summary will be sent to the provided email address.

## Part 1

*Please state the date the questionnaire was completed* ____/____/____

*Please select the most applicable option by marking the box on the right* ☒

1. Please indicate your highest level of education completed. If you are currently enrolled, please indicate your highest degree completed:

| | |
|---|---|
| Post Graduate Degree | ☐ |
| Graduate Diploma or Certificate | ☐ |
| Bachelor Degree | ☐ |
| Advanced Diploma and Diploma | ☐ |
| Certificate | ☐ |
| Secondary Education | ☐ |
| Primary Education | ☐ |
| Pre-primary | ☐ |
| Other | ☐ |

2. Do you speak another language other than English at home:

| | |
|---|---|
| No | ☐ |
| Yes | ☐ |
| If answering yes, what language do you speak at home:<br><br>---------- | |

3. Are you of Aboriginal and/or Torres Strait Islander decent?

| | |
|---|---|
| Yes | ☐ |
| No | ☐ |

4. Please indicate your marital status:

| | |
|---|---|
| Married/de facto | ☐ |
| Single, living with adult family support | ☐ |
| Single, living without adult family support | ☐ |

5. Are you currently employed (includes maternity leave)?

| | |
|---|---|
| Yes, full time | ☐ |
| Yes, part time | ☐ |
| Yes, casual | ☐ |
| No | ☐ |

6. Do you currently smoke?

| | |
|---|---|
| No, not at all | |
| Yes, daily | |
| Yes, at least weekly, not daily | |
| Yes, less often than weekly | |

7. The child I recently gave birth to was my:

| | |
|---|---|
| First (live birth) *please skip to Part 2 | |
| Second | |
| Third or more | |

8. If this was not your first pregnancy please indicate how your other children were delivered (please select all that apply):

| | |
|---|---|
| Spontaneous vaginal delivery | |
| Forceps delivery | |
| Vacuum extraction | |
| Caesarean section with labour | |
| Caesarean section, no labour | |

9. In your pervious labour/s, what type of fetal monitoring did you receive:

| | |
|---|---|
| No fetal monitoring | |
| Non-electronic monitoring conducted intermittently | |
| Electronic monitoring using CTG (cardiotocography) | |
| Electronic monitoring using STan (ST-Analysis) | |
| Don't know | |

10. How would you rate your overall satisfaction with your previous labour and birth?

| | |
|---|---|
| Very satisfied | |
| Satisfied | |
| Average | |
| Unsatisfied | |
| Very unsatisfied | |

## Part 2

*Please colour in one circle for each question that is the closest to how you have felt in the PAST SEVEN DAYS.*

1. I have been able to laugh and see the funny side of things

O As much as I always could
O Not quite so much now
O Definitely not so much now
O Not at all

2. I have looked forward with enjoyment to things

O As much as I ever did
O Rather less than I used to
O Definitely less than I used to
O Hardly at all

3. I have blamed myself unnecessarily when things have gone wrong

O Yes, most of the time
O Yes, some of the time
O Not very often
O No, never

4. I have been anxious or worried for no good reason

O No, not at all
O Hardly ever
O Yes, sometimes
O Yes, very often

5. I have felt scared or panicky for no very good reason

O Yes, quite a lot
O Yes, sometimes
O No, not much
O No, not at all

6. Things have been getting on top of me

O Yes, most of the time I haven't been able to cope at all
O Yes, sometimes I haven't been coping as well as usual
O No, most of the time I have coped quite well
O No, I have been coping as well as ever

7. I have been so unhappy that I have had difficulty sleeping

O Yes, most of the time
O Yes, sometimes
O Not very often
O No, not at all

8. I have felt sad or miserable

O Yes, most of the time
O Yes, quite often
O Not very often
O No, not at all

9. I have been so unhappy that I have been crying

O Yes, most of the time
O Yes, quite often
O Only occasionally
O No, never

10. The thought of harming myself has occurred to me

O Yes, quite often
O Sometimes
O Hardly ever
O Never

## Part 3

*Please indicate your level of agreement with the following statements.*

| | Strongly Agree | Agree | Not Sure | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| 1. I came through childbirth virtually unharmed. | 1 | 2 | 3 | 4 | 5 |
| 2. I thought my labour was excessively long. | 1 | 2 | 3 | 4 | 5 |
| 3. The delivery room staff encouraged me to make decisions about how I wanted my birth to progress. | 1 | 2 | 3 | 4 | 5 |
| 4. I felt very anxious during my labour and birth. | 1 | 2 | 3 | 4 | 5 |
| 5. I felt well supported by staff during my labour and birth. | 1 | 2 | 3 | 4 | 5 |
| 6. The staff communicated well with me during labour. | 1 | 2 | 3 | 4 | 5 |
| 7. I found giving birth a distressing experience. | 1 | 2 | 3 | 4 | 5 |
| 8. I felt out of control during my birth experience. | 1 | 2 | 3 | 4 | 5 |
| 9. I was not distressed at all during labour. | 1 | 2 | 3 | 4 | 5 |
| 10. The delivery room was clean and hygienic. | 1 | 2 | 3 | 4 | 5 |

## Part 4

*We would like to know if you have had any medical complaints and how your health has been in general, over the last few weeks. Please answer ALL the questions simply by circling the answer which you think most nearly applies to you. Remember that we want to know about your present and recent complaints, not those that you had in the past. It is important that you try and answer ALL the questions.*

*Have you recently*:

| | | | | |
|---|---|---|---|---|
| 1. Been able to concentrate on whatever you are doing? | Better than usual | Same as usual | Less than usual | Much less than usual |
| 2. Lost much sleep over worry? | Not at all | No more than usual | Rather more than usual | Much more than usual |
| 3. Felt that you are playing a useful part in things? | More so than usual | Same as usual | Less so than usual | Much less than usual |
| 4. Felt capable of making decisions about things? | More so than usual | Same as usual | Less so than usual | Much less than usual |
| 5. Felt constantly under strain? | Not at all | No more than usual | Rather more than usual | Much more than usual |
| 6. Felt you couldn't overcome your difficulties? | Not at all | No more than usual | Rather more than usual | Much more than usual |
| 7. Been able to enjoy your normal day-to-day activities? | More so than usual | Same as usual | Less so than usual | Much less than usual |
| 8. Been able to face up to your problems? | More so than usual | Same as usual | Less so than usual | Much less than usual |
| 9. Been feeling unhappy and depressed? | Not at all | No more than usual | Rather more than usual | Much more than usual |
| 10. Been losing confidence in yourself? | Not at all | No more than usual | Rather more than usual | Much more than usual |
| 11. Been thinking of yourself as a worthless person? | Not at all | No more than usual | Rather more than usual | Much more than usual |
| 12. Been feeling reasonably happy, all thing considered? | More so than usual | Same as usual | Less so than usual | Much less than usual |

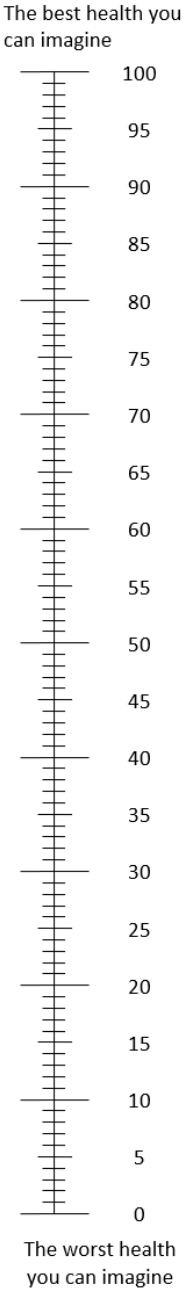
## Part 5

*Under each heading, please tick the ONE box that best describes your health TODAY.*

| | |
|---|---|
| **1. Mobility** | |
| I have no problems with walking around | ☐ |
| I have slight problems with walking around | ☐ |
| I have moderate problems with walking around | ☐ |
| I have severe problems with walking around | ☐ |
| I am unable to walk around | ☐ |
| **2. Personal Care** | |
| I have no problems with washing or dressing myself | ☐ |
| I have slight problems with washing or dressing myself | ☐ |
| I have moderate problems with washing or dressing myself | ☐ |
| I have severe problems with washing or dressing myself | ☐ |
| I am unable to wash or dress myself | ☐ |
| **3. Usual Activities (e.g. work, study, housework, family or leisure activities)** | |
| I have no problems doing my usual activities | ☐ |
| I have slight problems doing my usual activities | ☐ |
| I have moderate problems doing my usual activities | ☐ |
| I have severe problems doing my usual activities | ☐ |
| I am unable to do my usual activities | ☐ |
| **4. Pain/Discomfort** | |
| I have no pain or discomfort | ☐ |
| I have slight pain or discomfort | ☐ |
| I have moderate pain or discomfort | ☐ |
| I have severe pain or discomfort | ☐ |
| I have extreme pain or discomfort | ☐ |
| **5. Anxiety/Depression** | |
| I am not anxious or depressed | ☐ |
| I am slightly anxious or depressed | ☐ |
| I am moderately anxious or depressed | ☐ |
| I am severely anxious or depressed | ☐ |
| I am extremely anxious or depressed | ☐ |

- *We would like to know how good or bad your health is TODAY.*
- *This scale is numbered from 0 to 100.*
- *100 means the <u>best</u> health you can imagine. 0 means the <u>worst</u> health you can imagine.*
- *Mark an X on the scale to indicate how your health is TODAY.*
- *Now, please write the number you marked on the scale in the box below.*

YOUR HEALTH TODAY = ☐



## Part 6

*Please indicate the extent to which you agree with all of the following statements in regards to the electronic fetal monitoring you received during labour*

| | Strongly Disagree | Disagree | Neither Agree or Disagree | Agree | Strongly Agree | |
|---|---|---|---|---|---|---|
| I trust the technology behind the electronic monitoring. | 1 | 2 | 3 | 4 | 5 | |
| The staff seemed to be competent in their use of the electronic monitoring. | 1 | 2 | 3 | 4 | 5 | |
| I would recommend the electronic monitoring to a friend in a similar situation. | 1 | 2 | 3 | 4 | 5 | |
| The electronic monitoring made me uncomfortable. | 1 | 2 | 3 | 4 | 5 | |
| My experience with electronic monitoring was positive. | 1 | 2 | 3 | 4 | 5 | |
| I found the electronic monitoring restricted my movement. | 1 | 2 | 3 | 4 | 5 | |
| I felt that the electronic monitoring used was the right choice for myself and my baby. | 1 | 2 | 3 | 4 | 5 | |
| The electronic monitoring was invasive. | 1 | 2 | 3 | 4 | 5 | |
| I think the electronic monitoring I received is an acceptable way of monitoring my baby during labour. | 1 | 2 | 3 | 4 | 5 | |
| I would prefer a different type of electronic monitoring if possible, during future labours. | 1 | 2 | 3 | 4 | 5 | |
| I was concerned about the attachment of the scalp clip. | 1 | 2 | 3 | 4 | 5 | Not Applicable |

What were the positives of the electronic monitoring you received during labour?

What were the negatives of the electronic monitoring you received during labour?

## Part 7

*Please indicate the extent to which you agree or disagree with all of the following statements, please answer as best you can.*

| | Strongly Disagree | Disagree | Neither Agree or Disagree | Agree | Strongly Agree |
|---|---|---|---|---|---|
| 1. The reassurance I got from the electronic monitoring was more important to me than being able to move around in labour. | 1 | 2 | 3 | 4 | 5 |
| 2. Having a healthy baby was worth the invasiveness of the electronic monitoring. | 1 | 2 | 3 | 4 | 5 |
| 3. I would accept feelings of invasiveness from the electronic monitoring, if I knew it could reduce my chance of needing an unnecessary caesarean. | 1 | 2 | 3 | 4 | 5 |
| 4. The reassurance I felt from the electronic monitoring was more important than physical comfort. | 1 | 2 | 3 | 4 | 5 |
| 5. I would prefer being physically comfortable during labour over having better outcomes for my baby. | 1 | 2 | 3 | 4 | 5 |

## Part 8

*Please answer the following question by marking the box* ☒ *that reflects your current practice.*

1. How are you feeding your baby?

| | |
|---|---|
| Fully breastfeeding | |
| Almost breastfeeding (about 4 breast feeds out of 5 feeds daily) | |
| Mixed feeding | |
| Mostly bottle feeding (about 1 breast feed out of 5 feeds daily) | |
| Fully bottle feeding | |

*Thank you very much for taking the time to complete our questionnaire, your time is greatly appreciated.*

If you are interested in being contacted to learn more about possibly taking part in an interview in relation to your experience with the fetal monitoring you received, please provide your contact information below.

*If you agree to be contacted for a follow-up, you can always decline the request when contacted.*

*You may skip this question if you wish.*

Name:

_____

E-mail address:

_____

Phone number:

_____

If you would like to receive a brief summary of the findings of the study please provide your email below, the summary will be send to the email address provided once the study has concluded.

☐ I do not want to receive a brief summary of the study findings.

☐ I would like to receive a brief summary of the study findings. I have provided my email address so this information can be sent to me.

E-mail address:

_____

# APPENDIX J. STUDY THREE: REMINDER LETTER

Dear

We invite you to participate in a study about your experience with the electronic fetal monitoring you received during labour and your current health.

You recently would have received an information package in the mail regarding your participation in this study. If you have not yet returned the consent form and questionnaire, and you would like to participate in the study, you are still able to do so. If you have already completed the questionnaire we thank you for your time and please disregard this letter.

Included with this letter is an information sheet, consent form and questionnaire. If you are interested in participating, please read all the details in the information sheet. There are two options for completion of the questionnaire:
Option 1: complete the consent form and questionnaire included in this pack and return via the included pre-paid envelope.
Option 2: complete the consent form and questionnaire online, either on a computer or your mobile device, via the link provided below. Your Study ID is also provided below.

As we value your opinions and experiences with electronic fetal monitoring, we also invite you to participate in a face-to-face interview which would be conducted at a time and place convenient for you. If you are interested in participating, please complete the section that is located at the end of the questionnaire.

**Link:** https://start.adelaide.edu.au
**Study ID**: 10xxx

Yours sincerely,

A/Prof. Chris Wilkinson Prof. Deborah Turnbull Miss Madeleine Benton Dr Bronni Simpson

Version 1 29/3/17

# APPENDIX K. STUDY ONE: PUBLISHED PAPER

The published version of Chapter Three is on the following pages. Publication details:

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# Women's psychosocial outcomes following an emergency caesarean section: A systematic literature review

Madeleine Benton[1*], Amy Salter[2], Nicole Tape[1], Chris Wilkinson[3] and Deborah Turnbull[1]

**Abstract**

**Background:** Given the sudden and unexpected nature of an emergency caesarean section (EmCS) coupled with an increased risk of psychological distress, it is particularly important to understand the psychosocial outcomes for women. The aim of this systematic literature review was to identify, collate and examine the evidence surrounding women's psychosocial outcomes of EmCS worldwide.

**Methods:** The electronic databases of EMBASE, PubMed, Scopus, and PsycINFO were searched between November 2017 and March 2018. To ensure articles were reflective of original and recently published research, the search criteria included peer-reviewed research articles published within the last 20 years (1998 to 2018). All study designs were included if they incorporated an examination of women's psychosocial outcomes after EmCS. Due to inherent heterogeneity of study data, extraction and synthesis of both qualitative and quantitative data pertaining to key psychosocial outcomes were organised into coherent themes and analysis was attempted.

**Results:** In total 17,189 articles were identified. Of these, 208 full text articles were assessed for eligibility. One hundred forty-nine articles were further excluded, resulting in the inclusion of 66 articles in the current systematic literature review. While meta-analyses were not possible due to the nature of the heterogeneity, key psychosocial outcomes identified that were negatively impacted by EmCS included post-traumatic stress, health-related quality of life, experiences, infant-feeding, satisfaction, and self-esteem. Post-traumatic stress was one of the most commonly examined psychosocial outcomes, with a strong consensus that EmCS contributes to both symptoms and diagnosis.

**Conclusions:** EmCS was found to negatively impact several psychosocial outcomes for women in particular post-traumatic stress. While investment in technologies and clinical practice to minimise the number of EmCSs is crucial, further investigations are needed to develop effective strategies to prepare and support women who experience this type of birth.

**Keywords:** Systematic literature review, Childbirth, Emergency caesarean section, Psychosocial outcomes, Maternal health, Postpartum

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## Introduction

There has been a dramatic increase in caesarean section (CS) rates around the world over the past three decades, particularly in middle and high income countries [1]. At a population level, the World Health Organization has concluded that CS rates higher than 10% are not associated with reductions in maternal and newborn mortality rates [2]. Despite this, recent data has reported rates of 40.5% in Latin America and the Caribbean, 32.3% in Northern America, 31.1% in Oceania, 25% in Europe, 19.2% in Asia and 7.3% in Africa [3]. Globally, CS rates have almost doubled between 2000 and 2015, from 12 to 21% [4].

CSs are broadly classified depending on whether they are an elective or emergency procedure. An elective CS is defined as a planned, non-emergency delivery which occurs before initiation of labour [5]. In contrast, emergency caesarean section (EmCS) is defined as an unplanned CS delivery performed before or after onset of labour, which is typically urgent and is most often required due to fetal, maternal or placental conditions (eg. fetal distress, eclampsia, placental/cord accidents, uterine rupture, failed instrumental birth etc) [5, 6].

While CS has an important place in potentially protecting both mother and baby from harm, it is associated with short and long term physical and psychological risks which can extend many years beyond the current delivery and effect the health of the woman, her child, and future pregnancies [7]. In a review of research on the outcomes of CS, Lobel [8] noted that the procedure is uniquely challenging as it combines surgery and birth, events that elicit very diverse emotional responses. The circumstances surrounding an EmCS add an additional layer of complexity to this experience which has thereby prompted researchers to explore the psychosocial impact of this type of birth. The nature of the event accompanied by a series of subsequent rapid psychological adjustments may be distressing, anxiety-provoking and emotionally unsettling for women [9, 10].

The primary outcome of obstetric care, is of course, to ensure both mother and infant remain physically healthy however, psychosocial aspects and outcomes of maternity care and obstetrics are no less important [11, 12]. Psychosocial outcomes identified and examined in the literature as potentially related to CS include: mental health problems such as, postpartum depression, post-traumatic stress and anxiety; decreased maternal satisfaction with childbirth; the mother infant relationship; parents' sexual functioning; and health behaviours such as infant feeding.

### The current study

Given the nature of EmCS and the increased risk of psychological distress for women, it is imperative to gain insight into the diverse psychosocial outcomes for women experiencing this type of birth. Knowledge and awareness surrounding the impact of EmCS on women's psychosocial outcomes is likely to enhance the overall quality of maternity care. The aim of the current systematic literature review is to identify, collate, and examine the evidence surrounding women's psychosocial outcomes of EmCS.

## Method

A systematic literature review constituting a rigorous method of research for summarising evidence from multiple studies on a specific topic was undertaken [13, 14]. The present study was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) recommendations [15]. An a priori designed study protocol guided the literature search, study selection and data synthesis, with quantitative meta-analysis attempted when possible. This systematic review was registered in the international prospective register of systematic reviews (PROSPERO) database: CRD42018087677.

### Search strategy

The search strategy was designed and developed following consultation with a health and medical sciences university librarian in order to ensure a comprehensive search and increase the robustness of the study [16]. The medical and psychological electronic databases of EMBASE, PubMed, Scopus, and PsycINFO were searched between November 2017 and March 2018. When conducting searches, keywords were combined representing the two primary concepts; psychosocial outcomes and EmCS. In this systematic literature review, psychosocial outcomes were considered to be variables that encompass social and psychological aspects of an individual's life [17]. The Boolean operators 'OR' and 'AND' were utilised to facilitate maximum inclusion of relevant articles [18]. Detailed search algorithms and indexing language used for each database are outlined in the Additional File 1.

To ensure that included articles were reflective of original and recently published research, limits were applied within the literature search to incorporate inclusion criteria such as: research articles, publication within the last 20 years (1998 to 2018), and peer-reviewed articles [19]. Further, the search was limited to English language publications due to unavailability of funding for language translation. Grey literature or trial registries were not persued for practical purposes.

### Eligibility criteria

Inclusion and exclusion criteria (based on the PICOS [population, intervention, comparison, outcome, study design] framework) were established in advance and

documented in the review protocol to identify all pertinent studies.

- **P**opulation: Women who have delivered via EmCS
- **I**ntervention: EmCS
- **C**omparison: Any mode of delivery (MoD) where reported, otherwise no comparison
- **O**utcomes: Psychosocial variables (i.e. postnatal depression, anxiety, post-traumatic stress, infant feeding, sexual functioning, satisfaction, views and experiences)
- **S**tudy Design: Quantitative (excluding case studies), qualitative or mixed methods

### Study selection

Potential papers were screened initially by title and abstract by two reviewers who reviewed half of papers each (MB and NT) and full texts were retrieved for those citations considered potentially relevant for inclusion. Both reviewers completed an initial subset of papers together in order to ensure consistency in their approach. Reference lists of retrieved full text papers were examined to identify potentially relevant studies not captured by electronic searches [20]. Full texts of the remaining articles were independently appraised against the eligibility criteria for final inclusion by two reviewers (MB and NT). In case of disagreement in the selection process, a third reviewer was available for consultation.

### Data extraction

Utilising a data extraction form designed by the authors, MB extracted descriptive data on study aims, study design, study location, sample size, data collection period, measures utilised, and included a text description summarising the psychosocial and EmCS related findings from each study. These data were cross-checked by NT. A data synthesis of the findings from each article was then performed, involving identification of prominent and recurrent themes in the literature and the synthesis of findings from studies under thematic headings. This approach has been described as flexible, allowing considerable latitude to systematic reviewers, and provides a means of integrating qualitative and quantitative evidence [20].

### Quality assessment

In line with standard systematic literature review methodology a formal methodological quality appraisal of each included study was performed using the Mixed Methods Appraisal Tool (MMAT) version 11 [21]. This tool allows for the critical appraisal of quantitative, qualitative, and mixed methods studies and was developed to address some of the challenges of critical appraisal in systematic mixed studies reviews. The MMAT has been validated and used for quality assessment in similar mixed method systematic reviews [22]. The MMAT comprises 19 items for appraising the methodological quality of 5 different types of studies: qualitative studies (4 items), randomised controlled trials (4 items), non-randomized studies (4 items), quantitative descriptive studies (4 items), and mixed methods studies (4 items). Based on the number of criteria met for an individual study, the overall quality assessment rating (QAR) is presented using descriptors *, **, ***, and ****, ranging from * (single criterion met) to **** (all criteria met). Each study included in the quality assessment was evaluated by two independent reviewers (MB and NT). A third reviewer was available for consultation if disagreement occurred.

## Results

### Study selection and characteristics

A summary of the search process is illustrated in Fig. 1, as recommended by the PRISMA guidelines [15]. In total 17,189 articles were initially identified. For the initial screening, all search results were imported into citation management software Endnote ×7 where 1068 duplicates were identified and removed, leaving 16,121 articles (Pubmed, $n = 12{,}960$, EMBASE $n = 829$, PsycINFO $n = 56$, Scopus $n = 2276$). Titles and abstracts were then assessed by two reviewers (MB, NT), with this process ending with the inclusion of 208 articles. Full texts were then retrieved for those citations considered potentially relevant and assessed for eligibility by the two reviewers (MB, NT). Of these 208 articles, 149 were excluded. The most common reason for exclusion was a lack of differentiation between type of CS when reporting study results (see Fig. 1). Reference lists of included studies were hand searched by the first author and a further 7 articles were subsequently included. A total of 66 relevant articles [5, 9, 23–86] were thus included in the current systematic literature review.

### Description of included studies

Characteristics of the 66 included studies are presented in Table 1. Studies were conducted in 22 different countries with the majority conducted in Sweden ($n = 12$), followed by the UK ($n = 10$), and then Nigeria ($n = 5$). Most studies were quantitative in nature ($n = 51$), followed by qualitative ($n = 14$) and just one study with mixed methods. Cross sectional ($n = 19$) and prospective designs ($n = 31$) were most prevalent.

### Quality assessment

Mixed Methods Appraisal Tool quality assessment ratings (MMAT QARs) are included in Table 1. Among the 51 quantitative non-randomised studies, 14 met all five criteria, 31 met four criteria, 4 met three criteria and

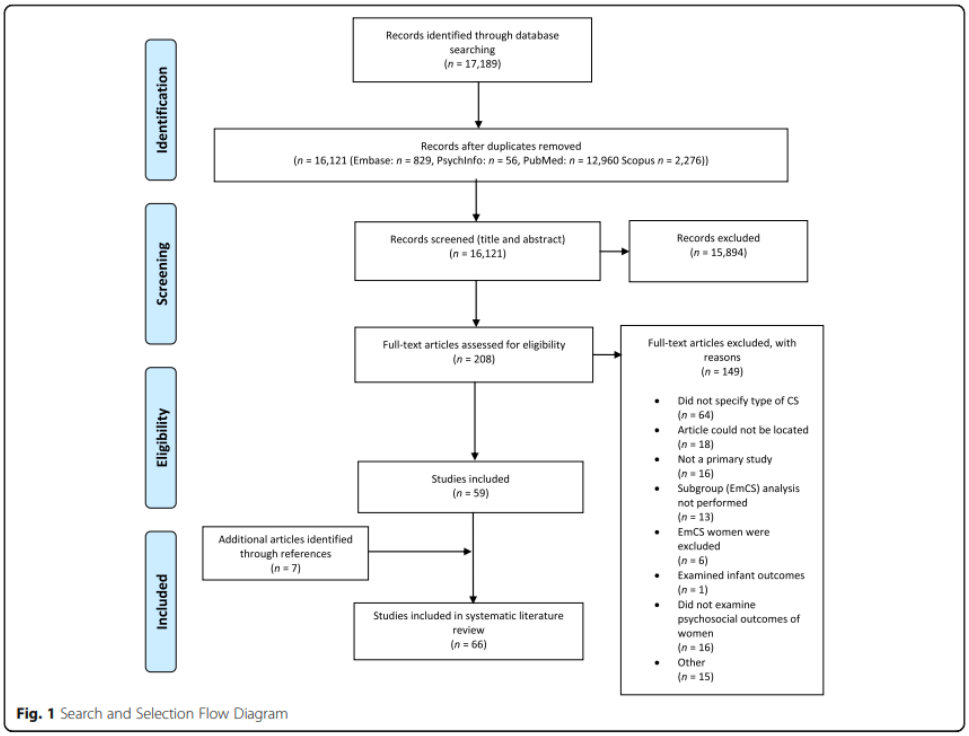


**Fig. 1** Search and Selection Flow Diagram

2 met two criteria. Of the 14 qualitative studies, 12 met all five criteria. The one study with mixed methods met four of the five criteria. The main reason several quantitative studies did not meet all criteria was a lack of reporting for the complete set of outcomes (without adequate justification), response rate or follow-up rate.

### Data extraction and synthesis

Key psychosocial outcomes were examined in the final 66 studies. Data synthesis was employed to extract and synthesise data pertaining to key psychosocial outcomes from each study into coherent themes. Psychosocial outcomes potentially associated with EmCS included postpartum depression, post-traumatic stress, health related quality of life, mother infant bonding, infant feeding, sexual function, experiences, satisfaction, self-esteem, distress, and fear. Due to an excess of methodological heterogeneity between studies (even for subsets of studies with some common features), a meta-analysis was deemed inappropriate. Table 2 summarizes evidence of associations for identified psychosocial outcomes and EmCS.

### Key outcomes

#### *Postpartum depression*

Twelve studies examined depression as an outcome of EmCS [33, 36, 38, 43, 45, 51, 60, 62, 71, 80, 85, 87]. These studies used varying measures, with the majority ($n = 8$) utilising the Edinburgh Postnatal Depression Scale (EPDS), three using Beck's Depression Inventory (BDI) and one study not specifying the measure used. Studies identified reported mixed findings in terms of postpartum depression (PPD) and the experience of EmCS. The majority of studies found no significant association between having an EmCS and PPD relative to other MoDs [33, 38, 43, 45, 62, 80, 85]. For example, a prospective cohort study ($n = 10, 934$) from the UK found no significant evidence of increased risk of PPD between different MoDs including EmCS [62]. In contrast, a much smaller prospective cohort study reported EmCS was a predictor of PPD [51]. Additionally, a recent cross-sectional study conducted in Iran [71] reported that the prevalence of PPD was 33.4%, of which the highest proportion consisted of women who had experienced EmCS at 41.3%. Furthermore, a recent large longitudinal study found that compared with spontaneous VD, women who delivered

**Table 1** Summary characteristics of included studies

| Author/Year | Aim | Study Design | Study Location | Participants | Time frame | Study Period | Measure | Psychosocial Outcomes | Relevant Key Findings | MMAT QAR[a] |
|---|---|---|---|---|---|---|---|---|---|---|
| Adams, 2012 | To assess the association between mode of delivery (MoD) and maternal postpartum emotional distress. | Prospective Cohort | Norway | 55, 814 | 17 & 30 weeks gestation and 6 months postpartum | 1998–2008 | Short form of the Hopkins Symptom Checklist-25 (SCL-8) | Emotional Distress | MoD was not associated with the presence of emotional distress postpartum. | ***** |
| Adewuya, 2006 | To estimate the prevalence PTSD after childbirth and to examine associated factors. | Cross-sectional | Nigeria | 876 | 6 weeks postpartum | 2004 | MINI International Neuropsychiatric Interview, Index of marital satisfaction, Medical Outcomes Study Social Support Survey, Life events scale, Labour agentry scale | PTSD | Instrumental delivery and Emergency Caesarean Section (EmCS) were associated with PTSD, while elective caesarean section (ElCS) sections showed no significant effect. | ***** |
| Ahluwalia, 2012 | To assess the relationship between MoD and breastfeeding. | Prospective longitudinal | United States | 3026 | Before birth and 10 times during the year after birth. | 2005–2006 | Study specific | Breastfeeding | Median breastfeeding duration was 20.6 weeks for EmCS. Breastfeeding duration among women who initiated breastfeeding show that the prevalence of breastfeeding at any time through 60 weeks after delivery was lowest for those who had induced VD or EmCS than among those in the other two groups (spontaneous VD or planned CS). | |
| Beck, 2008 | To explore the impact of birth trauma on mothers' breast feeding experiences. | Qualitative | New Zealand, US, Australia, UK, Canada | 52 | Unspecified | Unspecified | Study specific | Infant feeding | Women repeatedly explained that their decision to breastfeed was driven by their need to make amends to the infants for the traumatic way they had arrived into the world, for example, by EmCS. | ***** |
| Baas, 2017 | To understand the relationship between client-related factors and the experience of midwifery care during childbirth to improve care. | Prospective longitudinal | Netherlands | 2377 | 20 and 34 weeks pregnant and 6 weeks postpartum | 2009–2011 | Study specific and Labour Agency Scale | Experience of care | MoD effected experiences of care. Women who had an unplanned CS were more likely to indicate that they had received "less than good" midwifery care during childbirth. | **** |
| Baston, 2008 | To examine what factors relate to women's appraisal of their birth three years later. | Prospective Cohort | England and Netherlands | 2048 | 3 years postpartum | 2003–2004 | Study specific | Satisfaction of experience | EmCS was a factor contributing to a negative appraisal of birth in England and the | **** |

**Table 1** Summary characteristics of included studies *(Continued)*

| Author/Year | Aim | Study Design | Study Location | Participants | Time frame | Study Period | Measure | Psychosocial Outcomes | Relevant Key Findings | MMAT QAR[a] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Netherlands. | |
| Bergant, 1998 | To study the subjective psychological and physical stressful experience of childbirth burden. | Cross-sectional | Austria | 1250 | 5 days postpartum | 1993–1994 | EPDS, Trait-Anxiety Inventory, Burden of childbirth | Burden of childbirth | Women who experienced emergency surgical intervention (EmCS and vacuum extraction) demonstrated higher childbirth burden scores. | **** |
| Bryanton, 2008 | To determine factors that predict women's perceptions of the childbirth experience and to examine whether these vary with the type of birth a woman experiences. | Prospective cohort | Canada | 652 | 12–47 h postpartum | 2004–2005 | Questionnaire Measuring Attitudes About Labour and Delivery | Perceptions of birth | Women who had a planned CS birth scored significantly lower on birth perception than those who had an EmCS or a VD. | **** |
| Burcher, 2016 | To elicit women's narratives of their unplanned CS births to identify potentially alterable factors that contribute to CS regret. | Qualitative | United States | 14 | 2–6 weeks postpartum | Unspecified | Study specific | Regret and dissatisfaction | Four key themes emerged from patients' unplanned CS narratives: poor communication, fear of the operating room, distrust of the medical team, and loss of control. | ***** |
| Carquillat, 2016 | To compare subjective childbirth experience according to different delivery methods. | Cross-sectional | Switzerland and France | 291 | 4–6 weeks postpartum | 2014–2015 | Questionnaire for Assessing Childbirth Experience | Childbirth Experience | Women who had an EmCS were at highest risk of experiencing childbirth in a negative way. | **** |
| Chen, 2002 | To compare women who had a VD with those who had a CS in depression, perceived stress, social support, and self-esteem. | Cross-sectional | Taiwan | 357 | 6-weeks postpartum | 1999 | The Beck Depression Inventory, The Perceived Stress Scale, The Interpersonal SupportEvaluation List (ISEL) Short Form, Coopersmith's Self-Esteem Inventory | Depression, perceived stress, social support, self-esteem | There was no association found in this study between the type of CS (planned or emergency) and psychosocial measures. | ***** |
| Creedy, 2000 | To determine the incidence of acute trauma symptoms and PTSD in women as a result of their labour and birth experiences, and to identify factors that contributed to the women's psychological distress. | Prospective Longitudinal | Australia | 499 | 4–6 weeks postpartum | 1997–1998 | Posttraumatic Stress Symptoms interview | PTSD | The experience of an EmCS was correlated with the development of trauma symptoms. | **** |
| Durick, 2000 | To examine if unplanned CS would be related to less optimal outcomes and that this relationship would be | Longitudinal cohort | United States | 570 | 4 and 12 months postpartum | Unspecified | The Eysenck Personality Inventory Form, The Centre for Epidemiologic Studies Depression Scale, | Mother-infant interactions, Neuroticism, Depression, Self- | The psychological experiences associated with delivery by unplanned CS, by planned CS, or VD are | **** |

**Table 1** Summary characteristics of included studies *(Continued)*

| Author/Year | Aim | Study Design | Study Location | Participants | Time frame | Study Period | Measure | Psychosocial Outcomes | Relevant Key Findings | MMAT QAR[a] |
|---|---|---|---|---|---|---|---|---|---|---|
| | mediated by mother's appraisal of the delivery and would attenuate over time. | | | | | | Rosenberg's (1965) self-esteem scale | esteem, appraisal of the birth experience. | distinct, and unplanned CS deliveries are appraised most negatively. | |
| Eckerdal, 2017 | To explore the association between MoD and postpartum depression. | Longitudinal cohort | Sweeden | 3888 | 118th gestational week, the 32nd week of pregnancy, at 6 weeks, 6months postpartum | 2009–2014 | EPDS | Postpartum depression | A higher prevalence of depressive symptoms at 6 weeks postpartum was noted among women who delivered by EmCS, whereas no significant association with MoD was found regarding PPD at six months postpartum. | ***** |
| Enabudoso, 2011 | To assess the prevalence of satisfaction, and associated factors, among women who had recently delivered by CS. | Cross-sectional | Nigeria | 211 | 2–5 days postpartum | 2010 | Study sepcific | Satisfaction | Satisfaction with CS was significantly higher among women who had ElCS as compared with EmCS. | *** |
| Fenaroli, 2016 | To explore the influence of cognitive and emotional variables on labour and delivery outcomes and examine how individual characteristics, couple adjustment, and medical factors influence the childbirth experience. | Longitudinal cohort | Italy | 121 | Between 32 and 37 weeks of pregnancy and 30–40 days postpartum | 2010–2012 | Wijma Delivery Expectancy Questionnaire, EPDS, Dyadic Adjustment Scale | Childbirth expectations, depression | There was no relationship found between MoD and perceived emotional experience. | **** |
| Fenwick, 2009 | To explore women's experiences of CS. | Qualitative | England | 21 | Between 7 and 32 weeks postpartum | 1999–2000 | | Experiences | Feelings of failure were present whether or not the CS was planned or an emergency, and these feelings had an impact on their status passage to motherhood for several reasons. The surgery resulted in the loss of women's familiar, normal, healthy body. From their perspective, their body had let them down, denying them a normal birth. | ***** |
| Forti-Buratti, 2017 | To compare the mother-to-infant bond of mothers who gave birth by elective C-section versus EmCS. | Prospective cohort | Spain | 116 | 48–72 h and 10–12 weeks after delivery | Not specified | Mother-to-Infant Bonding Scale, responses to separation | Mother-infant bonding | No significant differences between the two CS in bonding, newborn response to separation or type of feeding were observed at any time | **** |

**Table 1** Summary characteristics of included studies *(Continued)*

| Author/Year | Aim | Study Design | Study Location | Participants | Time frame | Study Period | Measure | Psychosocial Outcomes | Relevant Key Findings | MMAT QAR[a] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | points. | |
| Furuta, 2016 | To identify factors associated with birth-related post-traumatic stress symptoms during the early postnatal period. | Prospective cohort | England | 1824 | 6–8 weeks postpartum | 2010 | Impact of Event Scale | PTSD | EmCS was a high risk factor for post-traumatic stress symptoms. | ***** |
| Gamble, 2005 | To examine the relationship between MoD and symptoms of psychological trauma at 4–6 weeks postpartum | Prospective cohort | Australia | 400 | 72 h and 4–6 weeks postpartum | 2001–2002 | Mini-International Neuropsychiatric Interview-Post-Traumatic Stress Disorder(MINI-PTSD) | PTSD | Women who had an EmCS or operative VD were more likely to meet the diagnostic criteria for PTSD than women who had an ElCS section or spontaneous VD. | **** |
| Gaillard, 2014 | To identify socio-demographic, psychosocial and obstetrical risk factors of postpartum depression. | Prospective cohort | France | 312 | 32–41 weeks gestation, and6–8 weeks postpartum | 2007–2009 | EPDS (French version) | Depression | Women with PND did not differ from the others in MoD (spontaneous vaginal, assisted vaginal, EmCS or ECS). | **** |
| Gibbins, 2001 | To explore, describe and understand the expectations during pregnancy and subsequent experiences of childbirth in women. | Qualitative | England | 8 | 2 weeks post birth | Unspecified | Study specific | Experiences | Women expressed positive feelings about their labours, even though all women felt that labour was different to what they had expected. | ***** |
| Goker, 2012 | To determine the effect of MoD on the risk of postpartum depression. | Cross-sectional | Turkey | 318 | 6 weeks postpartum | Unspecified | EPDS | Depression | Delivering by spontaneous VD, ECS, or EmCS had no effect on EPDS scores. | *** |
| Graham, 1999 | To assess the degree and nature of women's involvement in the decision to deliver by CS section, and women's satisfaction with this involvement. | Qualitative | Scotland | 166 | 3–4 days and 6–12 weeks postpartum | 1995–1996 | Study specific | Satisfaction and decision making | Women undergoing ElCS section generally received adequate information; however, with EmCS, half of the women had not received enough information during pregnancy. A significant proportion of women experienced negative feelings, particularly with EmCS (30%). | **** |
| Guittier, 2014 | To determine important elements associated with first delivery experience according to the MoD. | Qualitative | Switzerland | 24 | 4–6 weeks postpartum | 2012 | Study specific | Experiences | The MoD directly impacted on key delivery experience determinants as perceived control, emotions, and the first moments with the newborn. | **** |

**Table 1** Summary characteristics of included studies *(Continued)*

| Author/Year | Aim | Study Design | Study Location | Participants | Time frame | Study Period | Measure | Psychosocial Outcomes | Relevant Key Findings | MMAT QAR[a] |
|---|---|---|---|---|---|---|---|---|---|---|
| Handelzalts, 2017 | To compare the impacts on childbirth experience of `planned' delivery (elective CS and vaginal delivery) versus `unplanned' delivery (vacuum extraction or EmCS). | Cross-sectional | Israel | 469 | Up to 72 h postpartum | 2014–2015 | Subjective Childbirth Experience Questionnaire and Personal Information Questionnaire | Experience | Unexpected MoD (EmCS) results in a more negative birth experience than a planned MoD. | ***** |
| Herishanu-Gilutz, 2009 | To examine the significance of the subjective experience of mothers who gave birth by an EmCS. | Qualitative | Finland | 10 | 4–6 months | Unspecified | Study specific | Experiences | Themes were identified related to the traumatic experience of the operation, e.g. sense of loss of control regarding the decision to operate, feeling of fear and anger toward the caretaking staff. | ***** |
| Hobbs, 2016 | To examine MoD and breastfeeding initiation, duration, and difficulties reported by mothers at 4 months postpartum. | Prospective Cohort | Canada | 3021 | 34–36 weeks gestation and 12–14 months postpartum | 2008 | Unspecified | Infant feeding | Women who delivered by EmCS had a higher proportion of breastfeeding difficulties (41%), and used more resources before (67%) and after (58%) leaving the hospital, when compared to VD (29, 40, and 52%, respectively) or planned CS (33, 49, and 41%, respectively). | **** |
| Iwata, 2015 | To identify factors for predicting post-partum de-pressive symptoms after childbirth in Japanese women. | Prospective Cohort | Japan | 479 | 1 day before hospital discharge, 1, 2, 4, and 6 months post-partum. | 2012–2013 | EPDS, The Postnatal Accumulated Fatigue Scale, The Postpartum Maternal Confidence Scale, The Childcare Value Scale | Depression | Six variables reliably predicted the risk of postpartum depression including EmCS. | ***** |
| Jansen, 2007 | To investigate fatigue and HRQoL in women after VD, EICS, and EmCs. | Prospective cohort | Netherlands | 141 | 12–24 h after VD and 24-48 h after CS and 1,3, weeks postpartum | 2003–2004 | The Multidimensional Fatigue Inventory, EuroQoL 5D, Short-Form 36 | HRQoL | Patients after VD had higher mean physical HRQoL scores than after CS. The average period to reach full physical recovery was 3 weeks after VD, 6 weeks after elective CS, and 6 weeks after EmCS. | ***** |
| Karlström, 2017 | To compare self-reported birth outcomes for women undergoing birth through spontaneous onset of labour between those who actually had a vaginal birth and those who eventually | Prospective Longitudinal | Sweden | 870 | Mid pregnancy (18–19 weeks), late pregnancy (32–34 weeks), 2 | Unspecified | Study specific | Birth fear and experience | Birth experience were more among women having an EmCS. | **** |

**Table 1** Summary characteristics of included studies *(Continued)*

| Author/Year | Aim | Study Design | Study Location | Participants | Time frame | Study Period | Measure | Psychosocial Outcomes | Relevant Key Findings | MMAT QAR[a] |
|---|---|---|---|---|---|---|---|---|---|---|
| | had an EmCS. | | | | months and 1 year postpartum/ | | | | | |
| Karlstrom, 2007 | To investigate women's experience of postoperative pain and pain relief after CS and factors associated with pain assessment and the birth experience. | Cross-sectional | Sweden | 60 | 2–9 days postpartum | 2004 and 2005 | The Visual Analog Scale, and study specific | Experiences | The risk of a negative birth experience was 80% higher for women undergoing an EmCS compared with elective CS. | *** |
| Loto, 2010 | To examine the association between the MoD, self-esteem, and parenting self-efficacy both at delivery and at 6 weeks postpartum. | Prospective cohort | Nigeria | 115 | Prior to hospital discharge and 6 weeks postpartum | 2007–2008 | Rosenberg self-esteem scale and parent–child relationship questionnaire | Self-esteem | Factors that were significantly associated with low self-esteem include being single and having EmCS. | *** |
| Loto, 2009 | To assess the level of self-esteem of newly delivered mothers who had CS and evaluate the sociodemographic and obstetrics correlates of low self-esteem in them. | Cross-sectional | Nigeria | 109 | | 2007–2008 | Rosenberg self-esteem scale | Self-esteem | EmCS closely correlated with low self-esteem in women who had CS. | **** |
| Lurie, 2013 | To evaluate sexual behaviour longitudinally in the postpartum period by MoD. | Prospective cohort | Israel | 82 | 6, 12, and 24 weeks postpartum | 2010–2011 | Female Sexual Function Index | Sexual Function | Sexual function did not differ significantly by MoD at 6, 12, or 24 weeks postpartum. | **** |
| Maclean, 2000 | To examine women's distress in response to one of four obstetric procedures: spontaneous VD; induced VD; instrumental VD; or, EmCS. | Cross-sectional | England | 40 | 6 weeks postpartum | 1996–1997 | Impact of Event Scale, Hospital Anxiety and Depression Scale | Experience, wellbeing, distress | Women who gave birth assisted by instrumental delivery reported the childbirth event as distinctly more distressing than the women in the other three obstetric groups (VD; induced VD; EmCS). | **** |
| Modarres, 2012 | To estimate the prevalence of childbirth-related post-traumatic stress symptoms and its obstetric and perinatal risk factors. | Cross-sectional | Iran | 400 | 6–8 weeks after birth | 2009 | Post-traumatic Symptom Scale-Interview | PTSD | EmCS was a significant contributing factor to PTSD after childbirth. | **** |
| Noyman-Veksler, 2015 | To investigate the protective role of sense of coherence (SOC) and perceived social support in the effect of EmCS/ELCS on postnatal psychological symptoms and impairment | Prospective Longitudinal | Israel | 142 | 6 and 12 weeks postpartum | Unspecified | Post-partum bonding questionnaire, Post-traumatic diagnostic scale, Edinburgh post-natal depression questionnaire, Sense of coherence, Social support questionnaire | Depression, bonding, PTSD, social support | No effect was found of the MoD on bonding with the infant. An EmCS predicted an increase in PTSD symptoms in Time 2, but only among women with low levels of Time-1 social | **** |

**Table 1** Summary characteristics of included studies *(Continued)*

| Author/Year | Aim | Study Design | Study Location | Participants | Time frame | Study Period | Measure | Psychosocial Outcomes | Relevant Key Findings | MMAT QAR[a] |
|---|---|---|---|---|---|---|---|---|---|---|
| | in mother–infant bonding. | | | | | | | | support. | |
| O'Reilly, 2014 | To establish a greater understanding of the emotional and cognitive mechanisms associated with CS. | Cross-sectional | France | 201 | At least 6–8 weeks postpartum | 2011–2012 | Labour Agentry Scale, Maternal Self Report Inventory, Unconditional Self-AcceptanceQuestionnaire | Sense of control during the delivery, maternal self-esteem self-acceptance | Sense of control during labour and delivery was significantly higher for women who had a spontaneous VD when compared to those who had undergone an instrumental VD, a planned, or an EmCS. | ***** |
| Patel, 2005 | To assess the association between elective CS section and PD compared with planned VD and whether EmCS or assisted VD is associated with PD compared with spontaneous vaginal delivery. | Prospective cohort | UK | 10,934 | 8 weeks postpartum | 1991–1992 | EPDS | Depression | No increased risk of PD was found between MoD. | ***** |
| Porter, 2007 | To explore the factors that women identified as distressing so as to understand their responses to standard questions on satisfaction. | Mixed methods | Scotland | 1661 | Up to 22 years postpartum | 2002 | Study specific | Distress | Many women had never had an operation before and the fact that their CS was classified as an "emergency" frightened them. | **** |
| Redshaw, 2010 | To gain a better understanding of CS by investigating women's recent experiences and reflections on their care. | Qualitative | England | 2960 | 3 months postpartum | 2006 | Study specific | Experiences with care | Fear and confrontation with the unexpected were themes identified from women who had an EmCS. | ***** |
| Rowlands, 2012 | To examine the physical and psychological outcomes of women in the first three months after birth, and whether these varied by MoD. | Cross-sectional | England | 5332 | 3 months postpartum | 2010 | Study specific | PTSD and general psychological outcomes | Women having unplanned CS section births were marginally more likely to report PTSD-type symptoms, however, there was no association between PTSD type symptoms and planned CS section births. | **** |
| Ryding, 1998 | To describe women's thoughts and feelings during the process of a delivery that ended in an EmCS, to ascertain if an EmCS might fulfil the stressor criterion PTSD according to DMS IV. | Qualitative | Sweden | 53 | 2 days after birth | Unspecified | Study specific | PTSD and Experiences | 55% of women experienced intense fear for their own life or that of their baby. 8% felt very badly treated by the staff. Almost all women had adequate knowledge of the reasons for the EmCS. | ***** |

**Table 1** Summary characteristics of included studies *(Continued)*

| Author/Year | Aim | Study Design | Study Location | Participants | Time frame | Study Period | Measure | Psychosocial Outcomes | Relevant Key Findings | MMAT QAR[a] |
|---|---|---|---|---|---|---|---|---|---|---|
| Ryding, Wijma 1998 | To compare the psychological reactions of women after EmCS, ElC, instrumental VD, and normal VD. | Prospective cohort | Sweden | 326 | 2 days and 1 month postpartum | 1992–1993 | Wijma Delivery Expectancy Experience Questionnaire the Impact of Event Self-Rating Scalel, 35-item version of the Symptoms Check List | Experiences and trauma | The EmCS group reported the most negative delivery experience at both times, followed by the IVD group. At a few days postpartum the EmCS group experienced more general mental distress than the VD group, but not when compared with the ElCS or the instrumental VD groups. At 1 month postpartum the EmCS group showed more symptoms of post-traumatic stress than the ECS and instrumental VD groups, but not when compared to the VD group. | **** |
| Ryding, 2000 | To investigate the possibility to categorize women's experiences of EmCS based on the patterns displayed in their narration of the event, and to describe typical features of those categories. | Qualitative | Sweden | 25 | A few days and 1–2 months postpartum. | Unspecified | Study specific | Experiences | The narratives of the 25 women were categorized as follows: Pattern 1 - confidence whatever happens (n 5); Pattern 2 - positive expectations turning into disappointment (n 7); Pattern 3 - fears that come true (n 9); and Pattern 4 - confusion and amnesia (n 4). | * |
| Safarinejad, 2009 | To quantify the relationship between MoD and subsequent incidence of sexual dysfunction and impairment of quality of life (QOL) both in women and their husbands. | Prospective cohort | Iran | 912 | Every month post deliveryup to 12 months. | 2006–2007 | Female Sexual Function Index (FSFI), and International Index of Erectile Function (IIEF), | Sexual Function, QoL | Women with VD and EmCS had statistically significant lower Female Sexual Function Index (FSFI) scores as compared with planned CS Section women | ***** |
| Saisto, 2001 | To examine the extent to which personality characteristics, depression, fear andanxiety about pregnancy and delivery, and socio-economic background, predict disappointment with delivery and the risk of puerperal depression. | Prospective Longitudinal | Finland | 211 | Once after the 30thweek of pregnancy, and 2–3 months after delivery | Unspecified | Beck's Depression Inventory, the NEO-PI Scale for neuroticism, a partnership satisfaction scale, a Pregnancy Anxiety Scale, a revised version of a fear-of-childbirth questionnaire | Disappointment with delivery and satisfaction | Strongest predictors of disappointment with delivery were labour pain and EmCS. | ***** |

**Table 1** Summary characteristics of included studies *(Continued)*

| Author/Year | Aim | Study Design | Study Location | Participants | Time frame | Study Period | Measure | Psychosocial Outcomes | Relevant Key Findings | MMAT QAR[a] |
|---|---|---|---|---|---|---|---|---|---|---|
| Sarah, 2017 | To investigate the relationship between type of delivery and postpartum depression. | Cross-sectional | Iran | Unspecifed | Unspecified | 2013 | Beck depression inventory | Depression | The prevalence of postpartum depression is 33.4%, respectively, of which 13.8% related to EmCS, 7.2% of vaginal deliveries, and 8% of elective CS. | ** |
| Shorten, 2014 | To explore women's values and expectations during their process of decision making about the next birth. | Qualitative | Australia | 187 | 36–38 weeks pregnant and 6–8 weeks postpartum | Unspecified | Study specific | Decisions after prior CS | Women described long labours ending in CS did not want to go through it again, and especially did not want to repeat the "emergency" scenario. Many described a sense of loss after the previous CS experience and expressed a personal need to remedy this feeling through a better experience in the next birth. "After an emergency CS I felt I had failed, I felt cheated of the childbirth experience I had wanted". | ***** |
| Soderquist, 2002 | To study whether or not a more stressful delivery was positively related to traumatic stress after childbirth. | Cross-sectional | Sweden | 1550 | Unspecified | 1994–1995 | Traumatic event scale | Traumatic stress | Traumatic stress symptoms and having a PTSD symptom profile were both significantly related to the experience of an EmCS or an instrumental VD. | **** |
| Somera, 2010 | To explore women's experience of an EmCS birth to gain a better understanding of their thoughts, and feelings throughout the birth process. | Qualitative | Canadian | 9 | 1–5 days after birth and 11–27 days after birth | Not specified | Open-ended questions | Experience | Seven themes were identified describing the women's experience: (1) It was for the best, (2) I did not have control, (3) Everything was going to be okay, (4) I was so disappointed, (5) I was so scared, (6) I could not believe it and (7) I was excited. | ***** |
| Spaich, 2013 | To investigate the extent to which satisfaction with childbirth depends on the MoD, and evaluated factors determining postpartum satisfaction. | Prospective cohort | Germany | 335 | Unspecified | 2010–2011 | Salmon's Item List | Experience | There were no women in the subgroup with EmCS who score indicating an overall negative birth experience. The subjective experience of birth was | **** |

**Table 1** Summary characteristics of included studies *(Continued)*

| Author/Year | Aim | Study Design | Study Location | Participants | Time frame | Study Period | Measure | Psychosocial Outcomes | Relevant Key Findings | MMAT QAR[a] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | described as 'good/very good' in 89% of the women who underwent EmCS. | |
| Storksen, 2013 | To assess the relation between fear of childbirth and previous birth experiences. | Prospective cohort | Norway | 1657 | Weeks 17 and 32 pregnant | 2009–2011 | Wijma Delivery Expectancy Questionnaire | Fear | EmCS and vacuum extraction were associated with fear of childbirth in subsequent pregnancies. | ***** |
| Tham, 2007 | To examine the associations between new mother's sense of coherence (SOC) and obstetric and demographic variables a few days postpartum, and post-traumatic stress symptoms 3 months' postpartum in relation to women who had undergone an emergency CS section. | Prospective cohort | Sweden | 122 | 2 days and 3 month postpartum | Not specified | Sense of Coherence Scale (SOC-13), Impact of Event Scale (IES-15). | PTSD | 25% of the women reported symptoms of post-traumatic stress to a moderate degree (indicating a need for follow-up), and 9% had a high degree of symptoms (indicating possible PTSD). | **** |
| Tham, 2010 | To describe women with and without symptoms of post-traumatic stress following EmCS, and how they perceived the support received in connection with the birth of their child. | Qualitative | Sweden | 84 | 6–7 months postpartum | Not specified | Questions seeking the women'sexperienced social and emotional support from the staffand from their families | Experience and support | The midwives' action, the content and organisation of care, the women's emotions, and the role of the family were main categories that seemed to influence the interviewees' perceptions of support in connection with childbirth. Women with PTSS further mentioned nervous or non-interested midwives, intense fear and feelings of shame during delivery, lack of postnatal follow-up, long-term postpartumfatigue and inadequate help from husbands as influencing factors. Women without symptoms reported involvement in the EmCS decision and a feeling of relief. | **** |
| Trivino-Juarez, 2017 | To conduct a longitudinal study to analyse differences in HRQoL at the sixth week and sixth month | Prospective Longitudinal | Spain | 547 | 6 weeks and 6 months postpartum | 2013–2014 | EPDS, SF-36 | HRQoL | Women who had vaginal, forceps or vacuum-extraction births at the sixth week postpartum reported | **** |

**Table 1** Summary characteristics of included studies *(Continued)*

| Author/Year | Aim | Study Design | Study Location | Participants | Time frame | Study Period | Measure | Psychosocial Outcomes | Relevant Key Findings | MMAT QAR[a] |
|---|---|---|---|---|---|---|---|---|---|---|
| | postpartum, with mode of birth as the main independent variable. | | | | | | | | better physical functioning than women who had elective or EmCS. At the sixth month postpartum, a significantly higher proportion of women in the forceps group (34%) than in the EmCS group (15%) reported being less satisfied with their sexual relations than before pregnancy. | |
| Tully, 2013 | To examine women's experiences of and explanations for undergoing cesarean delivery. | Qualitative | England | 115 | Not specified | 2006–2009 | Study specific | Experiences | All mothers described labour prior to their unscheduled caesareans as wasted effort. | ***** |
| Ukpong, 2006 | To investigate postpartum emotional distress including depression women who had a CS by comparing them at 6–8 weeks following childbirth with 47 matched controls who had normal vaginal delivery. | Cross-sectional | Nigeria | 94 | 6–8 weeks postpartum | Unspecified | General Health Questionnaire (GHQ-30), Beck Depression inventory | Depression, general health | There was no relationship between the depression scores and being scheduled for either EICS or EmCS. | **** |
| Vossbeck-Elsebusch, 2014 | To replicate earlier findings regarding the prediction of PTSD levels following childbirth by known prenatal, perinatal and postnatal predictors. | Prospective cohort | Germany | 224 | 1–6 months | Unspecified | Posttraumatic DiagnosticScale (PDS), University of California, Los Angeles Social SupportInventory (UCLA-SSI-d), Peritraumatic DissociativeExperience Questionnaire (PDEQ), PosttraumaticCognitions Inventory (PTCI), Responsesto Intrusions Questionnaire (RIQ), German version of the PerseverativeThinking Questionnaire (PTQ) | PTSD | The mean PDS (Posttraumatic Diagnostic Scale) score for women who had an EmCS were significantly higher than the PDS score for women who had a normal VD. | ***** |
| Wijma, 2002 | To examine whether the women's psychological condition during pregnancy correlates with their psychological well-being after EmCS. | Prospective cohort | Sweden | 1981 | Gestation week 32, a few days, and one month | Unspecified | Wijma Delivery Expectancy/ Experience Questionnaire, Spielberger Trait Anxiety Inventory, Stress Coping Inventory, Impact of Event Scale, Symptom Checklist | Fear | Surgical complications including EmCs correlated with postpartum fear of childbirth negatively a few days after the operation, but positively one month later. | **** |

**Table 1** Summary characteristics of included studies *(Continued)*

| Author/Year | Aim | Study Design | Study Location | Participants | Time frame | Study Period | Measure | Psychosocial Outcomes | Relevant Key Findings | MMAT QAR[a] |
|---|---|---|---|---|---|---|---|---|---|---|
| Wiklund, 2009 | To examine changes in personality from late pregnancy to early motherhood in primiparas having vaginal or CS. | Prospective cohort | Sweden | 314 | 37–39 gestational weeks in pregnancy and 9 months after delivery. | 2003–2006 | Karolinska Personality Scales | Personality | Women who had an EmCS scored higher on the subscale measuring Psychasthenia (low degree of mental energy and stress susceptible) 9 months after birth compared to those who had a spontaneous VD. | **** |
| Wiklund, 2007 | To examine the expectations and experiences in women undergoing a CS on maternal request and compare these with women undergoing CS with breech presentation as the indication and women who intended to have VD acting as a control group and to study whether assisted delivery and EmCS in the control group affected the birth experience. | Prospective cohort | Sweden | 496 | Prior to delivery and 3 months postpartum | 2003–2005 | Wijma Delivery Expectancy/Experience Questionnaire | Experiences | Women planning a VD but experiencing an EmCS or an assisted VD had more negative birth experiences than the other groups. | **** |
| Xie, 2011 | To examine whether or not CS delivery is associated with increased risk of postpartum depression. | Cross-sectional | China | 534 | 2 weeks postpartum | 2007 | Chinese version of the EPDS (EPDS), Social Support Rating Scale, | Depression | PPD rate was higher in the group who had elective CS delivery than inthe group who had EmCS. | **** |
| Yang, 2011 | To examine whether MoD are associated with postnatal depression. | Prospective cohort | Taiwan | 10,535 | Unspecified | 2003–2006 | Data collected from the National Health Insurance Research Database | Depression | Risk of acquiring PPD was lower in mothers with a normal VD or an instrumental VD compared to mothers with an EmCS. The women who elected to have a CS section was higher risk than an EmCS. | **** |
| Zanardo, 2016 | To assess feelings towards newborn infants in mother swho delivered by elective (ElCD) or emergency EmCS. | Cross-sectional | Italy | 573 | Not specified | 2014–2015 | Mother-to-Infant Bonding Scale (MIBS) | Mother-infant bonding | EmCS negatively affected mother bonding and opening emotions, and originated inmother feeling sadness and disappointment for the unplanned delivery. | ** |

[a]Mixed Methods Appraisal Tool Quality Assessment Rating

**Table 2** Associations of identified psychosocial outcomes and EmCS

| Key psychosocial outcomes | Number of studies | Association between EmCS and psychosocial outcomes | Inconclusive associations between EmCS and psychosocial outcomes | Qualitative summary |
|---|---|---|---|---|
| Postpartum depression (PPD) | 12 | | + | Studies reported inconsistent findings. The majority of studies reported no significant association ($n = 7$) between EmCS and PPD whereas the remaining studies reported a relationship between EmCS and increased symptoms of PPD ($n = 5$). |
| Post-traumatic stress disorder (PTSD) | 11 | + | | All studies ($n = 11$) reported consistent findings that EmCS was a contributing factor to increasing post-traumatic stress symptoms and PTSD after childbirth. |
| Health related quality of life | 2 | – | | Consistent findings were found across studies ($n = 2$) that women who had an EmCS had poorer physical functioning compared to other MoDs. |
| Mother infant bonding | 3 | | – | Studies reported inconsistent findings. In $n = 1$ study EmCS appeared to have a negative association with mothers bonding and opening emotions with their baby. In contrast, no significant affect was found in terms of MoD on mother-infant bonding in the remaining studies ($n = 2$). |
| Infant feeding | 3 | – | | Consistent findings were found across studies in that EmCS impacted negatively in varying ways on infant feeding ($n = 3$). Women who have an EmCS were more likely to have had an unsuccessful first breastfeeding attempt, were less likely to breastfed their baby within the first 24 h and upon leaving the hospital, and to breastfeed for a shorter duration of time compared to other MoDs. |
| Sexual function | 3 | | +/– | Studies were inconsistent in their findings ($n = 3$) in terms of satisfaction with sexual relations after birth and sexual function postpartum. |
| Experiences | 21 | +/– | | In terms of quantitative research ($n = 9$), the majority of studies found that EmCS was more likely to result in a negative birth experience ($n = 6$), $n = 1$ study reported MoD had no influence on mother experiences and $n = 2$ studies reported that EmCS was related to positive experiences in comparison to other MoDs. In terms of the qualitative studies ($n = 12$) women described a wide variety of emotions as salient aspects to their EmCS experience however, a number of dominating negative experiences were consistent across all studies |
| Satisfaction | 4 | – | | Consistent findings were reported across all studies ($n = 4$) with women who had an EmCS more likely to appraise their deliveries less favourably than those who delivered via other MoDs. |
| Self-esteem | 3 | – | | Consistent findings were reported across all studies ($n = 3$). Women who had an EmCS were more likely to report feelings of emotional vulnerability after delivery including feelings of failure, regret, and lower self-esteem. |
| Distress | 3 | | – | Findings were inconsistent in terms of distress after EmCS. No significant association between MoD and distress were reported in a study ($n = 1$), another study reported other MoD causing more distress than EmCS ($n = 1$), the final study reported a relationship between EmCS and distress. |
| Fear | 2 | | – | Inconsistent findings were reported. With $n = 1$ study reporting EmCS was associated with increased fear of childbirth in subsequent pregnancies and $n = 1$ study reporting a correlation with fear of childbirth a few days after the operation, however this decreased one month later. |
| Other | | | | |
| Childbirth Burden | 1 | + | | Women who experienced emergency surgical intervention (i.e EmCS) were more likely to demonstrate higher childbirth burden scores than any other MoD ($n = 1$). |
| Feelings of control | 1 | – | | Women who had a spontaneous VD reflected having a significantly higher sense of control during their labour and childbirth relative to with an instrumental VD, a planned CS, or an EmCS ($n = 1$). |

+ indicates that some (or all) evidence supports a positive association
- indicates that some (or all) evidence supports a negative association

by EmCS had significantly higher odds of PPD 6 weeks after delivery (OR = 1.45) [36]. Additionally, a cohort study ($n$ = 10, 535) reported that the odds of PPD was significantly lower for women who had a normal VD (OR = 0.67) or an instrumental VD (OR = 0.56) compared to women who had EmCS [87]. However, women who had an elective CS had higher odds of PPD than women who had EmCS (OR = 1.48, $p$ = 0.0168) [87]. Heterogeneity in the tools, their use and findings can be seen in Table 3 and makes the comparison of these figures problematic.

#### *Traumatic stress*

Eleven included studies examined trauma as an outcome of an EmCS [24, 34, 41, 42, 59, 60, 65, 66, 73, 76, 81]. These studies were conducted across a diverse range of countries including Australia, Nigeria, UK, Iran, Israel, Sweden and Germany. Study designs included, six cross-sectional, four prospective and one qualitative. All studies consistently reported that EmCS was a contributing factor for post-traumatic stress symptoms and Post Traumatic Stress Disorder (PTSD) after childbirth. Several of the studies stated that any unplanned interventions during childbirth including EmCS were predictors of PTSD [42, 88]. For example, a prospective cohort study ($n$ = 1824) identified EmCS as a risk factor for post-traumatic stress symptoms [41]. Findings from a smaller cross-sectional study in Australia reported a greater than expected frequency of PTSD in women who had EmCS, specifically, 73% reporting trauma symptoms 4–6 weeks postpartum [42]. Further, a qualitative research study conducted in Sweden concluded that experiences of women who delivered via EmCS were traumatic enough to fulfil the stressor criterion of PTSD in the DSM IV [66]. This study stated that 55% of women interviewed a few days after an EmCS reported feelings of intense fear of death or injury to themselves or to their baby during the delivery process [66].

#### *Health related quality of life*

Two studies specifically examined Health Related Quality of Life (HRQoL) [52, 78]. One study utilised the Short-Form 36 (SF-36) to measure HRQoL [78] and the other utilised the SF-36 and the EuroQoL 5D [52]. Both studies reported consistent findings that women with an EmCS had poorer physical functioning, relative to other MoDs. A prospective study in the Netherlands reported that the average period to reach full physical recovery was 3 weeks after VD, 6 weeks after elective CS and EmCS [52]. Similarly, a larger more recent study reported that women who had a vaginal, forceps or vacuum-extraction delivery, had better physical functioning at 6 weeks postpartum relative to those with elective CS or EmCS [78]. In a cohort study in Sweden, women who had EmCS scored higher on the subscale measuring Psychasthenia (low degree of mental energy and stress susceptible) 9 months after birth relative to those with spontaneous VD [84].

**Table 3** Heterogeneity across studies examining depression

| Study | Cut score | Time post partum | Sample size | Participants with depression | EmCS subgroup | EmCS subgroup with depression | Evidence of association between EmCS and PPD |
|---|---|---|---|---|---|---|---|
| Edinburgh Postnatal Depression Scale | | | | | | | |
| Eckerdal, 2017 | EDPS> 12 | 6 weeks | 3888 | 505 (13%) | 346 | 50 (16.7%) | No |
| Gaillard, 2014 | EDPS> 12 | 6–8 weeks | 264 | 44 (16.7%) | 44 | 6 (13.6%) | No |
| Goker, 2012 | EDPS> 13 | 6 weeks | 318 | 100 (31.4%) | 106 | 37 (34.9%) | No |
| Iwata, 2015 | EDPS> 9 | 6 months | 479 | 21.5% | 60 | 24 (40%) | Yes |
| Patel, 2005 | EDPS> 13 | 8 weeks | 10,934 | N/A | 572 | 56 (9.8%) | No |
| Xie, 2011 | EDPS> 13 | 2 weeks | 534 | 103 (19.3%) | 149 | 24 (16.1%) | Yes: PPD higher in EICS than EmCS |
| Beck Depression Inventory | | | | | | | |
| Chen, 2002 | BDI 9–10 | 6 weeks | 357 | N/A | N/A | N/A | No |
| Sarah, 2017 | N/A | N/A | N/A | 33.4%, | N/A | 13.8% of 33.4% | No mention |
| Ukpong, 2006 | BDI > 9 significant, 10–18 mild/moderate, 19–29 moderate/severe, 30–63 extreme | 6–8 weeks | 47 | 29.8% | 40 | N/A | No |

### *Mother-infant bonding*

Three studies examined the relationship between EmCS and mother-infant bonding [5, 35, 40] with conflicting results. Two studies utilised the Mother-to-Infant Bonding Scale [5, 40] and the third utilised the Parent-Child Early Relational Assessment Tool [35]. A recent, large scale cross-sectional study found EmCS appeared to have a negative association with mothers bonding and opening emotions with their baby. In contrast, a similar sized study reported no significant differences in mother-infant interactions at 4 or 12 months postpartum between MoD [35]. Similarly, a smaller scale cohort study found that type of CS did not appear to significantly affect mother-infant bonding in the first 72 h following delivery or at 12 weeks postpartum [40].

### *Infant feeding*

Three studies examined the relationship between infant feeding and EmCS [25, 26, 50]. Study designs were prospective cohort, cross-sectional, and qualitative. The large scale prospective cohort study reported that women with EmCS were more likely to have an unsuccessful first breastfeeding attempt and were less likely to breastfed their baby within the first 24 h and upon leaving the hospital [50]. Furthermore, the study reported that women with EmCS had more breastfeeding difficulties (41%), and used more hospital resources before and after leaving the hospital (67, 58%), in comparison to those with a VD (29, 40, and 52%, respectively) or a planned CS (33, 49, and 41%, respectively). Additionally, a similar sized cross-sectional study reported that breastfeeding duration varied substantially with MoD [25]. In the same study, median breastfeeding duration was 45.2 weeks among women who had a spontaneous VD, 38.7 weeks among planned CS, 25.8 weeks among induced VD and 21.5 weeks among women with EmCS [25]. In the qualitative study women frequently stated that their decision to breastfeed was driven by their desire to make up for the traumatic way their baby was delivered, including, by EmCS [26]. In this study a women with EmCS stated, "breastfeeding became almost an act of vindication. I had to make up for failing to provide my daughter with a normal birth, so I sure wasn't going to fail again" [26].

### *Sexual function*

Three studies, conducted in Israel, Iran and Spain, examined the relationship between EmCS and sexual function postpartum [57, 69, 78], with inconsistent findings. A prospective cohort study reported a significantly higher proportion of women at 6 months postpartum being less satisfied with their sexual relations after birth in the forceps group (34%) relative to the EmCS group (15%) [78]. In contrast, a larger prospective cohort study reported that women who had a VD or EmCS had statistically significantly lower Female Sexual Function Index (FSFI) scores on average relative to those with a planned CS [69]. These findings were contrary to that of a small scale cohort study that found no significant difference between average sexual function scores and various MoD postpartum [57], potentially due to a lack of power.

### Experiences

A large number ($n = 21$) of identified studies examined women's experiences with EmCS. A variety of measures were used across studies including: Impact of Event Scale, Wijma Delivery Expectancy/Experience Questionnaire, and Questionnaire for Assessing Childbirth Experience (QACE). Studies examined varying aspects of women's experiences of EmCS including women's overall birth experiences, emotional experiences and experiences with care and staff.

The majority of quantitative research studies found that EmCS was more likely to result in a negative birth experience. For example, a recent large prospective cohort study in Sweden reported that birth experience was more likely to be negative among women with EmCS relative to VD [53]. Similar findings were reported in another recent but smaller cross-sectional study, where unexpected MoD including EmCS resulted in a higher likelihood of negative birth experiences [48] with this finding supported in numerous other studies [32, 54, 83, 89]. Contrary to this finding, two prospective cohort studies reported that MoD had no direct influence on women's experience of childbirth [38, 74]. Interestingly, in one of these studies no women in the EmCS subgroup attained a score which indicated a negative birth experience; rather 89% of these women described the birth experience as 'good/very good' [74]. Furthermore, the majority of women in this study with EmCS also evaluated their feelings of control during labour and the opportunities they had to make informed choices/decisions as 'good/very good' [74]. Interestingly, a large prospective study found that women who had a planned CS scored significantly lower in terms of negative birth perception than those who had an EmCS or a VD [30].

Twelve studies utilised a qualitative design to examine women's experiences of an EmCS [9, 31, 39, 44, 47, 49, 64, 66, 68, 72, 77, 79]. In all of these studies, women described a wide variety of emotions as salient to their EmCS experience however, a number of dominating negative experiences were consistent across all studies including: loss of perceived control and feelings of helplessness [9, 31, 39, 47, 49]; fear (own or/and for baby) [9, 31, 64, 66, 68, 77]; and disappointment [9, 66, 77]. In a study conducted by Shorten [72] one participant reported "after an emergency caesarean I felt I had failed, I felt cheated of the childbirth experience I had wanted".

#### *Experiences with maternity care and staff*

A large prospective cohort study reported that women who had an unplanned CS were more likely to indicate that they had received "less than good" midwifery care during childbirth [90]. It was suggested that as women who have an EmCS often have their care transferred to other care providers during childbirth, it is possible that the discontinuity of care between the providers may influence women's experiences with staff [90].

#### *Satisfaction*

Four studies examined women's satisfaction after EmCS [28, 37, 46, 70] with all reporting that women with EmCS were more likely to appraise their deliveries less favourably than those with other MoDs. In a large prospective cohort study conducted in both the Netherlands and England, EmCS appeared to be a contributing factor to a negative appraisal of birth [28].

#### *Self esteem*

Three studies examined women's self-esteem and EmCS [32, 55, 56] with all studies reporting consistent findings. A cross sectional study reported that MoD influenced women's mood at one-month postpartum, with an item reading 'I am proud of myself', representing self-esteem, being more likely to have negative results for women with EmCS [32]. In two smaller Nigerian studies, women were more likely to report feelings of emotional vulnerability after delivery including feelings of failure, regret, and lower self-esteem [55, 56].

#### *Distress*

Three studies in Norway, Scotland and England examined distress in relation to EmCS [23, 58, 63]. In a very large prospective cohort study ($n$ = 55,814) conducted over a 10 year period, no significant association between MoD and emotional distress postpartum was reported [23]. Further, a small cross-sectional study reported that women who gave birth assisted by instrumental delivery were more likely to report that their birth was distinctly more distressing than women in three other obstetric groups (VD, induced VD, EmCS) [58]. A mixed methods study reported that the fact that a CS was classified as an "emergency" frightened women, resulting in feelings of distress [63].

#### *Fear*

Two studies examined fear as an outcome of EmCS [75, 82]. A large prospective cohort study reported that EmCS was associated with increased fear of childbirth in subsequent pregnancies [75]. A similarly designed and sized study found that EmCS correlated with increased postpartum fear of childbirth a few days after the operation, however this decreased 1 month later [82].

#### *Other outcomes*

Childbirth burden and feelings of control were examined in two studies. A large cross-sectional study reported that women who experienced emergency surgical intervention (EmCS and vacuum extraction) were more likely to demonstrate higher childbirth burden scores than those with any other MoD [29]. A small cross-sectional study reported that women who had a spontaneous VD had a significantly higher sense of control during their labour and childbirth relative to those with an instrumental VD, a planned CS, or an EmCS [61].

## Discussion

### Summary of findings

A number of psychosocial outcomes were consistently and negatively reported to be associated by EmCS including post-traumatic stress, HRQoL, infant feeding, experiences, satisfaction and self-esteem. All studies examining post-traumatic stress consistently found that EmCS was a contributing factor for symptoms and PTSD after childbirth. Two studies exploring HRQoL reported consistent findings that women with EmCS had poorer physical functioning relative to other MoDs. Three studies examining infant-feeding reported that women with EmCS were more likely to have an unsuccessful first breastfeeding attempt, less likely to breastfed within the first 24 h and upon leaving the hospital, and to breastfeed for a shorter duration of time in comparison to other MoDs. These results are consistent with those reported by Ahluwalia [25] who noted that women with EmCS often experience; a difficult labour, stress, and delays in mother-infant interactions, each of which may reduce the likelihood or duration of breastfeeding.

Consistent findings were reported for satisfaction in that women with EmCS were more likely to appraise their deliveries less favourably than those with other MoDs. Studies examining self-esteem found women who had an EmCS were more likely to report feelings of emotional vulnerability after delivery including feelings of failure, regret, and lower self-esteem. Twenty one articles examined varying aspects of women's experiences of EmCS, which constituted the most commonly examined psychosocial outcome among included studies. In both quantitative and qualitative studies it was reported that women with EmCS were often at the highest risk of assessing their childbirth experience in a negative way and described a wide variety of negative emotions including: loss of perceived control and feelings of helplessness, fear (own or/and for baby), and disappointment.

Psychosocial outcomes including depression, mother-infant bonding, sexual function, fear, and distress were also identified and examined within in the literature. However, studies either reported mixed findings or no

sufficient evidence of an association between these outcomes and EmCS.

### Limitations

We recognise that potentially relevant articles could have been missed, written in languages other than English, or indexed in other databases other than those chosen and therefore may not have been identified. Studies identified in the review were conducted in 22 diverse countries and as such it must be acknowledged that cross-cultural differences are common and can greatly influence women's psychosocial outcomes of childbirth [91]. Postnatal access to healthcare; procedural differences; quality of available care; levels of social support; religious beliefs; poverty; societal attitudes regarding pregnancy, birth and motherhood; gender roles and attitudes regarding mental health problems are just a few of the known socio-cultural and environmental factors that may influence findings in the identified studies [92].

Of the included articles the strengths and meaningfulness of the findings differ substantially due to variations in study design, sampling procedures, and sample size. It has been previously identified that research examining the psychosocial outcomes of CS have generally suffered from numerous methodological limitations including; reliance on small sample sizes, use of measures of unknown reliability and validity and the lack of a comparison group or varying comparison groups [93]. Several of these limitations were present in the included studies. For example, as noted previously, one of the primary reasons for excluding articles was the failure to specify or differentiate between type of CS for women in a study. Furthermore, there was often no discussion within included studies about reasons and causes for EmCS and it is possible that some causes are more strongly associated with the psychosocial outcomes examined. Studies identified in the review reported on wide varying time frames for postpartum data collection, with collection ranging from hours after birth to years after birth as well ultilising different cut-points on the same measures for diagnosis. The timing of data collection is an important methodological consideration as there is considerable evidence that the impact of a women's birth experience changes over time [94]. As time passes, the positive affect from one's baby and satisfaction with being a mother has been shown in some cases to favourably influence a women's feeling about her labour experience [94].

As a result of the heterogeneous nature of these factors (exemplified in Table 3 for depression), meaningful pooled quantitative measures of study findings were unable to take place, even for subsets of studies. Overall, there appears a paucity of published evidence with consistent measures and adherence to guidelines for reporting (e.g. for cut-scores) which is crucial to rectify in future studies so that (gold standard) systematic literature reviews can meaningfully pool data in a quantitative manner.

### Strengths and implications

To our knowledge, this study is the first to systematically review the available literature on women's psychosocial outcomes of EmCS. The review presents the findings of quantitative, qualitative and mixed methods studies from a vast array of countries and as a result identifies and examines a wide variety of psychosocial outcomes.

The review has highlighted the need for the further development of technologies and clinical practices to reduce the number of unnecessary EmCSs. Critically, it underscores the requirement for evidence based strategies to provide psychosocial support and information about EmCS in the context of routine antenatal and postnatal care. While high-level research currently exists in this area, for example in the form of routine debriefing to prevent psychological trauma after childbirth (103), it fails to show benefit. More broadly, while programs for postnatal psychosocial support have been promoted in many countries to improve maternal knowledge related to parenting, mental health, quality of life, and physical health, it has been concluded in a systematic review that the most effective strategies remain unclear [95].

## Conclusion

The review has highlighted the diverse impact that EmCS can have on women. Numerous psychosocial outcomes that are negatively impacted by this MoD were identified including post-traumatic stress, health-related quality of life, experiences, infant-feeding, satisfaction, and self-esteem. In particular, there was strong consensus that EmCS contributes to symptoms and diagnosis of post-traumatic stress. This review has also highlighted the need for further investigation on this topic using robust methodology including the use of consistent, valid and reliable measures with consistent use of guidelines for appropriate cut scores, consistent comparison groups, adequately powered studies and differentiation between types of CS. Overall, enhanced knowledge and understanding in this area will provide an imperative step towards implementing effective strategies to improve women's health and well-being following EmCS.

## Supplementary information

**Supplementary information** accompanies this paper at https://doi.org/10.1186/s12884-019-2687-7.

**Additional file 1.** Logic Grids.

### Abbreviations

BDI: Beck's Depression Inventory; CS: Caesarean Section; EmCS: Emergency Caesarean Section; EPDS: Edinburgh Postnatal Depression Scale; HRQoL: Health Related Quality of Life; MMAT: Mixed Methods Appraisal Tool; MoD: Mode of Delivery; PPD: Postnatal depression; PROSPERO: Prospective register of systematic reviews; PRSIMA: Preferred Reporting Items for Systematic Reviews and Meta-analyses; PTSD: Post Traumatic Stress Disorder; QAR: Quality Assessment Rating; SF-36: Short-Form 36; VD: Vaginal delivery

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### Authors' contributions

MB, DT, AS have made substantial contributions to conception and design of the review. MB and NT conducted the literature search, initial screening of papers, full text assessment, and quality assessment of included studies. MB extracted data and characteristics of included studies. MB wrote initial manuscript and DT, AS, and CW provided intellectual content and extensive review of final manuscript. All authors read and approved the final manuscript.

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### Availability of data and materials

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Ethics approval was not needed for this systematic literature review.

### Consent for publication

Not applicable.

### Competing interests

The authors declare that they have no competing interests.

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## Publisher's Note

# APPENDIX L. STUDY TWO: PUBLISHED PAPER

The published version of Chapter Four is on the following pages. Publication details:

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# A qualitative study of a sample of women participating in an Australian randomised controlled trial of intrapartum fetal surveillance

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ABSTRACT

*Background:* The STan Australian Randomised controlled Trial (START), the first of its kind in Australia, compares two techniques of intrapartum fetal surveillance (cardiotocographic electronic fetal monitoring (CTG) plus analysis of the ST segment of the fetal electrocardiogram (STan+CTG) with CTG alone) with the aim of reducing unnecessary obstetric intervention. It is also the first comprehensive intrapartum fetal surveillance (IFS) trial worldwide, including qualitative examination of psychosocial outcomes and cost-effectiveness. In evaluating and implementing healthcare interventions, the perspectives and experiences of individuals directly receiving them is an integral part of a comprehensive assessment. Furthermore, the added value of using qualitative research alongside randomised controlled trials (RCTs) is becoming widely acknowledged.

*Objective:* This study aimed to examine women's experiences with the type of IFS they received in the START trial.

*Methods:* Using a qualitative research design, a sample of thirty-two women were interviewed about their experiences with the fetal monitoring they received. Data were analysed using thematic analysis.

*Findings:* Six themes emerged from analysis: reassurance, mobility, discomfort, perception of the fetal Scalp Electrode (FSE), and overall positive experience.

*Conclusion:* Interestingly, it was found that women who had an FSE in the CTG alone arm of the trial reported very similar experiences to women in the STan+CTG arm of the trial. Despite STan and CTG differing clinically, from women's perspectives, the primary difference between the two techniques was the utilisation (or not) of the FSE. Women were very accepting of STan+CTG as it was perceived and experienced as a more accurate form of monitoring than CTG alone. Findings from this study have significant implications for health professionals including midwives and obstetricians and implications for standard practice and care. The study has demonstrated the importance and significance of incorporating qualitative enquiry within RCTs.



## Introduction

Intrapartum fetal surveillance (IFS) using continuous cardiotocography (CTG) has become almost ubiquitous in the intrapartum setting (Kuah and Matthews, 2017), with routine data collection and other reports from Australia (East et al., 2015; Pregnancy Outcome Unit, 2018), the setting for START (STan Australian Randomised controlled Trial), demonstrating that it is used in 60–70% of all labours (East et al., 2015; Pregnancy Outcome Unit, 2018). Although there is some benefit from CTG during labour (Alfirevic et al., 2017) there is also evidence of it being associated with increased rates of caesarean section which are accompanied by risks to the mother and child (Alfirevic et al., 2017; Paterno et al., 2016; Sandall et al., 2018). Furthermore, there are psychosocial sequalae of emergency caesarean section that are often not considered (Benton et al., 2019).

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Alfirevic et al. (2017) describe CTG as the electronic recording of the baby's heart rate and the mother's uterine contractions. The fetal heart rate can be monitored by one of two methods: external CTG utilises a Doppler ultrasound transducer which is held to the mother's abdomen by an elastic strap; internal CTG utilises a fetal scalp electrode (FSE) attached to the back of the baby's scalp to calculate the fetal heart rate from the R-R' interval of the fetal electrocardiogram (Symonds et al., 1999). Resultant restriction to mothers' mobility using either method has been noted by Alfirevic et al. (2017). A pressure transducer is also utilised regardless of external or internal means of detecting the fetal heart rate. This transducer is also held by an elastic strap to the mother's abdomen, typically in proximity to the top of the uterus in order to monitor the timing of their contractions.

An alternative to CTG alone, is monitoring which undertakes ST analysis (STan) of the fetal electrocardiogram (Neoventa Medical, Gothenburg, Sweden) (Rosén and Lindecrantz, 1989) in addition to CTG. This approach identifies changes to the ST segment which are related to metabolic acidosis in the unborn baby, and these changes are interpreted together with the CTG (Rosen et al., 1984; Rosén and Lindecrantz, 1989; Westgate et al., 2001). Similar to the internal CTG monitoring, STan monitoring requires the placement of an FSE to detect the fetal ECG (Belfort et al., 2015; Sacco et al., 2015). With up to a 60% false positive diagnosis of fetal distress using CTG alone (Chandraharan and Arulkumaran, 2007), the additional information afforded by STan may have considerable impact on the reduction of a false positive diagnosis of fetal distress and thus a reduction in unnecessary operative births (Sacco et al., 2015).

To date, there have been six international randomised controlled trials (RCTs) comparing STan in addition to CTG with CTG alone (Amer-Wahlin et al., 2001; Belfort et al., 2015; Ojala et al., 2006; Vayssière et al., 2007; Westerhuis et al., 2010; Westgate et al., 1992). Meta-analyses have also been conducted which include some or all RCTs (Becker et al., 2012; Blix et al., 2016; Neilson, 2015; Potti and Berghella, 2012; Salmelin et al., 2013; Schuit et al., 2013). To our knowledge, STan has not been previously utilised in the Australian maternity care system beyond its introduction and piloting at the study institution (Women's and Children's Hospital) in 2015. STan+CTG is being compared to CTG alone in our institution and the primary aim of the randomised controlled trial (START) is to determine if STan in addition to CTG can reduce emergency caesarean section rates and other interventions, whilst maintaining or improving neonatal outcomes (Turnbull et al., 2019).

In evaluating and implementing healthcare interventions, the perspectives and experiences of individuals directly experiencing those interventions are critical (Brewster et al., 2015; Sekhon et al., 2017; Smith et al., 2017). Examination of women's views and experiences of maternity care has become an important indicator of the quality of health-care provision, with growing acceptance of the need to adapt services to improve women's experiences (Karlström et al., 2015). Overall, women's views, including their thoughts, opinions, preferences and experiences toward aspects of maternity care, carry important implications for postnatal psychological functioning (Michels et al., 2013). Furthermore, the added value of using qualitative research alongside RCTs is becoming widely acknowledged (Cooper et al., 2014; Snowdon, 2015) and increasing numbers of RCTs are including qualitative components (Cathain et al., 2013). A number of benefits of this qualitative research in RCTs have been identified including; a more comprehensive interpretation of trial findings, exploration of users perceptions of the feasibility and acceptability of an intervention, and understanding of the effect of social context in which an intervention is delivered (Russell et al., 2016).

Surprisingly, little recent research has examined women's experiences and views in the broad area of IFS. Thus, this RCT offered the ideal opportunity to examine women's experiences of two different fetal monitoring techniques. A recent systematic review has explored women's views and experiences of electronic fetal monitoring during labour (Smith et al., 2017). The review reported on 10 studies from which four themes were identified including: discomfort; anxiety; reassurance; and communication (Smith et al., 2017). However, the systematic literature reviewed did not identify any studies that examined views and experiences of STan monitoring. To the author's knowledge, only one quantitative study conducted in the UK has examined women's retrospective self-reported satisfaction with STan (Parisaei et al., 2010), with the majority of women viewing STan as acceptable. However, beyond this binary measure of acceptability, no views or opinions were sought. Subsequently, a pilot exploratory investigation on pregnant women's hypothetical views about STan monitoring was conducted by our group prior to the current trial (Bryson et al., 2017). Pregnant women were interviewed about their perceptions of both STan and CTG after reading hypothetical vignettes describing the two forms of monitoring. While women tended to prefer CTG, their views were multifaceted and complex.

The current study builds on the earlier small study with the aim of generating insights in terms of IFS by investigating women's retrospective experiences of the type of fetal monitoring they received during their participation in START.

## Methods

This qualitative study utilised individual, face-to-face, semi-structured interviews to explore women's experiences with the type(s) of IFS they received.

### *Procedure*

Women were recruited for the qualitative study from the participants of START, conducted at the Women's and Children's Hospital, a public tertiary hospital that manages the largest number of births in South Australia. As part of the trial women were randomised to one of two arms: CTG alone or STan+CTG. In the study institution, continuous fetal monitoring by CTG is the most common method of IFS and its use over intermittent auscultation of the fetal heart during labour is guided by recommendations listed in the Royal Australasian College of Obstetricians and Gynaecologists (RANZCOG) guidelines for IFS (RANZCOG, 2019). In our study setting, women may have experienced several monitoring methods during their birthing experience. All women were deemed to require continuous CTG monitoring, per the RANZCOG guidelines (RANZCOG, 2019) prior to randomisation. If randomised to the CTG alone arm, the fetal heart rate may have been obtained via external (CTG no FSE) or internal (CTG with FSE) methods depending on the clinical situation. CTG was conducted with transducers connected to the monitor or via telemetry dependant on the type of machine already in the birthing room the woman was allocated to. Women who were randomised to the STan+CTG arm initially received CTG monitoring as described for CTG alone until it was clinically appropriate to commence STan monitoring. This was immediate if an FSE was already in situ and connected to a monitor capable of ST analysis (Neoventa) or may have been delayed until it was clinically possible to apply an FSE and/or connect to a Neonventa monitor brought into the birthing room.

Approximately seven weeks after birth, expressions of interest for interviews from women recruited to START were sought. A precursor letter and information sheet were sent to women who had expressed an interest in an interview. The researcher made telephone calls to these women to discuss the study, and interview

times and locations were arranged with those who wished to participate, with written informed consent obtained directly before conducting the interview.

It was initially planned to adopt 'maximum variation sampling' (Palinkas et al., 2015) in which participants are sampled based on predetermined criteria (i.e. type of IFS received in the trial, parity and previous experiences of fetal monitoring) in order to cover a range of constituencies to ensure representativeness and diversity. However, this approach proved to be impractical and so we moved to a more pragmatic approach where we interviewed consenting women based on the type of monitoring they received, irrespective of their broader clinical and demographic profile.

A pilot interview, aimed at gauging the comprehensibility and flow of the interview questions was conducted prior to the commencement of formal interviews with one women who had recently given birth and received fetal monitoring (but was not enroled in START) and clinical staff including a midwife. The pilot interviews provided feedback to the researcher regarding the effectiveness of the interview questions and amendments were made to the interview schedule accordingly.

Women interviewed were asked open-ended questions designed to elicit discussion which was guided by an interview schedule. The interview schedule allowed the researcher to pursue the same basic lines of enquiry with each participant and assisted in managing the interviews in a systematic and comprehensive way (Al-Busaidi, 2008). The interview schedule was informed by relevant literature on women's experiences of fetal monitoring in labour (Smith et al., 2017), as well as literature on STan monitoring in general (Bryson et al., 2017).

To enhance methodological rigour throughout the research process, criteria for rigorous qualitative research were followed, specifically Tracy (2010) "Big-Tent" criteria for excellence in qualitative research. As recommended, an audit trail was kept by the researcher to ensure transparency and rigour in the research process, which included records of all interactions with participants, reflections on the quality of the interview process, notes surrounding emerging themes and methodological decisions.

A further important element of qualitative research is self-reflexivity, considered to be honesty and authenticity with one's self, one's research, and one's audience (Tracy, 2010). It is important to acknowledge the potential impact of the researcher's subjective values, biases and preconceptions on the research. The primary researcher, who conducted the interviews, is a young female who has no children of her own, and thus this may have influenced the way in which women responded to the interview. A number of women expressed their appreciation in being able to talk about their experiences. The third author is a male obstetrician with a child of his own and the remaining authors were women with children of their own. As such, the authors approached the data analysis from their respective positions.

### *Data analysis*

Transcripts were analysed using Thematic Analysis (TA) to identify, analyse and report patterns (themes) within the data. A semantic approach was taken allowing the analysis to be driven by the research question without searching for meaning beyond what the participants reported (Braun and Clarke, 2006). We used a combined deductive/inductive approach in order to examine the data according to previous research, specifically the previous pilot study (Bryson et al., 2017), while also identifying additional themes suggested from the data itself (Nowell et al., 2017).

Braun and Clarke (2013) describe six steps involved in undertaking TA. The first step involved familiarisation and immersion with the data. The researcher achieved this through familiarisation with transcription, multiple readings and beginning to note preliminary ideas. The second step involved generating initial codes by grouping interesting features across the dataset. Third, the initial codes were collated into potential emergent themes and subthemes. Fourth, these themes were reviewed in relation to the raw data, initial codes, and relevance to the research aims. Fifth, themes that best represented the data were refined, defined and named. Finally, transcript extracts were selected to illustrate each theme. To improve the consistency and trustworthiness of the chosen themes, Braun and Clarke (2013) also recommend that the codes and themes are cross-checked by multiple researchers. Three authors discussed initial emerging themes (MB, DT, AS) at which point the observation was made that women were commenting in very similar ways, irrespective of the type of monitoring received; so the decision was made that study arms would not be routinely compared and the data set would be analysed as a whole, and not by treatment arm. Subsequently, two authors (DT and AS) crossed-checked initial codes and emerging themes identified by the primary researcher (MB). Themes emerging from the data were discussed throughout analysis by three authors (MB, DT, AS).

### *Ethical considerations*

Human Research ethics approval was gained from both Women's and Children's Hospital Network Human Research Ethics Committee and the University of Adelaide Human Research Ethics Committee (HREC/17/WCHN/14).

## Results

### *Participants*

Interviews were conducted with 32 women who were between 7 and 24 weeks postpartum from May, 2018 to August, 2019. All interviews were conducted by the primary researcher (MB) with four interviews being conducted in public locations, including cafes, and the remaining 28 completed in women's homes for their convenience. All interviews were audiotaped and the mean interview time was 23 min (between 11 and 60 min). Data saturation was determined by the 30th interview as the most recently conducted interview appeared to yield no new themes. To ensure this was the case, two additional interviews were completed (Guest et al., 2006). Audio-taped interviews were transcribed verbatim by the primary researcher using study numbers and pseudonyms to maintain anonymity of participants.

Participants were aged between 20 and 42. Sixteen participants were randomised to STan+CTG and 16 participants to CTG alone, of which 12 had a FSE applied for clinical reasons and 4 did not. Key characteristics of the participants are described in Table 1.

It is important to preface that meaningful differences in women's experiences between each treatment arm of the trial were expected to be found but this wasn't the case. Interestingly, it was found that the main point of difference for women was whether the FSE was present or not. Women's intrapartum monitoring experiences typically began with standard external CTG monitoring before they were randomised to either arm of the trial (CTG alone or STan+CTG). More often than not, women in the qualitative study population had received an FSE in the CTG alone arm due to clinical necessity and women in the STan+CTG arm always received a FSE (as described previously). Participants will have experienced one of four combinations of IFS: external CTG only; external CTG converted to internal CTG when a FSE was applied for clinical reasons; external CTG then CTG+STan after FSE was applied to enable STan as randomised to STan arm; and external CTG converted to internal CTG for clinical reasons and then STan enabled as randomised to STan arm. It should be noted that

**Table 1**
Participant characteristics.

| Participant name* | Monitoring | Age | Parity | Weeks postpartum | Epidural |
|---|---|---|---|---|---|
| Ida | CTG wt FSE | 26 | 1 | 15 | Yes |
| Alice | STan | 22 | 1 | 14 | Yes |
| Olivia | STan | 33 | 2 | 20 | Yes |
| Sophia | STan | 31 | 1 | 13 | Yes |
| Samantha | CTG wt FSE | 30 | 2 | 11 | No |
| Mia | CTG no FSE | 20 | 3 | 17 | No |
| Christianna | CTG wt FSE | 25 | 1 | 13 | No |
| Michelle | CTG wt FSE | 30 | 1 | 23 | Yes |
| Caroline | STan | 31 | 2 | 18 | Yes |
| Julia | STan | 27 | 1 | 17 | Yes |
| Victoria | CTG wt FSE | 27 | 2 | 13 | Yes |
| Emily | CTG wt FSE | 42 | 1 | 12 | Yes |
| Naomi | STan | 33 | 1 | 19 | Yes |
| Isabelle | STan | 31 | 1 | 14 | Yes |
| Rose | STan | 35 | 1 | 13 | Yes |
| Mary | CTG no FSE | 31 | 1 | 15 | Yes |
| Irina | CTG no FSE | 36 | 1 | 14 | Yes |
| Florence | STan | 36 | 1 | 16 | Yes |
| Elena | CTG wt FSE | 32 | 1 | 12 | Yes |
| Grace | CTG wt FSE | 31 | 1 | 16 | Yes |
| Josephine | CTG no FSE | 38 | 1 | 18 | Yes |
| Charlotte | STan | 36 | 2 | 9 | Yes |
| Fiona | STan | 31 | 1 | 17 | No |
| Sarah | STan | 31 | 2 | 11 | Yes |
| Leila | CTG wt FSE | 30 | 1 | 25 | Yes |
| Jane | STan | 31 | 1 | 14 | Yes |
| Clara | STan | 42 | 1 | 13 | Yes |
| Ava | STan | 41 | 2 | 12 | Yes |
| Mila | STan | 21 | 1 | 19 | Yes |
| Penelope | CTG wt FSE | 29 | 1 | 11 | Yes |
| Zoe | CTG wt FSE | 35 | 2 | 8 | Yes |
| Caroline | CTG wt FSE | 29 | 1 | 12 | Yes |

* *Note*: Participant names are pseudonyms.

women's descriptions of their monitoring experience may be influenced by, and in reference to any part of their IFS experience and therefore quotes may appear out of context with the type of IFS stated that they received.

Five key themes that describe women's experiences with the fetal monitoring they received were identified: reassurance, mobility, discomfort, perception of the FSE, and overall positive experience.

### *Reassurance*

In general, reassurance emerged as a dominant theme across interviews and was strongly related to opportunities women had to hear their baby's heartbeat.

> "It just gave me that sound of mind of everything being okay" (Mia - CTG no FSE).

Women explained that hearing their baby's heartbeat allowed them to feel more relaxed knowing the baby was safe so they could in turn increase focus on labour.

> "It was lovely knowing that they knew exactly what was happening with him and they were confident, which made me a lot more relaxed and everything throughout the process" (Caroline - STan+CTG).

#### *Belt-mounted ultrasound transducers: inaccuracy and stress*

Several women described the belt-mounted ultrasound transducers as causing additional stress and anxiety in labour due to their experienced inaccuracy. This experienced inaccuracy was typically due to the ultrasound transducer moving and losing contact with baby's heartbeat.

> "The whole time, I was super anxious because it was just all over the place… I found the bands just way to inaccurate" (Jane - STan+CTG).

#### *FSE: reliable monitoring*

Women described the FSE (whether it be with STan+CTG or CTG alone) as a more reliable form of monitoring and therefore more reassuring in comparison to their experiences with external CTG alone. Women reported that internal monitoring utilising a FSE was able to provide constant monitoring of their baby's heartbeat whereas belt-mounted ultrasound transducers often moved on women's abdomens and contact would be lost with the baby's heartbeat.

> "I didn't have to ever worry about losing track of the baby's heart rate, it was actual proper continuous monitoring. Whereas I feel with the bands it wasn't, it was just up and down, up and down" (Isabelle - STan+CTG)

Several women also expressed increased feelings of safety with the FSE.

> "I felt safer with it on her head because the fact that they kept losing the heart rate with the one on the tummy…it made me feel more comfortable so that I knew she was safe"(Christianna - CTG with FSE).

> "It was good having that constant … accurate monitoring as opposed to the CTG … it just kept falling off" (Fiona - STan+CTG).

In addition to increased feelings of safety, women also described feeling more relaxed and in control when they had the FSE, either with STan+CTG or CTG alone in comparison to when belt-mounted ultrasound transducers were used (external CTG) as they didn't have to worry about a loss of contact with their baby's heartbeat.

"I felt like there was a lot more control and it was much more accurate because I know when I had the thing on my belly…it'd drop in and out and you're freaking out" (Olivia – STan+CTG).

"The clip [FSE] just gave us piece of mind and one less thing we had to worry about in labour" (Samantha - CTG with FSE).

*Monitoring impact on partner*

Women reported the continuous monitoring generally appeared to reassure their partners and generate a sense of their involvement in labour.

"He liked being able to see what was happening with contractions and things like that as well, because obviously I could feel them and I knew what was going on but he was able to be a bit more involved by actually being able to see what was happening" (Penelope - CTG with FSE).

In contrast, a small sub-set of women described anxiety the monitoring caused their partner either in terms the belt-mounted ultrasound transducer losing contact with their baby's heartbeat or in terms of the application of the FSE. One women described her husband's reaction to when the belt-mounted ultrasound transducer was not picking up their baby's heartbeat.

"He actually got quite stressed out and thought that the baby had died because everything had dropped of the monitor" (Grace - CTG with FSE).

*Technology informing staff*

Many women described further reassurance by the FSE (either with STan+CTG or CTG alone) as they considered it a valuable source of added information for staff to base clinical decisions on.

"They were able to explain more with the one on his head" (Caroline - CTG with FSE).

Furthermore, STan was seen as a new technology that could potentially reduce women's chances of experiencing additional intervention. Women also said if they were required to have an emergency caesarean section, they knew it was because it was necessary.

"It definitely made me confident that I could keep going the way I was going and made my obstetrician confident that everything was fine so there was no rushing to do anything" (Caroline – STan+CTG).

*Mobility*

Maintaining mobility was discussed as a significant preference and was consistently reported as an important pain management technique during women's labour. Women discussed the significance of mobility in terms of moving around the bed and changing positions. Women described the belt-mounted ultrasound transducer as inhibiting their desire to remain mobile as they reported the belts repeatedly moved on their abdomen and were having to be constantly readjusted.

"It didn't allow me to do any movement what so ever, every time I moved during a contraction … the bands would slip off" (Isabelle - STan+CTG).

"In-between every contractions I had to lie back on my back for them to strap the thing back on and find the heartbeat. In between contractions, it's ridiculous" (Samantha - CTG with FSE)

To overcome the problem of the belts moving, women reported having to stay in one position or holding the belts so they would not slip off in order to allow for a consistent reading of their baby's heartrate.

"because it doesn't stay there properly, I didn't move after that. I just kept one position. Or when I wanted to move I just held it and pressed it. So I didn't move too much" (Florence - STan+CTG).

"I was literally stuck in the same position on the bed" (Josephine - CTG no FSE).

Several women discussed how this focus on the belt-mounted ultrasound interrupted their overall mindset and focus on labour, increasing their anxiety and frustration.

"every time … I had a break in contractions I had to lie completely still in a position to get it reapplied … so it just sort of disturbed my train of thought of not trying to get to caught up in the pain" (Isabelle - STan+CTG).

"it was frustrating, it was like I didn't want to be paying attention to those [belt-mounted ultrasound transducer], I wanted to be kind of in the moment I guess, talking to my husband rather than going "uh this freakin bands" it was definitely a distraction" (Leila - CTG with FSE).

In comparing their experiences, women who had an FSE either with STan+CTG or CTG alone reported considerably increased mobility during labour as it would provide constant readings of the baby's heart rate.

"You can kind of do whatever you wanted to, like you weren't restricted as much so it was a lot easier than the CTG for sure" (Fiona - STan+CTG).

"I felt a lot better when the clip [FSE] was on cause I felt like I could do whatever I wanted without disrupting it, I felt a bit more free to move compared the other scan thing [CTG alone]" (Jane - STan+CTG).

*Discomfort*

Discomfort was discussed and associated with the monitoring equipment for women in both treatment arms of the trial in terms of either the application of the internal FSE or the belt-mounted ultrasound transducer. Some women who had the FSE described the application as unexpectedly uncomfortable.

"I think because it did quite hurt when they attached it the first time. I didn't realise there would be any sort of discomfort to be honest so I wasn't prepared…so when it happened I was sort of a bit taken back by it (Caroline - STan+CTG).

Women expressed that more information surrounding the application may be useful to prepare them for any discomfort with application.

"would hate for it to discourage women to use it but I suppose if you are mentally prepared for it to be a little bit uncomfortable you are sort of more [physically] prepared for it (Caroline - STan+CTG).

Several women expressed the difficulty some staff had in inserting the FSE, with some women describing several application attempts having to be undertaken by staff causing women stress, anxiety and feelings of panic. One women described the application as traumatic and later resulting in a panic attack.

*"The actual application of the clip [FSE] I found quite traumatic" (Grace - CTG with FSE).*

One woman described the application of the FSE with staff attempting to attach it three times before it was successfully applied. She described the impact on her partner.

*"It [the application] made my husband really anxious…he was concerned for her [baby] wellbeing and knowing there were three attempts at jabbing into her head and he was super just concerned" (Leila - CTG with FSE).*

However, epidural anaesthesia reduced discomfort associated with the application of the FSE.

*"Couldn't even feel it … I don't even know they were putting it in there but I can imagine if I hadn't [had an epidural], maybe putting something in there might be uncomfortable" (Naomi - STan+CTG).*

Women also described the application of the FSE as less invasive, relative to other procedures they had experienced during labour.

"Compared to all the other things going on it was insignificant" (Jane – STan+CTG).

Discomfort was consistently reported by women in terms of the belt-mounted ultrasound transducer.

"The belts were really uncomfortable after a while because they are pushing in to really get the heart beat and the contractions so they actually leave little dents (Rose - STan+CTG).

Women also described discomfort arising from the enforced immobility with the belt-mounted ultrasound transducer.

"It's uncomfortable because I need to stay there in one position for hours" (Florence - STan+CTG).

### *Perception of the FSE*

In terms of the FSE, women who either received STan+CTG or CTG alone with the FSE described their initial concerns when staff described it to them.

"It sounds painful. Even just the name doesn't sounds appealing" (Sarah - STan+CTG).

"They called it the "scalp clip" and I was like that sounds terrifying "what", they're like we put it on your baby's head when they are still in there and I was like "how" … This sounds silly, I didn't like the name scalp clip. I was like that sounds really invasive for the baby (Jane - STan+CTG).

Some women didn't understand how the FSE either with STan+CTG or CTG alone functioned.

"I actually thought it was going to be a little suction cap" (Caroline - STan+CTG).

"I was thinking…like a full metal clip that somehow attached" (Ava - CTG with FSE).

Other women were misinformed about the impact of the FSE, particularly on mobility, with some women opting not to have as FSE until they had an epidural.

"They told me that I couldn't move, that I had to be lying down for it [FSE], had to be still, not still but I had to labour on the bed with it and I was kind of like ohh no I don't want to do that " (Leila - CTG with FSE).

Many women further expressed concerns in relation to how the FSE would impact their baby.

"The idea of it being inserted and that it was a metal clip being attached to the scalp made me feel uncomfortable just cause you know its metal, and attaching to your new born baby's scalp like so I found it a little unsettling" (Ava - CTG with FSE).

However, these concerns in relation to the FSE were then typically described as an acceptable trade-off for potentially better outcomes for their baby.

"You worry that it's going to hurt the baby but I guess from our experience of knowing what could go wrong…[resuscitation in previous birth] that was a really minor impairment…I guess for us we rationalised that putting a probe in, in a really quick procedure…would be much better if it could avoid some of those more drastic medical procedures" (Sarah - STan+CTG).

Several women also described feelings of guilt they had in terms of the marks left by the FSE on the baby's head.

"There was like a little bit of mark on the head for a while and I was like "ohh" you know, of course you're a mother and you're like "ohhh I'm sorry" (Fiona - STan+CTG).

"When baby was born I found it a little distressing to see the clip [FSE] and to see clearly that she had been bleeding…not that it was gushing but it's still again your brand new little baby to see a little sore on their head already…you kind of have to reconcile that" (Ava - CTG with FSE).

Women suggested additional information about the potential impact on their baby would be beneficial.

"Setting that expectation of what you can visibly see when the baby comes out" (Ava - CTG with FSE).

### *Positive experience*

Overall, women described having the FSE whether it be with STan or with CTG to be a more positive experience overall in comparison to experiences with the belt-mounted ultrasound transducer. The FSE allowed women to focus on labour and reduce worry in relation to fetal monitoring.

"they switched to the scalp monitoring [STan] which obviously once that was connected it never lost connection again I found it a lot more relaxing, I could just focus on labour and delivery….the whole experience was a lot more positive and less bothersome than the bands" (Isabelle - STan+CTG).

The FSE was discussed as a method to possibility mitigate unnecessary interventions such as emergency caesarean section and therefore was frequently embraced by women.

"I definitely had more faith…if there was distress then it was genuine distress…if there was intervention to come from it then that was necessary" (Ava - CTG with FSE).

Women conveyed they would have liked to have been offered and received the FSE earlier in their labour.

"If anything I probably would have asked for the scalp monitoring sooner even right from the beginning instead of struggling with the bands for so long" (Isabelle - STan+CTG).

### *Discussion*

The current study examined women's experiences with two different techniques of IFS. Overall, the FSE was found to be used more frequently than anticipated, due to clinical indication of need rather than solely to facilitate STan, which led to findings that were not originally anticipated. Interestingly, it was found that women who had an FSE in the CTG alone arm of the trial reported very similar experiences to women in the STan+CTG arm of the trial. Despite STan+CTG and CTG alone differing clinically, from women's perspectives the primary difference between the two IFS techniques was the utilisation (or not) of the FSE. Overall, five key

themes were identified that describe women's experiences with the fetal monitoring they received including: reassurance, mobility, discomfort, perception of the FSE, and overall positive experience.

*Reassurance*

Supporting previous research (Barber et al., 2013; Smith et al., 2017) women found IFS generally reassuring. However, women reported the FSE added an additional layer of reassurance to their labour experience, especially when compared to the belt-mounted ultrasound transducers alone. This was typically a result of the inaccuracy of the belts related to loss of contact with the baby's heartbeat with women's movements. The FSE was perceived as a more reliable and accurate addition to monitoring as it provided women with a constant record of their baby's heartrate resulting in increased feelings of safety and allowing women to relax and focus during labour. Women who experienced STan+CTG expressed that knowing they were using newer technology that had the potential to reduce their chance of intervention provided them additional feelings of safety. These findings are contrary to the previous pilot study of women's prospective views (which examined women's preferences guided by hypothetical scenarios) rather than lived experiences towards different IFS techniques whereby STan+CTG was perceived as somewhat risky as it was a newer technology to the study institution (Bryson et al., 2017). Monitoring of either type was also discussed as helpful in providing reassurance to partners and an increased sense of involvement. This finding has also been described in other studies (Barber et al., 2013; Starkman, 1976).

*Mobility*

It is recognised that mobility is an important preference in labour for women due to its perceived physiological benefit such as pain management (Priddis et al., 2012). Interestingly, the limited research examining women's experiences of FSEs suggests that they do not increase women's mobility. A qualitative study of staff perspectives describe contrasting views of staff in relation to mobility and the FSE (Kerrigan et al., 2015). The study described a common assumption of staff that the application of an FSE would lead to a higher incidence of immobility during labour whereas other staff members saw the use of the FSE as a way to increase mobility (Kerrigan et al., 2015). Women in the current study described meaningful increases in mobility with the FSE in contrast with CTG alone which utilised the belt-mounted ultrasound transducer. Women reported the belt-mounted ultrasound transducers would often lose contact with their baby's heart rate, due to the belts moving on their abdomen leading to a reduction in mobility as women felt the need to stay in one position so a consistent fetal heart could be detected. Thus, with regard to mobility, the authors suggest that women perceived the advantage of the FSE as contributing to the ability to move and change position without losing contact with the fetal heart rate, rather than permitting movement around the birthing room during labour per se. In our study setting, the ability for unrestricted ambulation is facilitated by the monitors that have telemetry (not all monitors) and additionally these monitors can only be used for CTG only (with or without an FSE). Our version of Neoventa monitors (S31) do not have telemetry and additionally, current STan technology does not allow for telemetry with STan enabled.

Overall these findings highlight the need for updated consumer information from women's perspectives to clearly explain the impact of the FSE on mobility, and the potential for it to actually increase women's mobility rather than decrease it as previously suggested.

*Discomfort*

Discomfort was associated with the monitoring equipment for some women in both treatment arms of the trial in terms of either the application of the internal FSE or the enforced immobility and continual readjustment of the transducer belts. We acknowledge that the belt holding the pressure transducer to measure contraction timing remained after the application of a FSE, however, women did not specifically state that this belt presented a problem. Similarly, to the current findings, discomfort in the systematic literature review was reported in relation to the FSE and transducer belts particularly around enforced immobility associated with continuous monitoring and considerable restriction in movement (Smith et al., 2017).

*Perception of FSE*

Women expressed initial concerns when the FSE was introduced to them by midwifery and medical staff. Concerns were typically centred around the impact the FSE may have on their baby and women described a lack of adequate information in relation to this. Interestingly, the previous pilot study also described women's feelings of uncertainty and concern in relation to the FSE (Bryson et al., 2017). Furthermore, women in the current study outlined that staff primarily referred to the FSE as a "scalp clip" which frightened women and they also felt it was not an accurate representation of the technology. Several women suggested that staff referring to it as a "scalp electrode" may increase acceptability of the technology. Women's initial concerns towards the FSE underlines the need for clear information to explain the procedure and potential risks, to enable decision making and that is aligned with women's views and preferences. The provision of clearer information will assist in mitigating potential issues around the application of the FSE and perceived mobility. However, it should be noted that this is not always possible, women described several instances where there was often no time for full explanation and consideration of the intervention if there were serious clinical concerns about the unborn baby's heart rate and the FSE needed to be placed immediately.

*Positive experiences*

Women described several positive impacts that the FSE had on their labour experiences, particularly when compared to their experiences with the belt-mounted ultrasound transducer. Benefits of the FSE reported by women included: increased mobility during labour; providing further reassurance; providing increased information for staff, which lead to increased feelings of safety, allowing women to relax and concentrate on labour. Contrary to our findings, the pilot study of women's prospective views towards monitoring described the FSE as adding an additional level of uncertainty to labour (Bryson et al., 2017). This speaks to the need for care providers to examine and consider women's experiences towards their care, and incorporate them into practice.

*Strengths and limitations*

To our knowledge, this is the first qualitative study to explore women's retrospective experiences with STan, which, for the first time, is being trialled in Australia. Previous research incorporating women's perceptions and experiences with STan has been limited with only one other qualitative study exploring women's prospective views of the monitoring using hypothetical vignettes. Furthermore, this is one of the few studies to examine women's experiences with different techniques of IFS. In terms of the research methodology, following Tracy's (2010) model for quality and excellence in qualitative research lends additional credibility to the study's findings. Moreover, analysis was conducted with rigour, with emerging themes being corroborated between authors (MB, DT & AS) and all authors reaching consensus on the final interpretations. While this study provides significant insight into women's experiences of monitoring of the fetal heart rate during labour, the

findings need to be considered within the context of the following limitations.

Despite the sample having diverse demographic characteristics, women were only sampled from one hospital (the RCT site), thus potentially limiting the generalisability of the findings beyond this setting. Women had to express interest in the interview to take part, and they may have been more inclined to participate when having criticism they wanted to share and it is also possible that women experiencing too much stress may have been less inclined to participate. Many of the birthing women at Women's and Children's Hospital have risk factors that may have necessitated periods of continuous CTG during the antenatal period and thus may be exposed to more than one monitoring experience during that pregnancy episode which could shape their experience and perception beyond what was directly experienced within the RCT setting. Furthermore, as previously described, there was a range of potential experiences women may have had with fetal surveillance during participation in START. This study did not aim to tease out the nuanced differences but rather to examine experiences with monitoring at a more general level – STan+CTG compared with CTG alone, with the main finding being that differences related more to whether or not a women received an FSE. Additionally, although all of the women openly shared their experiences, there is always the potential for recall bias in interviews that are retrospective in nature.

*Implications*

Incorporating this qualitative component in relation to women's experiences of monitoring alongside the RCT with a primary focus on clinical outcomes has allowed for an exciting opportunity to demonstrate the importance of the additional examination of women's views and experiences. Findings from this study will have significant implications for health professionals including midwives and obstetricians, as well as implications for standard practice and care. Overall, women were very accepting of STan in addition to CTG as it was perceived and experienced as a more accurate form of monitoring than CTG alone. STan was reported to provide several benefits to women including a reduction in the chance of medical intervention including emergency caesarean section. In terms of the FSE which is always used with STan and more often than not used with CTG, women described it as reassuring, proving more accurate monitoring, and enabling increased mobility when compared to the belt-mounted ultrasound transducer belts alone. In contrast the belt-mounted ultrasound transducers were described as reducing mobility, providing less accurate monitoring and distracting women. These findings may therefore be used to inform staff perspectives and the development of consumer information to best support women to make informed and value-based choices about monitoring methods in labour. Further, findings provide support for the acceptability of STan in addition to CTG to women in Australia.

## Conclusion

The current study has demonstrated the diverse impact that variances in monitoring technique can have on women's experiences of labour. Consideration of women's experiences and perceptions towards IFS is crucial to an understanding of this important aspect of care. Health care professionals must remain knowledgeable of the current evidence on IFS to engage in evidence-base care. Regular education for all staff that incorporates experiences of women, as identified in this study, will provide a useful opportunity to engage in effective evidence base practice informed not only by clinical outcomes, but also by views of women receiving this care. Findings may be used to inform the development of staff and consumer information to best support both women and staff make informed and value-based individualised choices about utilisation of fetal monitoring technology during labour. Whilst START is comparing two forms of IFS (CTG alone compared to STan+CTG) from a clinical perspective, the current study has outlined that women's lived experiences were not determined by trial arm, but by whether the FSE was used or not. As a result, this study has importance and relevance in advancing the value of RCTs, as it provides an example of the valuable contribution that a qualitative enquiry can bring.

## Ethical approval

This study was approved by both the Women's and Children's Hospital Network Human Research Ethics Committee and the University of Adelaide Human Research Ethics Committee (HREC/17/WCHN/14).

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## Declaration of Competing Interest

None declared.

## CRediT authorship contribution statement

**Madeleine Benton:** Conceptualization, Methodology, Investigation, Formal analysis, Writing - original draft, Writing - review & editing. **Amy Salter:** Conceptualization, Methodology, Formal analysis, Writing - review & editing. **Bronni Simpson:** Conceptualization, Methodology, Writing - review & editing. **Chris Wilkinson:** Conceptualization, Writing - review & editing. **Deborah Turnbull:** Conceptualization, Methodology, Formal analysis, Writing - review & editing.

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## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.midw.2020.102655.

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