The Impact of General Anaesthetic Caesarean Section on Parental Mental Health & Infant Bonding: a scoping review

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Abstract

Background: Women and birthing people who undergo caesarean section with general anaesthesia are in a state of controlled unconsciousness, meaning they do not experience the birth of their infant and are often unable to engage in early bonding interactions with their newborn. The impact of this on postnatal parental mental health and infant bonding is unknown.

Aim: This review aimed to establish what is known regarding the psychological impact of GACS, with or without Intensive Care Unit (ICU) admission, on parental mental health and infant bonding.

Methods: A scoping review was conducted following Arksey & O'Malley's Five-Stage Methodological Framework in combination with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines. Databases including Maternity & Infant Care, MEDLINE & EMBASE (OVID), PUBMED, CINHAL were searched using MeSH terms, subject headings and keywords. Full text articles published up to May 2024 were included with no date restrictions.

Results: Five studies were identified: two focused on maternal mental health, one on childbirth experience, one on mother-infant bonding and one on father/partner experiences. No studies were identified specifically exploring ICU admissions following GACS. Findings indicated an increased risk of postpartum depression, birth dissatisfaction and impaired maternal-infant bonding for GACS compared to neuraxial anaesthesia groups. Additionally, the presence of fathers in the operating theatre during emergency GACS did not lead to adverse mental health outcomes three months postnatally.

Conclusion: Further research is required to better understand the psychological implications of GACS, particularly the impact on parental mental health and infant bonding.

Keywords: General anaesthetic caesarean, postpartum depression, infant bonding, fathers, scoping review.

Statement of significance

Problem: General anaesthetic caesarean section is characterised by the distinct experience of being in a state of controlled unconsciousness during birth. Despite this, there is a paucity of research exploring the psychological impact on parental mental health and infant bonding postnatally.

What is already known? Unexpected interventions such as emergency caesarean can be traumatic for the woman and increase the risk of post-traumatic stress disorder, depression, anxiety and stress postnatally. Furthermore, the mental health of father/partners may also be influenced by birth experiences. Mental health issues in the postnatal period are known to impact maternal-infant bonding.

What does this paper add? This review highlights the mechanisms through which general anaesthetic caesarean birth may impact parental mental health and infant bonding.

The Impact of General Anaesthetic Caesarean Section on Parental Mental Health & Infant Bonding: *a scoping review*

(Word Count exc. Tables & Refs. 4,528 words)

Introduction

The physical and emotional experiences of childbirth are often profound for the woman,[1] partner and child, with long lasting psychological impacts whether these be positive or negative (McKelvin, Thomson et al. 2021). For women who undergo a caesarean section under general anaesthesia and remain in a state of controlled unconsciousness at birth, much less is known about the immediate or subsequent psychological impacts on them and the family as a whole.

While there are considerable national variations in caesarean section rates, the overall trend is increasing and has been over the last 30 years (Boerma, Ronsmans et al. 2018). In the UK, the CS rate (England, Wales & Scotland) is around 29% of overall births (NMPA, 2022, PHS, 2023). Of these, GACS accounts for around 4-8% of the overall CS rate (Bamber et al., 2020; Bhatia et al., 2021). GACS is typically carried out as an elective or emergency intervention when neuraxial anaesthesia (NA) is contraindicated or when rapid anaesthetic induction is required to expedite birth (Sung, Jee et al. 2021). Risks associated with general anaesthesia (GA) include aspiration pneumonia, maternal awareness during the operation (with a reported risk of 1 in 256 for all obstetric surgery (Odor, Bampoe et al. 2021), failed intubation, respiratory complications for both mother and newborn and increased risk of postpartum haemorrhage and postoperative pain (Sung, Jee et al. 2021) (Ring, Landau et al. 2021) (Makeen, Farrell et al. 2022). Perioperative complications or critical illness may necessitate admission to an Intensive Care Unit (ICU) following GACS, an occurrence that has been observed in low-and middle-income countries (Lumbiganon, Moe et al. 2020).

A consequence of GACS is the lack of skin-to-skin contact between mother and newborn immediately following birth. Skin-to-skin contact is widely facilitated to promote breastfeeding and maternal infant bonding (UNICEF 2021) (Widstrom, Brimdyr et al. 2019) (Moore, Bergman et al. 2016). Two small trials found that women who experienced skin-to-skin contact following caesarean birth were more likely to breastfeed for at least one to four months (Moore, Bergman et al. 2016). Additionally, newborn admission to the neonatal intensive care unit (NICU), may negatively affect parental mental health, and potentially hinder maternal/paternal newborn infant bonding and attachment. A systematic review found a high prevalence of anxiety and PTSD in parents whose infants required NICU admission, lasting well after discharge (Malouf, Harrison et al. 2022). Other studies show that around 40-50% of parents whose infants require NICU care exhibit symptoms of depression and anxiety during this period (Grunberg, Geller et al. 2022) (Hynan, Mounts et al. 2013). As GACS is most often carried out as an emergency procedure the likelihood of NICU admissions (Hung, Tsao et al. 2022) increase, however, the specific impacts of GACS in addition to NICU admission on parenting remain unknown.

[1]This review uses the term ‘women’ throughout. In all cases this term is used to describe both those who identify as women and birthing people who were assigned female sex at birth but who do not identify as women. The term ‘partners’ are used to describe partners of any gender and fathers.

GACS may impact on the mental health of both mothers and fathers. Unexpected interventions during labour such as emergency caesarean sections, can be traumatic for the woman and are associated with an increased risk of Post-Traumatic Stress Disorder (PTSD) (Ayers, Bond et al. 2016, Simpson and Catling 2016), anxiety, postpartum depression (PPD) and stress (Guglielminotti and Li 2020, Skov, Hjorth et al. 2022). Paternal and partner mental health during the perinatal period is also important and independently influences maternal mental health and child development (Stein, Pearson et al. 2014). Fathers/partners may experience vicarious PTSD from witnessing a traumatic birth (Elmir and Schmied 2022), yet their own mental health and support needs during the perinatal period are often under-recognised by healthcare professionals (Darwin, Galdas et al. 2017). In most cases, partners are prevented from attending GACS, but the psychological impact of this absence on them, mothers and infants is unknown. The events preceding birth can also be traumatic, with partners often facing complex decisions regarding the aftercare of both mother and baby, particularly in the context of critical illness or post-operative complications.

The distinct experience of GACS is characterised by being in a state of controlled unconsciousness during birth, and in some cases, compounded by ICU admission and other peri-and postoperative complications. Despite over 6000 women giving birth by GACS every year in the UK, its impact on postnatal mental health and newborn bonding remains underexplored. This review aims to establish what is known regarding the psychological impact of GACS on parental mental health and early infant bonding.

Methods

A scoping review of available literature was undertaken to explore maternal mental health and infant bonding during the first postnatal year following GACS, as well as the experiences of fathers/partners. Studies were included where the mother spent a significant period of time in a state of controlled unconsciousness during birth or in the immediate hours after, such as in cases involving subsequent ICU admission.

Arksey & O'Malley's Five-Stage Methodological Framework, further developed by Levac and the JBI (Arksey and O'Malley 2005, Levac, Colquhoun et al. 2010, Tricco, Lillie et al. 2016) was followed, in combination with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines(Tricco, Lillie et al. 2018).

The stages performed in this scoping review consisted of: (1) identifying the research question; (2) identifying relevant studies; (3) study selection; (4) charting the data; and (5) collating, summarising and reporting the results (Arksey and O'Malley 2005).

Stage 1: Identifying the research question

From the identified gap in literature the following research question was developed- '*What is currently known about the experiences and impact of GACS on women and fathers/partners mental health, and maternal-infant bonding?'*

Stage 2: Identifying relevant studies

Population, Concept, Context' (PCC) was used to outline the criteria for including studies in this review and to align to the overarching aim *(see Table 1)*.

Table 1: Inclusion & Exclusion *(Word Count 133)*

Criteria for including studies in the review	
Population	Women who underwent GACS. No geographical restriction on inclusion (although only English-language papers were considered).
Concept	Women undergoing GACS, either elective or emergency and subsequent ICU admission where it occurred immediately following GACS.
Context	*Setting* Sources of evidence pertaining to any contextual setting were eligible for inclusion, including hospital admissions, postnatal care, any country using a hospital setting or providing postnatal care. *Study design* Any study design including quantitative, qualitative and mixed methodologies. *Exclusion* Studies that do not specify type of anaesthetic used for CS. Women requiring perimortem CS. Studies not in English
Outcomes of interest:	Psychological impact and distress for mother and father/partner in the first year after GACS and/or identification of maternal/infant bonding experiences in the first year after birth.

A preliminary search was carried out to inform search terms noting index terms and searching the Medical Subject Heading (MeSH) database with an initial limited search of MEDLINE & CINHAL. The preliminary search was limited to one year of publication (2021-2022). There were no date restrictions on the full search.

A search strategy was developed to identify all articles pertaining to the objectives of this review. The Maternity & Infant Care, MEDLINE & EMBASE (OVID), PUBMED, CINHAL databases were searched up to May 2024, with full search terms detailed in *Appendix 1*. Reference lists of included studies were scrutinised and relevant papers were included for review. To identify unpublished literature, the System for Information on Grey Literature in Europe (OpenSIGLE) and the Healthcare Management Information Consortium (HMIC) databases were searched, but no records were found. The Database of Abstracts of Reviews of Effects (DARE), Cochrane Database of Systematic Reviews (CDSR) and PUBMED were also searched for existing reviews. The CDSR returned 23 results; however, none were relevant to the review question.

Stage 3: Study Selection

Database searches identified 12,910 records. Of these, 3774 were removed due to duplicates, titles were reviewed and 3323 due to irrelevance, and 5,813 abstracts were reviewed by three researchers (MA, NF, AE) to determine eligibility. A further 35 full-length articles were retrieved and reviewed independently by three researchers (MA, NF, AE) based on eligibility criteria. Five articles met the eligibility criteria for inclusion. Search results are presented in a PRISMA flow diagram *(Figure 1.0)*. Results are presented in *Table 2*.

Figure 1: PRISMA Flow Diagram of Search Results

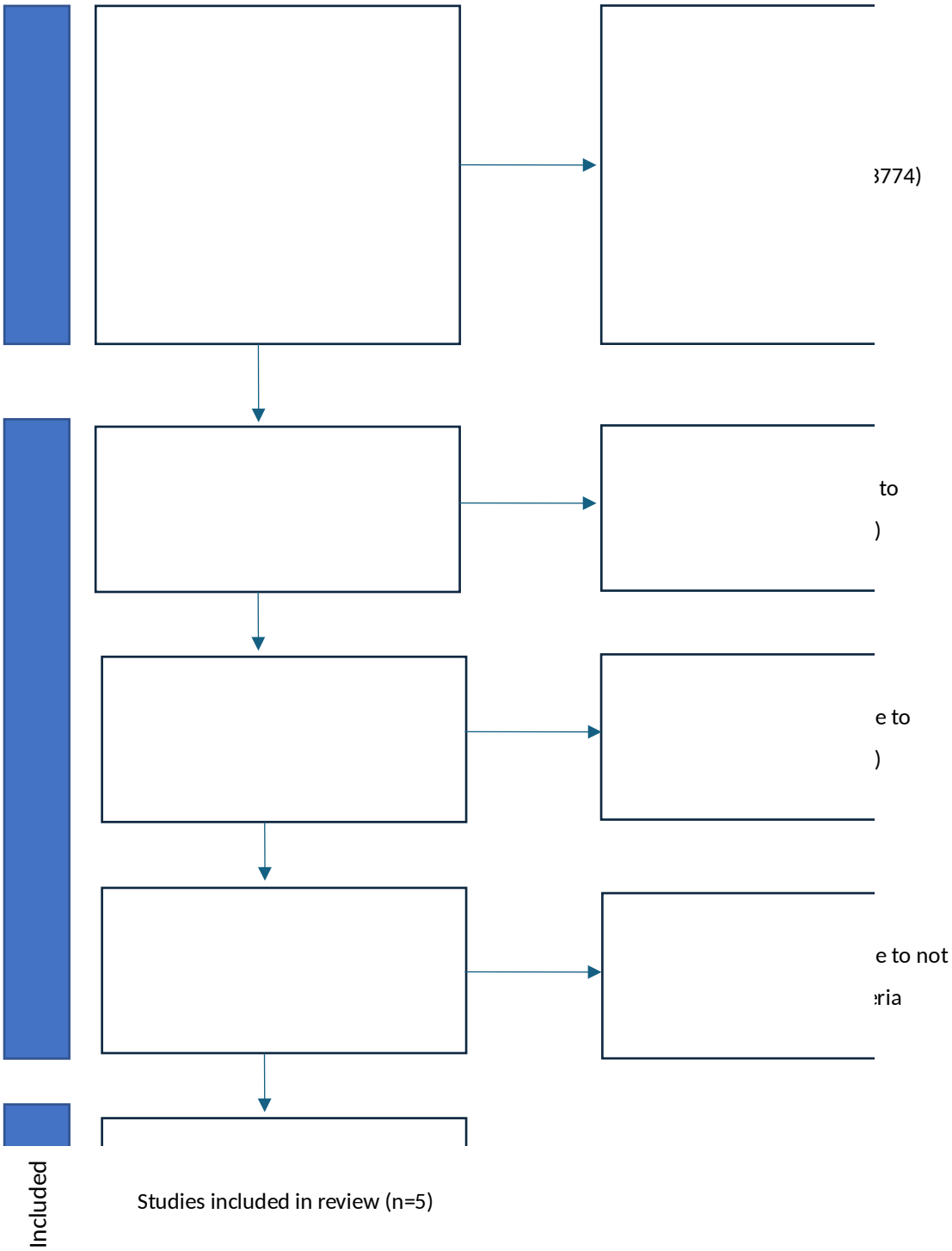


Table 2.0: Results *(Word Count 597)*

Author, Year, Country	***Study Design***	***Inclusion Criteria /Concept***	***Measure***	***Participant Demographics***	***Outcomes of Relevance***
Guglielminotti et al, 2020, USA.	Retrospective cohort study, propensity score matching.	GACS vs NACS, new onset depression, suicidal ideation, anxiety, PTSD.	State Inpatient Database for New York, within 1 year of birth inferred from an adapted ICD-9 algorithm.	N=428,204 CS discharge analyses, GA=34,356 (16, 477 GA) matched to (98, 862 NACS). Maternal age-GA (24-34), NA (24-34). Non-White race including Hispanics-GA (19,341 (56.8%), NA (190,185 (49.3%). New depressive events GA (n=112), NA (n=1034).	In the matched sample, GACS was associated with 54% increased odds of PPD and 91% increased odds of suicidal ideation or self-inflicted injury.
Nitahara et al, 2020, Japan.	Retrospective , propensity score matching.	GACS vs NACS on maternal/infant bonding.	Routinely collected data from Mother's medical records at Kyushu University Hospital. Mother Infant Bonding Scale (MIBS) scores at hospital discharge and at 1 month post birth. EPDS scores at 1 month post birth.	N=457 (NA n=344 75.3%), (GA n=113 24.7%). Maternal age range-GA (30-39), NA (29-38).	Emergency GACS was an independent risk factor associated with impaired mother-infant bonding.
Hung et al, 2022, China.	Retrospective nested case-control study.	Data linkage-between 2008-2017, women who gave birth GACS/ NACS/NSD and association between PPD risk and	National Health Insurance Research Database (NHIRD), the National Birth Reporting Database in Taiwan, and the National Death	NSD (n=1,027,146), NACS (n=535,612), GACS (n=16,234). Matching (GA n=15,706), (NA=15,706), (NSD	GACS was associated with significantly higher risks of PPD and sleep disorders. Antidepressant and hypnotic use were highest in the GA population. GA

		anaesthesia method.	Index Database, PPD diagnoses, antidepressant and hypnotic prescriptions 1 year before pregnancy, during pregnancy, and 1 year postpartum.	n=15,706). Maternal age range-GA & NA <25->40. Depression *only* at 1 year postpartum- GA (n=1014), NA (n=977), NSD (n=928).	was a risk factor for PPD.
Viirman et al, 2022, Sweden.	Cohort study.	To explore the impact of risk factors representing three different time periods during pregnancy on negative childbirth experience.	Registered based cohort study using the Swedish Pregnancy Register of births and Visual Analogue Scale-Childbirth Experience between 2013 & 2018.	(N=80,482) SVD, 62,222 (77.3%), operative vaginal birth 9112 (11.3%), unplanned NACS 7911 (9.8%), GACS 1237 (1.5%) GACS. Primiparas with singleton pregnancies and live term birth (after 37 weeks of gestation) were included. Elective CS was excluded. Only births in hospitals with a reporting rate for childbirth experience of >50% during the study period were included, which corresponded to 29 birth clinics from different parts of Sweden.	Women undergoing unplanned GACS had a five-fold increased risk of reporting a negative childbirth experience compared to those who had spontaneous vaginal births.
Nedargaard et al, 2024. *Denmark*	Prospective exploratory study.	To explore partner experiences of being present during Cat 1 GACS.	Questionnaires Day 1 or 2 following CS. Partners from both sites-semi-structured interviews at 3 months. Partners were screened for Post-	Two hospital sites in Denmark. Site 1 Partners inside OT, and Site 2 partners outside in LW room. Site 1 n=16 (GA), Site 2 n=8 (GA).	**Site 1:** All but 1 partner preferred being in theatre during CS. Mothers were aware partner in room and all 16 (94) % felt 'very good, or (6%) 'good' about it. **Site 2:** 2 out of 8 partners would have preferred to be present in theatre (however, one changed his mind 3 months later). Mothers aware partner was

	Traumatic Stress using the PTSD-8 tool.	Maternal age Site 1: (31-34), Site 2: (31.5-35.5).	not present and 3 (38%) answered 'very good' or 'good', 3 (38%) answered 'good' and 'bad' and 2 (25%) answered 'bad' or 'very bad'. No partners developed PTSD at 3 months follow-up.

Key terms: **CS**-*Caesarean Section*, **EPDS**-*Edinburgh Postnatal Depression Scale*, **GA**-*General Anaesethetic*, **OT**-*Operating Theatre*, **LW**-*Labour Ward*, **MIBS**-*Mother Infant Bonding Scale*, **NA**-*Neuraxial Anaesethisia*, **NSD**-*Normal Spontaneous Delivery*, **PPD**-*Postpartum Depression*, **PTSD**-*Post Traumatic Stress Disorder*

Stage 4: Charting Data

Extraction

A Data Extraction spreadsheet was developed in Microsoft Excel to collect the following outcome domains-

- Sociodemographic & antenatal mental health characteristics of women who undergo GACS.
- Maternal & paternal mental health characteristics in the first postnatal year following GACS.
- Maternal infant bonding experiences in the first postnatal year.

All reviewers extracted data from two included studies to pilot and modify the tool to ensure consistency and accuracy. Modifications included additional columns relating to outcome measure tools used in the included studies.

Stage 5: Collating, mapping and reporting the results

Results were collated and summarised. Firstly, descriptive numerical analysis is provided which includes the articles, year of publication and study type. Data was then synthesised to provide an overview of literature on GACS. Full text articles were quality assessed using the Mixed Methods Appraisal Tool (MMAT) (Hong 2018) *(Appendix 3)*.

Findings

All five included studies analysed records or enrolled participants for women requiring GACS. The studies included were geographically diverse, 1 (USA) (Guglielminotti and Li 2020), 1 (Japan) (Nitahara, Hidaka et al. 2020), 1 (China) (Hung, Tsao et al. 2022), 1 (Sweden) (Viirman, Hesselman et al. 2022), 1 (Denmark) (Nedergaard, Weitling et al. 2024), and all from high- or middle-income countries.

Four studies were quantitative and one mixed-methods and included cohort (Viirman, Hesselman et al. 2022), retrospective, propensity score matched multivariable analysis (Guglielminotti and Li 2020) (Nitahara, Hidaka et al. 2020), case-control (Hung, Tsao et al. 2022) and prospective exploratory (Nedergaard, Weitling et al. 2024). Methods of data collection included state databases, data linkage, hospital records, birth registers, questionnaires and semi-structured interviews.

The included studies met all five-fifteen quality criteria of the MMAT, demonstrating clear alignment between research questions, study design, and data collection methods, which indicates good methodological quality. However, the MMAT's scoring system (Yes, No, Can't Tell), does not account

for key variables which may affect quality, such as sample size and the reporting of study demographics. These limitations are further examined in the discussion section.

Participant characteristics

All studies provided some information on participant characteristics. A median age range of 30-34 years was reported for GACS. Only one paper reported on ethnicity, which found a slightly higher prevalence of GACS in Black and Hispanic groups (n=19, 341 (56.8%) compared to White ethnicities (Guglielminotti and Li 2020). Other areas of sociodemographic status, such as marital status and educational level, and socioeconomic status were not consistently reported so have not been included in the findings.

Clinical events

Indications for GACS were abnormality in fetal heart rate or rhythm, fetal distress, abruptio placenta, uterine rupture, umbilical cord prolapse, placenta praevia, placenta accreta, preterm labour, uterine rupture (actual or suspected), fetal malpresentation, hypertensive disorders (Nitahara, Hidaka et al. 2020), (Nedergaard, Weitling et al. 2024). Maternal contraindications to neuraxial anesthesia included coagulation factor deficit and Von Willebrand disease, thrombocytopenia, sepsis and septic shock, chorioamnionitis (Guglielminotti and Li 2020), (Nitahara, Hidaka et al. 2020).

GACS & mental health

The primary domain measured in two of the included studies was depression. Guglielminotti (2020) analysed the State Inpatient Database for New York between 2006 and 2013, defining new onset Postpartum Depression (PPD) using an adapted ICD-9 algorithm (Guglielminotti and Li 2020). Hung (2022) examined three linked databases (National Health Insurance Research Database (NHIRD), the National Birth Reporting Database in Taiwan, and the National Death Index Database) from 2008-2017 to assess diagnoses of depression in the first postnatal year. Nitahara (2020) assessed PPD as a secondary outcome using routinely collected Edinburgh Postnatal Depression Scale scores at hospital discharge and at the one-month postpartum visit. In addition to depressive symptoms, Guglielminotti et al. (2020) examined secondary outcomes including new-onset suicidal ideation, self-inflicted injury, anxiety disorders, and PTSD in the first year after birth.

Gugliemminotti et al (2020) identified 124 new depressive episodes for women following GACS, of those 76 were readmitted between 64-261 days for severe PPD. Hung (2022) found that prevalence rates of depressive disorder were approximately 30% for women prior to birth regardless of mode, however, this increased postpartum to almost 44% for GACS (compared to 27% (natural birth) and 36% for (NACS).

Viirman et al (2022) retrospectively analysed childbirth experience using routinely collected healthcare data from the Swedish Pregnancy Register, which incorporated the Childbirth Experience Scale (Ahearn 1997), between 2014 and 2018. Only births from hospitals with a reporting rate for this measure of >50% during the study period were included, which corresponded to 29 birth clinics from different parts of Sweden. Primiparous women, with singleton pregnancies who gave birth at >37 weeks, without elective CS were included. GACS (n=1,237/80,482) were reported as having five-fold higher odds ratios for reporting negative childbirth experience compared to women with spontaneous vaginal birth.

Table 3 presents a comparison of mental health characteristics between GACS and NACS in studies where mental health was the primary outcome.

Table 3.0 GACS and maternal mental health characteristics as primary outcome *(Word Count 82)*

Study (mental health as primary outcome measure)	**Domain measured**	**Population GACS % and (n)**	**Population Comparison to NACS % and (n)**	**Data collection tool**
Guglielminotti, 2020, Hung 2022	Postnatal Depression (ICD-9 algorithm(Guglielminotti and Li 2020). (ICD-9 codes, medication with hypnotics and antidepressant prescriptions(Hung, Tsao et al. 2022)).	1126 (2.25%) (N=50,062)	2011 (0.49%) (N=409,554)	Hospital database, data linkage.
Guglielminotti, 2020	Suicidal Ideation or self-inflicted injury (ICD-9 algorithm).	32 (0.09%) (N=34,356)	182 (0.05%) (N=393,848)	Hospital database

Guglielminotti, 2020	Anxiety (ICD-9 algorithm).	50 (0.15%) (N=34,356)	636 (0.16%) (N=393,848)	Hospital database

The two studies that assessed depression as the primary domain (Guglielminotti and Li 2020) (Hung, Tsao et al. 2022) reported higher rates of PPD among women in the GACS group compared to the NACS group. In contrast, Nitahara (2022) found minimal differences in EPDS scores between GACS/NACS groups.

Gugliminotti (2020) found that following postnatal hospital discharge, women in the GACS group were readmitted for PPD between 2-8 months (64-261 days), compared to 1-7 months (35-242 days) for the NACS group (Guglielminotti and Li 2020). Readmission for suicidal ideation or self-inflicted injury occurred between 4-9 months (127-300 days) in the GACS group, compared to 2-8 months (87-255 days) in the NACS group (Guglielminotti and Li 2020). GACS was not associated with increased odds of anxiety or PTSD in the first year after birth (Guglielminotti and Li 2020).

Maternal/infant bonding

Nitahara (2020) examined maternal/infant bonding and depression in women undergoing GACS. Data was collected using scores from the Mother-Infant Bonding Scale (MIBS) and EPDS, which were routinely collected at hospital discharge and at one-month post-partum. Propensity score matching controlled for the following covariates: age, marital status, public welfare support, Assisted Reproductive Technology (ART), psychiatric disorder history, unemployment, interhospital transfer before delivery, postoperative ambulation delay, non-reassuring fetal status (NRFS), arrest of labour, previous cesarean delivery, fetal malpresentation, malposition of the placenta, hypertensive disorder, fetal sex, Apgar scores at 1 and 5 min, gestational age at birth, birthweight, and admission to the NICU. This study found that the GACS group had higher MIBS scores at the time of hospital discharge, with higher Lack of Affection scores persisting up to one-month postpartum compared to the NACS group. However, Anger and Rejection scores did not differ between groups.

Partner experiences

Nedergaard (2024) explored the experiences of partners either present or not present in the operating theatre during a Category 1 caesarean (immediate threat to the life of the woman or fetus (NICE 2021), across two different hospital sites. This was a prospective non-randomised cohort study

conducted in Denmark, which included a qualitative component. The study aimed to understand the role of the father/partner being present in the operating theatre and was informed by existing literature suggesting that relatives often prefer to be present during medical emergencies, which may reduce the risk of PTSD for family members (Soleimanpour, Tabrizi et al. 2017).

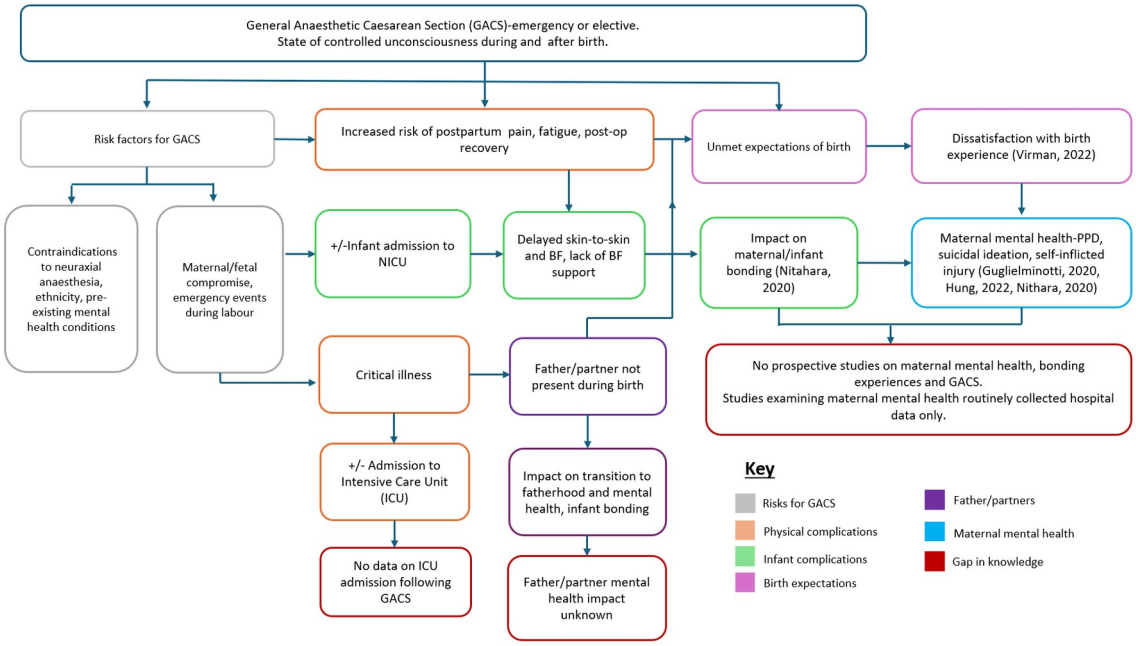
Participants were drawn from two parallel cohorts at Site 1 and Site 2. At Site 1, all partners were present in the operating theatre. Of the 17 women who underwent a Cat 1 emergency caesarean at this site, 16 received GA, and one received spinal anaesthesia. In contrast, at Site 2, none of the partners were present in the operating theatre, and all eight women received general anaesthesia for their Cat 1 caesarean. Questionnaires were completed by mothers and partners on Day 1 & 2 after GACS and partners were also followed up at 3 months postpartum.

At Site 1, all women (n=17) reported feeling ‘very good’ (n=16-94%) or ‘good’ (n=1-6%) knowing their partners were with them during GACS. Similarly, all partners except one expressed a preference for being in the operating theatre during GACS.

At Site 2, where partners were not present, 38% of women (n = 3) reported feeling 'very good' or 'good', another 38% felt 'both good and bad', and 25% (n = 2) felt 'bad' or 'very bad' about their partner's absence. Two out of the eight partners expressed a preference to have been in the theatre, though one changed his mind three months later.

None of the partners at either site reported PTSD symptoms when screened 3 months later (Nedergaard, Weitling et al. 2024).

Figure 2: GACS Mechanisms of influence on mental health



Discussion

This scoping review explores what is known about the impact of GACS on maternal mental health, mother-infant bonding and father partner experiences. Five studies were identified: two focused on maternal mental health (Guglielminotti and Li 2020) (Hung, Tsao et al. 2022), one on childbirth experience (Viirman, Hesselman et al. 2022), one on mother infant bonding (Nitahara, Hidaka et al. 2020) and one on father/partner experiences (Nedergaard, Weitling et al. 2024). No studies specifically explored ICU admissions following GACS, although such admissions may have occurred in some of the studies included in this review.

Unexpected interventions during labour, such as emergency caesarean, have been associated with an increased risk of PPD and PTSD (Ayers, Bond et al. 2016) (Froeliger, Deneux-Tharaux et al. 2024). However, very little is known about the role of GACS in these outcomes. Two studies in this review reported more than a fourfold increase in the risk of PPD following GACS compared with NACS (Guglielminotti and Li 2020, Hung, Tsao et al. 2022), with suicidal ideation and self-inflicted injury nearly twice as high in GACS groups (Guglielminotti and Li 2020). In the UK, prevalence of PPD and anxiety in the first year after childbirth is estimated at 15-20% (NICE 2025). Therefore, identifying factors that may contribute to the development of PPD is important, as mood disorders are risk factors for non-fatal and fatal perinatal suicide attempts (De Backer, Pali et al. 2024).

Given that suicide remains the leading cause of maternal mortality in the UK within the first year of birth, and is often associated with untreated depression (Yu 2024) (Kalifeh 2016) (Knight 2020), the

findings of Guglieminotti (2020) and Hung's (2022) studies raise important concerns regarding the role of GACS in postnatal mental health. However, limitations in data quality mean that the presence of PPD was inferred from indirect indicators, such as ICD-9 codes, prescriptions for hypnotics and antidepressants (Hung, Tsao et al. 2022), and an ICD-9-CM algorithm with high specificity but low sensitivity (Guglielminotti and Li 2020). These limitations may have influenced the interpretation of findings, as the reliance on indirect indicators could have led to an underestimation or misclassification of PPD cases. Additionally, PPD cases were restricted to hospitalisation at the time of birth or subsequent readmission, excluding data from outpatient or emergency department visits (Guglielminotti and Li 2020). Therefore, it is likely that only severe PPD cases were identified, resulting in an underestimation of its true incidence (Guglielminotti and Li 2020).

Guglieminotti (2020) found no association between GACS and PTSD; however, this finding may also reflect limitations of routinely collected healthcare data. While PTSD prevalence is high among ICU survivors in the general population, it has also been reported in perinatal populations (Davydow, Gifford et al. 2008) (Furuta, Sandall et al. 2014). Previous research has not specifically examined the relationship between PTSD and the type of anaesthetic used during birth, leaving the potential impact of GACS-related factors on the development of PTSD underexplored.

One study reporting on childbirth experience found that women undergoing GACS were five times more likely to describe their birth experience as negative compared to those who had spontaneous vaginal births (Viirman, Hesselman et al. 2022). Complications in labour, which can shape women's perceptions of birth and often precede GACS, were not accounted for in this study. Birth experiences, especially when perceived as traumatic, are known to impact postnatal psychological wellbeing (Waller, Kornfield et al. 2022). This may be particularly so when there is incongruity between a woman's expectations and her actual lived experience of childbirth (Duricekova, Skodova et al. 2024). For instance, anticipating a vaginal birth but unexpectedly requiring an emergency GACS may evoke feelings of sadness and grief over the loss of the 'idealised' birth experience (DeGroot 2017) thereby potentially increasing the risk of PPD. Furthermore, the reliance on routinely collected healthcare data (Guglielminotti and Li 2020) (Hung, Tsao et al. 2022) (Viirman, Hesselman et al. 2022), fails to capture the broader context of a woman's birth experience, including interactions with healthcare professionals-whether positive or negative, which may influence postnatal mental health (Reed 2017) (Ahmadpour, Faroughi et al. 2023).

Women receiving psychiatric care during pregnancy were also more likely to report negative childbirth experiences (Viirman, Hesselman et al. 2022). Pre-existing mental health issues are well-established risk factors for PPD (Wisner, Parry et al. 2002) (Rondung, Massoudi et al. 2024). Hung

(2022) reported a 30% prevalence of antenatal depressive disorders, rising to 44% postpartum in GACS cases, compared to 27% in natural births and 36% in NACS. However, GACS cases were more likely to require neonatal medical support and experience neonatal mortality within the first month, which may partially explain why PPD was higher in this group.

Prior research has demonstrated associations between pre-existing mood disorders, such as depression, and a range of obstetric outcomes, including cesarean sections, ICU admissions and adverse outcomes such as postpartum haemorrhage, preterm birth, low birth weight and intrauterine growth restriction (Runkle, Risley et al. 2023), (Faulks, Edvardsson et al. 2024). These outcomes are underpinned by multifactorial mechanisms, including barriers to accessing care, stigma and fear, fragmented referral pathways, and sociocultural factors such as language barriers and cultural values (Faulks, Edvardsson et al. 2024). The relationship between prenatal mental illness and GACS is unknown.

The second objective of this review examines the impact of GACS on mother and infant bonding. Nithara (2020) found that women who underwent GACS had higher MIBS scores at the time of hospital discharge and higher Lack of Affection scores at one month postpartum compared to NACS groups (Nitahara, Hidaka et al. 2020). However, women undergoing GA were more severely ill and in need of urgent surgery, which may explain the higher MIBS scores. Higher scores are considered a risk factor for impaired infant bonding (Nitahara, Hidaka et al. 2020). Follow-up was limited to one month postpartum; further research is necessary to explore the longer-term impact of GACS on maternal/infant bonding (Nitahara, Hidaka et al. 2020).

The same study found minimal differences in EPDS scores between GACS and NACS groups (Nitahara, Hidaka et al. 2020). In contrast, other studies have reported an association between GACS and increased risk of PPD (Guglielminotti and Li 2020) (Hung, Tsao et al. 2022). Detection of PPD is important; it can impact bonding by disrupting maternal availability and responsiveness to infant cues, which over time, may compromise attachment security and affect children's cognitive and emotional development (Makeen, Farrell et al. 2022) (Brockington 2004) (Stein, Pearson et al. 2014).

Additionally, the physical challenges of recovery following GACS may play a part in influencing psychological wellbeing and bonding. According to the literature, factors such as delays in breastfeeding, low milk supply, fatigue, pain, and inadequate support from healthcare professionals contribute to higher rates of breastfeeding difficulties after any type of caesarean birth (Paksoy Erbaydar and Erbaydar 2020) (Ulfa, Maruyama et al. 2023). However, GACS is also often associated with poorer outcomes for both mother and neonate, including increased risk for postpartum hemorrhage and blood transfusion, heightened postpartum pain, and a greater likelihood of

neonatal admission (Ring, Landau et al. 2021) (Makeen, Farrell et al. 2022). These postoperative challenges may also lead to difficulties for the mother in caring for and bonding with her infant.

While it is difficult to infer a direct association between GACS and bonding issues from a single study, potential impacts on the mother-infant relationship in the early postpartum period can be understood through interconnected risks. These include unexpected events during labour, incongruity between the anticipated and actual birth experience (potentially leading to birth dissatisfaction and an increased risk of depression (Bell and Andersson 2016), and heightened levels of postpartum pain. Furthermore, the unique experience of being unconscious at birth, resulting in the mother 'missing' the birth of her newborn, and the associated emotional and psychological impact, highlights the distinct consequences of GACS and its potential influence on postnatal wellbeing and bonding.

There was poor reporting of sociodemographic characteristics, primarily ethnicity and deprivation, which have strong associations with maternal and infant outcomes. Only one study provided data on ethnicity, categorising it broadly as '*all non-white races including Hispanics'* without disaggregating specific ethnic groups (Guglielminotti and Li 2020). This is consistent with findings from UK and USA studies, which show Black and Hispanic women overall are more likely to receive GA for caesarean sections than their White counterparts (Lee 2023) (Bamber, Goldacre et al. 2023) (Tangel, Matthews et al. 2020).

A large cohort study linking maternity and intensive care data for over 631,000 women who gave birth in England and Wales between April 1, 2015, and March 31, 2016, found that the overall rate of ICU admission was 2.24 per 1,000 maternities (Jardine, Gurol-Urganci et al. 2022). Black women were more than twice as likely as women from other ethnic groups to be admitted to ICU, even after adjusting for demographic, lifestyle, pregnancy and birth related factors (Jardine, Gurol-Urganci et al. 2022).

Socioeconomic deprivation, which disproportionately affects minority ethnic groups, may exacerbate these disparities. Poverty has been associated with poor mental health and adverse pregnancy outcomes, including stillbirth and preterm birth (Katz 2018) (Kingdon, Roberts et al. 2019) (Mehra 2019) (Thomson, Cook et al. 2022). Women in the most deprived regions of the UK experience higher maternal and neonatal mortality rates than those in less deprived areas (Felker 2024). No studies included here specifically reported on socio-economic status, deprivation, or economic stress, and if these are risk factors for GACS.

The third objective of this scoping review examines the impact of GACS on fathers' and partners' mental health. Approximately, 10% of fathers experience perinatal depression, 7.2% PTSD symptoms, and 18% anxiety(Schobinger, Stuijfzand et al. 2022) (Leach, Poyser et al. 2016) (Paulson and Bazemore 2010).

The transition to fatherhood is particularly relevant in the context of GACS as most partners are excluded from the operating theatre. There is some suggestion that men begin to identify with fatherhood immediately following the birth of their child (Draper (2003)). Therefore, exclusion from birth experience may disrupt the formation of fatherhood identity, which plays a key role in influencing paternal mental health (Baldwin, Malone et al. 2018).

A survey conducted over a decade ago found that 82% of women and 91% of partners expressed a desire to be present during GACS (Mcllmoyle 2012). More recently, research on fathers present in the operating theatre during a Category 1 GACS found that they evaluated their experiences positively, even in cases where the birth was traumatic or the infant did not survive (Nedergaard, Weitling et al. 2024). These positive experiences were attributed to valuing the opportunity to witness the clinical team's efforts in attempting to save their newborn and being able to *'fill out the missing pieces'* of the birth narrative for the mother (Nedergaard, Weitling et al. 2024). Interestingly, fathers who were not present during the procedure also rated the experience positively, although mother and staff evaluations varied (Nedergaard, Weitling et al. 2024).

Father's presence in the operating theatre is likely influenced by their own cultural beliefs, practices and norms, as well as local healthcare systems. Therefore, understanding fathers/partners wishes regarding GACS and their presence in the operating theatre, particularly during emergencies, may be important for supporting their autonomy and respecting their right to exercise choice.

Importantly (although not powered to detect a difference) none of the fathers/partners who witnessed distressing events during a Cat 1 GACS developed PTSD (Nedergaard, Weitling et al. 2024). However, the absence of partners from the operating theatre has been identified as a contributing factor towards PPD in mothers (Froeliger, Deneux-Tharaux et al. 2024). This suggests that a partner's involvement in the birth process, and their support for the mother, may serve as protective factors for postnatal psychological wellbeing for both parents. Consequently, being present in the operating theatre, even during distressing events, might offer greater benefits for the transition to fatherhood and for supporting the mother's psychological wellbeing, than being excluded from the birth.

Nedergaard (2024) was the only prospective study available for inclusion in this review. However, the sample size was small and therefore, findings should not be used to draw definitive conclusions on

the experience of partners present in the operating theatre during a Cat. 1 GACS (Nedergaard, Weitling et al. 2024).

This review has addressed an important evidence gap regarding the impact of GACS on maternal mental health, infant bonding and father/partner experiences. Although an association between GACS and the increased risk of PPD has been identified, this may reflect the higher incidence of adverse perinatal outcomes in this group, as well as the experience of not being 'present' at birth and 'missing out' on early bonding activities in the immediate postpartum period. As fathers are often not permitted in the operating theatre during GACS, their early bonding experiences may also be disrupted. In fact, the ways in which the absence of both parents at birth interrupts the unification of the family unit and the implications for the development of parent-infant relationships in both the short and longer term remain underexplored. Due to the current lack of evidence, the type and extent of support required by women and families following GACS remain unclear. Future research recommendations should include prospective observational studies examining the impact of GACS on maternal mental health, mother-infant bonding and health inequalities, as well as qualitative research exploring the experiences of GACS and ICU admission in both mothers and fathers/partners.

Limitations of this review

This review included only studies published in English, which may have excluded relevant research in other languages, potentially limiting the generalisability of the findings to non-English speaking populations. Furthermore, all studies were conducted in high-income countries, which may limit the applicability of the findings to low- and middle-income settings, where healthcare systems and maternal experiences may differ. There were no studies from the UK, where the rate of GACS is approximately 4%-8%, therefore further research is needed to address this gap.

Additionally, the absence of ethnicity data in all the included studies limits the ability to explore the potential impact of racial and cultural factors. Furthermore, no studies were identified examining the impact of ICU admission following GACS. This is important, given that women who give birth by caesarean section are five times more likely to be admitted to ICU (Jardine, Gurol-Urganci et al. 2022), yet the relationship between GACS and ICU admission remains poorly understood. Experiences of fear, anxiety and trauma, including PTSD have been reported in women with severe maternal morbidity (Furuta, Sandall et al. 2014) (Hinton, Locock et al. 2015). Yet how these experiences interrelate with GACS is unknown.

In conclusion, further research is needed to elucidate the psychological implications of GACS experiences, particularly within diverse populations, to explore putative mechanisms of influence, and ultimately inform effective interventions to support women and their partners following this event.

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