Advanced Maternal Age And Rise In Caesarean Sections In New South Wales Hospitals - A Review Of The Evidence

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Citation

V B . *Advanced Maternal Age And Rise In Caesarean Sections In New South Wales Hospitals - A Review Of The Evidence*. The Internet Journal of Gynecology and Obstetrics. 2019 Volume 23 Number 1.

DOI: 10.5580/IJGO.54019

Abstract

Caesarean section rates are on a global rise and Australia's rates rank highly in comparison with other developed countries. However, this increase has not been accompanied with improved maternal or neonatal outcomes. Concurrently, there has been a trend towards delayed motherhood reflected by a rise in pregnancies in the 35 and over age group. This study aimed to investigate the rising trend in caesarean sections in New South Wales (NSW), Australia's most populous state, and outline the potential contributing factors to this rise. Evidence from this review suggests that although caesarean sections rates and the percentage of mothers aged 35 and above have risen in NSW, there is lack of accurate knowledge about the strength of association between these two trends. Despite this rise in caesarean sections, stillbirths have not decreased, older mothers do not necessarily have an increased risk of small for gestational age infant, and there is lack of association between dystocia-related caesarean sections and maternal age.

PURPOSE

Trend analysis of caesarean section (CS) rates have demonstrated that the global average CS rate is increasing, particularly in middle- and high- income countries (Betrán et al. 2016). Data published by HealthStats NSW (New South Wales) shows that the rates of CS in Australia increased from 23.5% in 2001 to 32.4% in 2015 (HealthStats NSW 2016). Australia's rates of CS are higher than the Organisation for Economic Co-operation and Development (OECD) countries, ranking 22nd out of 32 (AIHW 2013). However, from a population perspective, these increasing rates in CS have not been accompanied with improvement in maternal and neonatal outcomes (Nippita et al. 2015).

According to the World Health Organisation (WHO), new studies have shown that there is no evidence for a decline in maternal and neonatal mortality when CS rates rise above 15%.5 A recent article suggests that the optimal international CS rate is actually 20% (Robson and de Costa 2017). Notwithstanding these figures, Australia's CS rates have been consistently sitting above 20% and have not plateaued. Moreover, literature suggests that CS in first pregnancy imposes complications and risks for future pregnancies in comparison with vaginal birth as mode of birth for first pregnancy (Taylor et al. 2005). Understanding the current rise in CS and its potential drivers, can give a clearer perspective on methods to reduce the overall CS rate. Hence, it is the aim of this review to investigate the rising trend in CS in NSW and identify risk factors from the literature.

Furthermore, the impact of career and economic factors on women's lives, has given rise to a trend towards delayed motherhood (Carolan and Nelson 2007). Assisted reproductive technology (ART) is also believed to have contributed to this rise (Kenny et al. 2013). This is reflected in the proportion of pregnancies in the 35 and over age group. The percentage of mothers in this age groups has risen from 18.1% in 2001 to 23.4% in 2015 (NSW mothers and babies 2002, 2016). A UK study identifies this rise in the age of mothers at childbirth as one of the main reasons for the rising trend in CS (Kenny et al. 2013). Despite the rise in CS associated with advanced maternal age, there is still uncertainty in literature about the contributing factors to this association.

Given the abovementioned rise in CS rate, and the growth in proportion of women delaying pregnancy in Australia (Australian Bureau of Statistics [ABS] 2010), it is important to investigate the increased risk of CS associated with advanced maternal age in order to be able to provide better advice to older women regarding their risks. For this reason,

the aim of this study is to assess whether advancing maternal age is a risk factor for CS in NSW.

In sum, the aim of this review is to examine the rise of CS in NSW and the objectives are to outline the potential contributing factors to this rise by evaluating the current literature regarding advanced maternal age and its relation to the rise in CS rates in NSW.

CONTEXT AND BACKGROUND

A population-based study in NSW (Stavrou et al. 2011) found that the overall CS rate rose from 19.1 (per 100 births) in 1998 to 29.5 in 2008. Additionally, a similar study (Roberts et al. 2012) showed that primary CS was the biggest driving factor for the overall rise in CS in NSW between 1994 to 2009. This included both prelabour and intrapartum CS. The increase in primary CS has led to a subsequent rise in repeat CS, driving the numbers even higher (Roberts et al. 2012).

Since 1992, CS rates have almost doubled in Australia (Catling and Homer 2016). The reasons for increased rates of CS are multifactorial, however, advancing maternal age, high BMI, breech presentation, low birth weight, and multiple pregnancies are known associated factors (ABS 2007). Other interesting factors have also been noted to contribute to this rise. A decrease in working hours of obstetrics registrars has led to fewer opportunities for these trainees to advance their skills in the management of complicated vaginal births (such as instrumental or breech vaginal births) and a greater tendency towards surgical birth (NSW Ministry of Health Policy Directive 2010). Furthermore, the trend away from home births and towards birth in hospital settings, where there is heavy reliance on medical technology, may have altered the perception of safety for health care staff when it comes to the management of normal vaginal births. Changes in clinical practice, such as the management approach to breech presentations, and increased use of oxytocin and labour inductions have also played a part in this increasing trend (Roberts et al. 2012). Medicolegal concerns and maternal request are other important factors to consider in this regard. A NSW civil suit alleging negligence in a vaginal birth, which was settled in 2001 with a final payout of $11 million, received large media attention and is thought to have contributed to the significantly large increase in rates of CS seen between 2000 and 2001 (Roberts et al. 2012). Moreover, a recent study suggests that low-risk primiparous women have more chance of a surgical birth in a private hospital (Dahlen et al. 2012).

In 2014, the rate of CS among privately insured mothers increased to 41.6% compared to 28.2% in 2001 (NSW Mothers and Babies 2016). Given that CS carries major implications for the mother's health and wellbeing, and potential complications in future pregnancies (such as increased risk of placenta praevia and placenta accreta associated with morbidity), it is important to address the contributing factors to this rise in order to minimise the overall rate.

From a public health perspective, CS has significant implications for health care provision. The National Hospital Cost Data Collection (NHCDC) collects public hospital cost data on a yearly basis (Independent Hospital Pricing Authority 2016). This data is employed for planning hospital services and funding purposes. According to the Australian Public Hospitals Cost Report for 2013-2014, the average cost per episode for a single, uncomplicated vaginal birth was $4,832. The same report notes that the average cost per Diagnosis Related Groups (DRG) for an uncomplicated CS was $9,835, which is just over twice the costing for a normal vaginal birth. It is important to note that these costs do not include antenatal costs or further costs incurred as a result of extended stay in hospital, or readmission for either maternal or neonatal complications. Babies born by CS are also at greater risk of complications such as respiratory distress requiring admission to special care nursery or neonatal intensive care (Hansen et al. 2008). This significant cost difference between the two modes of birth further emphasises the need for analysis of the contributing factors to the increases in CS in NSW so that costs could be directed to other maternal/neonatal areas of need.

Life in the 21st century has had a significant impact on women's reproductive health insofar as it is now commonplace to see women having children at age 35 years and beyond due to educational and economic reasons (ABS 2010). Although the cut-off point for advanced maternal age varies in the literature, it has mostly been defined as the age of the mother at the time of birth being 35 years or greater (Bayrampour and Heaman 2010). Increasing maternal age has been consistently associated with the rise seen in CS (Roberts et al. 2012). However, there are inconsistent conclusions regarding the strength of this association (Carolan and Frankowska 2011).

The first review into maternity care in NSW was the Shearman Report (1989). As discussed by Catling and Homer (2016), one of the important aims of this review was

to decrease the medicalisation of childbirth and to give more opportunity to pregnant women when it came to the decision-making process regarding their care. The report recommended that if rates of medical intervention in childbirth (provided by maternity units) exceed beyond the state or other comparable birthing units' average, birthing unit policy and procedures should be reviewed. Now, 28 years later, its recommendations continue to remain relevant but not completely addressed. The study of the link between advancing maternal age and risk of CS can significantly influence hospital policies and ward procedures and in turn provide improved maternal outcomes.

APPROACH AND METHODS

To identify relevant studies, the following databases were searched for English language articles: PubMed, Informit, and Google Scholar. The term austral* and MeSH terms C*esarean section AND maternal age were used to search PubMed. This search yielded 52 articles. The terms maternal age AND C*esarean section AND NSW were used to search Google Scholar. In order to narrow the scope of results, this search was restricted to all articles from 2013. The search yielded 149 results. The terms C*esarean section AND maternal age were used to search Informit. This yielded 32 results. A total of 233 abstracts were located and assessed for appropriateness of inclusion using the study inclusion criteria. The following inclusion criteria was used to select articles for this report: (a) studies were conducted in Australia, or a developed country as they have similar socioeconomic profiles to Australia; (b) the study was conducted between 2001 and 2015. This time span was chosen as the review focused on increased CS rates since 2001; (c) studies that did not report on advanced maternal age and CS were excluded. A total of six abstracts remained after this process which were relevant to the review's intent. Furthermore, the bibliographies of retrieved articles were also hand-searched to identify any additional and relevant studies.

The NSW Mothers and Babies reports from 2001 to 2015 were used in the examination of data for this review. These reports utilise data from the NSW Perinatal Data Collection (PDC), previously known as the Midwives Data Collection, and Maternal and Child Health Register. The NSW PDC is a state-wide surveillance system which monitors all births in NSW public and private hospitals and home births (NSW Ministry of Health 2016). This covers all live births and stillbirths of at least 20 weeks gestation or 400g birth weight. The study population consisted of all women who gave birth in NSW from 2001 to 2014.

This review complied with NHMRC guidelines for clinical research and did not require ethical approval as only publicly available data and records were used. Research was not undertaken on human subjects and personal documents or information were not accessed. Data was not collected using questionnaires or other research tools.

FINDINGS

Results of this review illustrate that among NSW mothers, the CS rate increased from 23.5% in 2001 to 32.4% in 2015 (figure 1). Moreover, between 2001 and 2015, the percentage of NSW mothers aged 35 and over has increased from 18% to 23.4% (figure 2). Several potential reasons for the high CS rate among older mothers have been noted in literature. For example, dystocia (failure of progression), malpresentation, and intrauterine growth retardation leading to CS, have been found to have a higher prevalence among older nulliparous women (Waldenström et al. 2012). Biological factors such as decreased uterine contractility and poor uteroplacental perfusion as a result of the ageing processes in the uterus and placenta have been attributed to these diagnoses. However, it is not clear how much of the positive association between maternal age and CS can be explained by these physiological factors. Changes in obstetric practices and lowered threshold for the decision to carry out a CS in older mothers are believed to have contributed significantly to this rise in CS (Bayrampour and Heaman 2010). This is heavily impacted by the notion that these pregnancies are 'precious' ones.

This report will analyse stillbirth, small for gestational age, and dystocia in relation to advanced maternal age.

Figure 1

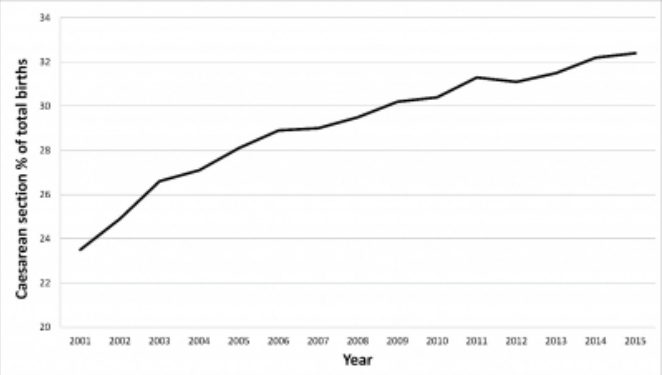
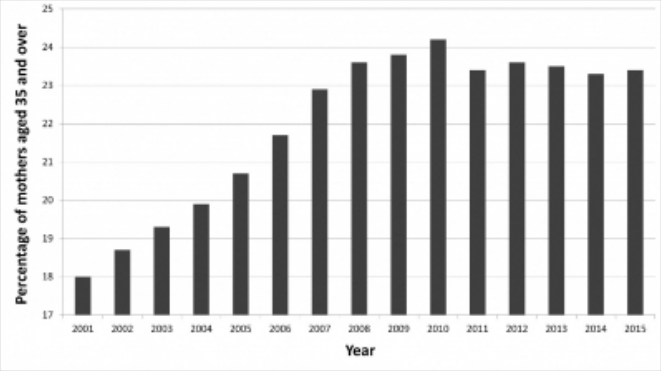


Figure 2



Stillbirth

The literature suggests that advancing maternal age is a risk factor for antepartum stillbirth in NSW (Gordon et al. 2013). This risk has been shown to increase at 40 weeks gestation for women aged over 35 by 1.4 times, and for women over 40 by 2.4 times. However, despite the rise in CS rates at earlier gestations, Australia's mothers and babies report (2014) states that the stillbirth rate has not changed significantly since 2004 and remains between 7 and 7.8 per 1000 births over this period. Furthermore, it notes that the majority of stillbirths (87%) in 2014 were pre-term and only 15% of stillbirths happened at term. This questions the rise in rates of planned (elective) CSs which are carried out pre-term to avoid stillbirths. This is of particular concern given the evidence that preterm babies have an increased risk of neurodevelopmental problems and respiratory distress (NSW Ministry of Health Guideline 2016).

It is important to note that although CS rates have risen, a corresponding decrease in fetal demise has not been reported in NSW (Nassar et al. 2013).

A systematic review (Huang et al. 2008) noted that with regards to stillbirth risk, a cut-off of 35 years for age is not applicable for healthy women who do not engage in risky behaviours (e.g. smoking) as neonatal outcomes do not change markedly until the age of 40.

Small for gestational age

The definition of small for gestational age (SGA) is an infant who is born with a birth weight below the 10th centile. The risk of SGA has been reported to increase with maternal age in literature (Ludford et al. 2012). RANZCOG states that women who have a major risk factor for SGA (odds ratio [OR] >2) should be referred for serial ultrasound measurements of fetal size and umbilical artery Doppler from 26-28 weeks of gestation (RANZCOG 2014). However, a systematic review on the accuracy of umbilical artery Doppler in a high-risk population to diagnose a SGA infant has only shown moderate accuracy (LR+ 3.76, 95% CI 2.96–4.76; LR– 0.52, 95% CI 0.45–0.61) (Morris et al. 2011). Furthermore, studies suggest that ultrasound-estimated fetal weight is subject to large intra- and inter-observer variability (Dudley 2005). Although one study in NSW showed that if sonographers are trained in measurement techniques inter-operator variability becomes insignificant, it is important to consider that large errors associated with fetal weight estimation equations overshadow the small variations in error (Oliver et al. 2013). This questions the reliability of these modes of investigations on which much of clinical decision making relies upon.

Additionally, although maternal age ≥40 carries an OR of 3.2 (major risk) for SGA, maternal age ≥35 carries an OR of 1.4, making it a minor risk for SGA. In the context of advanced maternal age and lowered threshold for CS, it would be important for future research to explore if in practice, mothers over 35 are deemed to have the same risks as mothers over 40 years of age.

A South Australian study found that advanced maternal age was associated with risk of having a SGA infant, however, smoking was found to be the largest contributing factor to this (Ludford et al. 2012). In general, older mothers are found to be of higher educational level and socioeconomic status leading them to pursue healthy lifestyle choices and abstain from smoking (Carolan and Nelson 2007). The NSW mothers and babies report (2014) shows that mothers aged 35 years and over were far less likely to smoke than younger mothers.

Additionally, the abovementioned study stated that a reduced number of antenatal visits was associated with restricted fetal growth. The Australian Antenatal Guidelines (AHMAC 2012) recommend for the first antenatal visit to take place within the first 10 weeks of pregnancy (Australian Institute of Health and Welfare [AIHW] 2016). In this regard, in 2014, 89% of mothers aged 35-39 attended their first antenatal visit before 20 weeks gestation (compared to 72% for those aged less than 20). This corresponds to evidence in literature (Carolan and Nelson 2007) regarding older mothers having increased health awareness and greater use of health care facilities.

Dystocia

Age-related myometrium inefficiency, decreased number of oxytocin receptors, and lack of previous labour-induced gap junction formations have been put forward as potential physiological factors for the increase in CS in older mothers (Bayrampour and Heaman 2010). According to a study by Treacy et al. (2006), intrapartum CS due to dystocia, increases progressively with advancing maternal age for nulliparous women. However, Bell et al. (2001) found a lack of association between maternal age and the proportion of deliveries by CS related to dystocia, which opposes this hypothesis. Furthermore, Treacy et al. (2006) found that irrespective of maternal age, dystocia can be corrected by oxytocin augmentation in the majority of cases.

Given that intrapartum CS is a major contributor to the overall upward trend of CS in NSW hospitals (Roberts et al. 2012), efforts should be made to provide a more accurate and standardised definition of dystocia and to investigate the true relationship between dystocia and CS in advanced maternal age.

DISCUSSION

Strengths of this review are its focus on NSW women and the use of routinely collected population-based data. Moreover, the reviewed papers were comparatively homogenous in terms of study design, quality, and accuracy, allowing for an improved comparison between their results. Five systematic reviews and 13 high quality population-based studies were reviewed. Advanced maternal age was considered as 35 and above and was a common outcome across the reviewed papers which adds to the validity of the findings. Given the comprehensive literature search, the results usefully represent the current state of knowledge in the field. This study has limitations which must be considered. Firstly, only studies which were conducted in developed countries were reviewed. Secondly, only articles in English language were included. However, as this reflects the majority of Australian women, this is reflective of our population.

In conclusion, this review has highlighted that both CS rates and the percentage of mothers aged 35 and beyond have risen in NSW since 2001. Although we know that maternal age is a risk factor for CS, advancing maternal age only explains 18% of the total rise in CS in NSW (Roberts et al. 2012). The finding of one study in Brisbane, Australia, showed that the notion that increasing CS rates are due to older and more medically complicated population is false as CS rates in this group rose similarly to those without complications (Janssens et al. 2008).

Hence, while there is abundant information in literature regarding a link between advanced maternal age and CS, there is a lack of accurate knowledge about the actual determinants of CS, especially among older mothers. This may be due to the fact that maternal request and obstetrician's decision have significant impact on the decision to carry out a CS. A NSW study looking at variations in hospital CS rates found that different decision making and processes of induction can greatly influence the risk of CS (Nippita et al. 2015). In this regard, written standardised guidelines for labour management, can help reduce the rates of CS.

Understanding the nature of the cascade of obstetric interventions can also have a powerful impact on reducing CS rates. Pharmacological interventions can affect the mode of birth as they interrupt the descent of the baby. One study in Victoria, Australia, showed that women over 35 were more likely to have epidural analgesia and a subsequent CS (Carolan et al. 2011). A systematic review found that epidural analgesia was associated with risk of CS (Rossignol et al. 2014). The study also noted that intermittent auscultation and nonpharmacological labour pain control methods (such as one-on-one support, relaxation, and breathing techniques) have a great potential for reducing CS. Incorporating these findings into the decision making process can impact method of delivery.

FUTURE DIRECTIONS

The study of other factors, such as maternal country of birth, in a multicultural society such as that of NSW, can improve our understanding of the rising trends of CS. Potential areas for future research also include exploration of changing clinical practices due to physician's and mother's perception of risk in relation to advanced maternal age.

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