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## **FACTORS DETERMINING CAESAREAN BIRTH RATES IN UGANDA.**

<sup>1</sup>Ruth Atuhaire, <sup>1</sup>Will Kaberuka, <sup>1</sup>Alex Mugarura

<sup>1</sup>Makerere University Business School, Uganda

### **ABSTRACT**

This study set out to establish factors that determine caesarean birth in Uganda using data from Mulago hospital. Secondary data was collected from Mulago hospital medical records department for the period 2013/2014. Ordinary least squares regression method was used for analysis. The results showed a significant relationship between maternal age, birth weight and caesarean birth rate.

The study recommends that C-section should not be looked at as a pre-condition for child birth rather it should be looked at as a solution. C-section can prevent still births caused by the mother's fatigue, complications or failure to push the baby, and C-section should only increase with improvements in technology to avoid hemorrhage. However in order to minimize or curb the incidence of C-section among pregnant mothers due to the associated complications like breathing problems, hemorrhage and long stays in the hospital, mothers should be informed that vaginal birth is a better choice by health professionals. Women should be sensitized on the advantages of producing early than wait when they are too old. Seeking antenatal care helps to monitor the baby's weight and find solutions early. Women should do exercises such as pelvic floor exercise which can help them maintain their pelvic tightness which will help during vaginal births.

**Keywords:** Caesarean Birth, Maternal Age, Birth Weight, Caesarean Delivery

### **1. INTRODUCTION**

A caesarean birth is delivery of a foetus through a surgical incision in the abdominal wall, known as a laparotomy, and an incision through the uterine wall, known as a hysterectomy (Felkin, 1884). This operation is used as a life-saving procedure for the mother and/or her baby due to a

number of factors, such as, the increasing labour induction rate, the option for women to choose an elective caesarean birth, and the decreasing option of vaginal birth after caesarean ( VBAC) (Kim Keen, 2004).

In the last 10 years, the numbers of cesarean births have skyrocketed, sending more women than ever under the knife in order to have their babies. Caesarean section rate is number of caesarean sections as proportion of all deliveries. The United States has reached an all-time high with 32 percent of births resulting in cesareans. More than a million cesareans are performed each year, making this procedure one of the most common surgeries done. Who is responsible for this rapid acceleration of cesareans? Surgically, removing a live child from a mother's womb is evident in records from ancient cultures including China, Rome, Uganda, Greece, India, Europe and Egypt. Traditionally caesarean was done as a last effort to retrieve the child from a dead or dying mother. For mothers in an age when birth labor is commonly managed by medical professionals in hospitals, the surgical procedure has vastly improved as science and technology advances. There are many reasons why cesarean surgery is performed. These include a baby in distress, arrested dilation (cervix fails to open during labor), a mother's health risk, structural problems in the birth canal or with the baby's position (Stewart- Hall, 2000 and Lavender et al, 2005).

Caesarean section births is not a new procedure in the health care system, even in the developing world. For instance, experience with abdominal child deliveries in Africa predates colonialism. In 1884, Robert Felkin a Scottish final year medical student gave a lecture to the Edinburgh Obstetrical Society about his experience of observing caesarean section in Africa. The title of the lecture was; "Notes on Labour in Central Africa." He narrated how, while in Uganda in 1879, he had observed the Baganda performing a successful emergency caesarean section using a large knife and alcohol as anaesthetic, analgesic, and antiseptic. The healer used banana wine to semi-intoxicate the woman and to cleanse his hands and her abdomen prior to surgery. He used a midline incision and applied cautery to minimize haemorrhaging. He massaged the uterus to make it contract but did not suture it; the abdominal wound was pinned with iron needles and dressed with a paste prepared from roots. The patient recovered well, and Felkin concluded that this technique was well-developed and had clearly been employed for a long time. This was probably the first record of caesarean section performed in Africa under very meticulous conditions (Felkin, 1884).

Studies show that both mother and child still face increased surgical risks from cesarean birth, such as infections, severe blood loss and fetal injury. Women who have had cesareans may be more likely to have higher risks of complications with subsequent pregnancies such as uterine rupture, placenta previa (placenta attached near or over the cervix), and placenta accreta (placenta attached too deeply into the uterine wall) (Stewart-Hall, 2000).

Despite these risks, cesarean rates are higher than ever and still increasing. Data suggests that it is somewhat abstract as to who is asking for the procedure. Usually there is a medical need or concern as observed through regular prenatal check-ups, and obstetricians will often advise the mother to consider a caesarean for her health or that of her unborn child. Some mothers may prefer to have cesarean for reasons other than medical necessity. Any number of complications can arise during a mother's trial of labor, unforeseen developments that lead to unscheduled emergency cesareans. It is against this background that the study is carried out to examine the factors that determine caesarean birth rates in Uganda.

## **2.0 LITERATURE REVIEW**

### **Maternal age and caesarean birth rate**

In the past two decades, trends of delayed childbearing have become increasingly common in high-income countries (Bre'art et al., 2003; ABS, 2007; Ventura et al., 2009), and women are now having fewer babies and commencing childbearing at an advanced age.

Average age of first birth has increased significantly and the greatest increase is seen among women aged 35–39 years (ABS, 2001, 2007; Bre'art et al., 2003; Ventura et al., 2009). This trend of advanced maternal age is driven by changing socio demographics. Childbearing women over 35 years of age are today more likely to be well educated (Carolan, 2003; Hammarberg and Clarke, 2005), and of higher socio- economic status (ABS, 2001; Hammarberg and Clarke, 2005). and of low parity (ABS, 2007; Davey et al., 2008); in contrast to their earlier peers who were more likely to be of lower socio-economic status and of high parity (Wildschut, 1999).

A large body of literature indicates a link between advanced maternal age and poorer perinatal outcomes (Cnattingius et al., 1992; Adashek et al., 1993; Fretts and Usher, 1997, 2003;), while others challenge these findings and suggest that good outcomes can be expected among healthy women (Prysak et al., 1995; Smit et al., 1998). Studies suggest that advanced maternal age is a predictor of risk, while at the same time reporting that the actual incidence of adverse outcomes remains small (Kozinszky et al., 2002; Diejomaoh et al., 2006; Panagopoulos et al., 2006). Despite worrying associations between advanced maternal age and poorer perinatal outcomes, it is unclear how these results relate to healthy contemporary women.

It is also important that we remain mindful of the datasets from which some of these reports emerge. Some of data used are now 25–30 years old (Hoffman et al., 2007; Aliyu et al., 2008). As such, these studies do not take into account recent demographic changes. Moreover, a range of studies generally report on advanced maternal age, including all women above 35 years of age (which may include women aged 45 years and above) without commenting on incremental age or parity differences (Astolfi et al., 2005; Delbaere et al., 2007). There is limited consensus

among scholars as to the maternal age when adverse findings become significant. Some authors have suggested that this association only becomes significant at age 40 and above (Nybo-Anderson et al., 2000; Huang et al., 2008), while others suggest that age of 35 years as the cut-off for increased risk (Cnattingius et al., 1992; Astolfi et al., 2005; Delbaere et al., 2007). Against this background of uncertain findings, contemporary women aged above 35 years have higher rates of caesarean section and intervention in labour (Bell et al., 2001; Kozinszky et al., 2002; Montan, 2007; Janssens et al., 2008). Caesarean rates are reported in the range of 25–35% for women aged above 35 years and approximately 40% for women aged above 40 years compared with estimates of 14–20% for women aged below 35 years (Bell et al., 2001). Trends of caesarean section for older women appear to be related largely to concerns for fetal welfare (Cnattingius et al., 1992; Adashek, et al., 1993).

Nulliparous women aged above 35 years are particularly likely to give birth by caesarean section (Kozinszky et al., 2002; Delbaere et al., 2007). Rates among nulliparous women of advanced maternal age (AMA) may be as high as 30–40% compared with approximately 18% for nulliparous women aged below 35 years (Delbaere et al., 2007). In more recent times, the greatest caesarean increase has been seen in pre labour caesarean section (Bell et al., 2001; Johnson and Coory, 2006; Janssens et al., 2008). Rates of pre labour caesarean section may be as high as 11% for nulliparous women aged above 35 years and double that amount for nulliparous women aged above 40 years (Bell et al., 2001). This means that a large percentage (11–22%) of primiparous women aged above 35 years do not experience labour, and this feature has implications for both women and maternity services, particularly as trends of advanced maternal age continue. Caesarean section rates for multiparous women are also high, and the most common cited reason is previous caesarean section. In Australia, where this review was conducted, women aged 35 years and above constitute approximately 25% of the childbearing population (ABS, 2007; Davey et al., 2008), and this figure is likely to increase as trends of delayed childbearing continue. At present, the ‘real’ or physiological risk for this group of women is not clear, and the caesarean rate is continuing to rise. This review, therefore, aims to provide up-to-date information on the relationship between perinatal outcomes and advanced maternal age for healthy women aged 35–39 years.

### **Birth weight and caesarean birth rates**

Riskin, et al (2004) published an observational, population-based study that included 2 955 infants with gestational ages between 24 and 34 weeks and birth weights less than 1 500g. They looked at the relationship between delivery mode and mortality in very low- birth-weight singleton pregnancies with a vertex presentation. The study showed that caesarean section did

not enhance survival, and the study concluded that caesarean section should not be recommended unless there were other obstetric indications.

In 2006 Lee and Gould studied whether there was any advantage for very-low-birth-weight babies delivered by caesarean section, reviewing the US Health Statistics data from 1999 to 2000 they found out that caesarean section rates were above 40%, and their analysis showed that caesarean delivery conferred a survival advantage if the foetus weighed less than 1 300 g.

When an extremely low-birth-weight baby is delivered by caesarean section there is an increased likelihood of a midline uterine incision being necessary. Ventura et al (2009) investigated whether delivery by caesarean section was associated with a better neuro developmental outcome at 2 years than vaginal delivery for preterm infants born weighing 1 250 g or less. They found no difference in neurodevelopmental morbidity. Neurodisability increased equally in both groups for babies born weighing 750 grams or less and/or born at 26 weeks gestation or less. Recently Janssens et al (2008). found that the indicators for poor neuro- logical outcome were gestational age less than 25 weeks and birth weight less than 500 g.18.( Lee, Gould , (2006).

Elkousy et al (2003) reported an examination of 9960 women with a previous Caesarean section planning a trial of labour. The study was further stratified by neonatal birth weights and birth history (primarily, whether they had a previous vaginal delivery and whether it occurred before or after their Caesarean). Their results indicate that the likelihood of successful VBAC decreases with increasing birth weight and is lowest in women who have never had a successful vaginal birth.

Parity and newborn birth weight are said to be significant determinants of primary caesarean birth (Stewart-Hall, 2000). First-time mothers and mothers delivering infants weighing over 4000 grams are at higher risks for C-section deliveries. Parrish et al. (1994) found in a study of Washington State caesarean rates that maternal age, parity, birth weight, and plurality accounted for a quarter of the rise in caesarean births. Taffel (1994) suggested that age, prenatal care history and parity alone account for most demographic changes because there is a high primary caesarean rate for first births to women 30 years of age and older (Braveman et al., 1995; Taffel, 1994).

### **Weight gain by mother and caesarean delivery**

In 2008, the Agency for Health Care Research and Quality (AHRQ) from the US Department of Health and Human Services reported that of the 21 studies identified (14 fair, 7 poor), all but 4 showed some degree of association between higher weight gain and caesarean delivery and the association appeared to be stronger among overweight and obese women. Nine studies (8 fair, 1

poor) examined the association between gestational weight gain classified by the Institute of Medicine (IOM) guidelines and caesarean delivery. These studies suggest moderate evidence for increased risk of caesarean for weight gain above IOM recommendations for underweight and normal weight women, and weak evidence for obese or morbidly obese women. Overall, the majority of studies suggested an association between weight gain and caesarean delivery. The findings of a higher risk of caesarean for overweight and obese women, coupled with the lack of significance of weight gain above IOM recommendations among obese or morbidly obese women, suggests that underlying health risks (such as increased risks of abnormal glucose tolerance) associated with high pregravid weight are likely confounders in the relationship between gestational weight gain and caesarean delivery (AHRQ, 2008)

Evidence from seven studies reported that birth weight increased between 16.7 and 22.6 g for every 1 kg increase in weight gain. Three studies examined the effect of weight gain by trimester on infant birth weight. All three studies were consistent in demonstrating the least effect of gestational weight gain in the third trimester. Two of three studies that used similar definitions of trimester found that a 1-kg increase in gestational weight gain during the first trimester was associated with 18-31 g increases in birth weight, whereas during the second trimester, such gains were associated with increases of 26-32.8 g and increases of 7-17 g during the third trimester. 10 articles (1 good, 8 fair and 1 poor) from nine databases provide strong evidence that weight gain below IOM recommendations is associated with lower birth weights. Seven studies found an association between high weight gains and higher birth weights, particularly for underweight and normal-weight women. Overall, we found strong evidence in support of an association between gestational weight gain and birth weight. Low gestational weight gain is associated with lower birth weights across all pregravid weight status groups whereas high gestational weight gain resulting in higher birth weight appears to be limited to underweight and normal-weight women. Thirteen studies (one good, nine fair, three poor) provided strong evidence that low weight gain increases the risks of low birth weight (AHRQ, 2008)

### **3.0 METHODOLOGY**

#### **Data Types and Sources**

This study used secondary data collected from Mulago National Referral hospital data bank. Data collected covered the monthly caesarean birth rates, maternal age, maternal weight and birth weight.

#### **Data Analysis**

Descriptive statistics were conducted with the variables of interest. Analysis was also done at bivariate and multivariate level using Eviews and statistical test done at 5% level of significant.

### **Univariate Analyses**

Under univariate analysis, descriptive statistics were conducted with variables of interest and the objective interpretations made. (The results are presented in table 4.1).

### **Bivariate Analyses**

Under bivariate analysis, correlation analysis to establish the degree and strength of the relationships between the variables of interest was done. Only the significant variables were included in the multiple regression model. (Weight gained by mother was found to be insignificant. The results are presented in table 4.2)

### **Multivariate Analyses**

Under multivariate analysis, a multiple linear regression model was used and the following model fitted  $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \epsilon_i$

Where; Y= monthly caesarean birth.  $X_1$ , = maternal age.

$X_2$ = child's birth weight. (The results are presented in table 4.3).

## **4.0 ANALYSIS AND PRESENTATION OF THE FINDINGS**

The study findings were presented after analysis according to the research hypotheses and study variables. The purpose of the study was to examine the determinants of caesarean birth rates in Uganda.

**Table 1 Descriptive Statistics (period 2013/2014)**

|             | Caesarean Birth Rates (%) | Weight gained by mother | Maternal age | Child's birth weight |
|-------------|---------------------------|-------------------------|--------------|----------------------|
| Mean        | 20.94                     | 7.56                    | 29.00        | 3.31                 |
| Median      | 20.75                     | 8.78                    | 30.00        | 3.35                 |
| Maximum     | 26.40                     | 13.70                   | 36.00        | 3.80                 |
| Minimum     | 16.70                     | 3.19                    | 20.00        | 2.80                 |
| Std. Dev.   | 2.10                      | 0.53                    | 5.00         | 0.36                 |
| Jarque-Bera | 3.20                      | 1.90                    | 2.00         | 1.71                 |
| Probability | 0.202                     | 0.278                   | 0.350        | 0.425                |

From the descriptive statistics in table 1, it is observed that; the average caesarean birth rate in Mulago hospital was at 20.94%.The maximum caesarean birth rate being 26.4% and the minimum 16.7%. The median caesarean birth rate was 20.75%. The average maternal age in Mulago hospital was approximately 29 years, the maximum maternal age being 36 years and the minimum being 20 years. The average birth weight in Mulago hospital was approximately 3.3kg, the maximum birth weight being 3.8kg and the minimum being 2.8kg. The statistics show that majority of mothers who seek caesarean services are old in age.

**Table 2; Correlation analysis of the study variables.**

| <i>Study variables</i>       |                         | <i>Caesarean Birth rates</i> | <i>Maternal age</i> | <i>Child's birth weight</i> | <i>Weight gained by the mother</i> |
|------------------------------|-------------------------|------------------------------|---------------------|-----------------------------|------------------------------------|
| <i>Caesarean Birth rates</i> | Correlation Coefficient | 1.00*                        | .624**              | .371**                      | .114**                             |
|                              | Sig. (2-tailed)         | .000                         | .001                | .023                        | .060                               |
|                              | N                       | 5304                         | 5304                | 5304                        | 5304                               |
| <i>Maternal age</i>          | Correlation Coefficient | .624**                       | 1.00*               | .252**                      | .450**                             |
|                              | Sig. (2-tailed)         | .001                         | .000                | .000                        | .012                               |
|                              | N                       | 5304                         | 5304                | 5304                        | 5304                               |
| <i>Child's birth</i>         | Correlation Coefficient | .371**                       | .252**              | 1.00*                       | .126*                              |

|                                    |                         |        |        |       |       |
|------------------------------------|-------------------------|--------|--------|-------|-------|
| <i>weight</i>                      |                         |        |        |       |       |
|                                    | Sig. (2-tailed)         | .023   | .000   | .000  | .345  |
|                                    | N                       | 5304   | 5304   | 5304  | 5304  |
| <i>Weight gained by the mother</i> | Correlation Coefficient | .114** | .450** | .126* | 1.00* |
|                                    | Sig. (2-tailed)         | .060   | .012   | .345  | .000  |
|                                    | N                       | 5304   | 5304   | 5304  | 5304  |

- \*5% level of significance \*\* 10% level of significance

Pearson Correlation results revealed that there is a positive significant relationship between the maternal age and caesarean birth rates (0.624) at 5% level of significant (0.001<0.05). Results further revealed a positive significant relationship between the child’s birth weight and caesarean birth rates (0.371) at 5% level of significant (0.023<0.05). From this study, there was no significant relationship between the weight gained by the mother and caesarean birth rates at 5% level of significant (0.06>0.05).

**Table 3; linear regression analysis for maternal age, child’s birth weight and the caesarean birth rate.**

Dependent Variable: Caesarean birth rates

| Variable             | Coefficient | Std. Error            | t-Statistic | Prob.    |
|----------------------|-------------|-----------------------|-------------|----------|
| C                    | 7.298736    | 3.004895.             | 2.428949    | 0.0242   |
| Maternal age         | 0.173431    | 0.065027              | 2.667054    | 0.0144   |
| Child’s birth weight | 2.618658    | 1.049466              | 2.495229    | 0.0210   |
| R-squared            | 0.564647    | Mean dependent var    |             | 20.93750 |
| Adjusted R-squared   | 0.523185    | S.D. dependent var    |             | 2.101513 |
| S.E. of regression   | 1.451133    | Akaike info criterion |             | 3.699034 |
| Sum squared resid    | 44.22150    | Schwarz criterion     |             | 3.846291 |
| Log likelihood       | -41.38841   | F-statistic           |             | 13.61837 |
| Durbin-Watson stat   | 1.978828    | Prob(F-statistic)     |             | 0.000161 |

Caesarean birth rates=  $7.23 + 0.17 \times \text{maternal age} + 2.62 \times \text{child's birth weight}$ . The results in the table show that for the period under study without the impact of both maternal age and birth weight, the caesarean birth rate was approximately on average 7.3%. A one year increase in maternal age led to an increase in caesarean birth rate on average by 0.17% holding other factors constant implying that maternal age has a significant impact on caesarean birth rates which is in line with the findings of Bell et al., 2001 who found out that caesarean rates were high amongst women aged above 35 years. Taffel, 1994 also suggested that maternal age alone accounts for most demographic changes because there is a high primary caesarean rate for first births to women 30 years of age and older.

A one kilogram increase in a child's birth weight led to an increase in caesarean birth rate on average by 2.619% holding other factors constant implying that the child's birth weight has a significant positive impact on caesarean birth rates which is in agreement with Stewart-Hall, 2000 who found that newborn birth weight is a significant determinant of primary caesarean birth.

It can be observed that the value of adjusted R-squared is 0.523185 implying that approximately 52% of the variations in caesarean birth rates are explained by the joint effect of maternal age and birth weight.

The magnitude of the t-statistic value corresponding to maternal age is greater than 2 ( $2.667054 > 2$ ), which implies that maternal age has a significant impact on the caesarean birth rate at 5% level of significance moreover the corresponding p value (0.0144) is less than 0.05, hence there is a statistically significant relationship between maternal age and caesarean birth rate. The magnitude of the t-statistic value corresponding to birth weight is greater than 2 ( $2.495229 > 2$ ) and the p value (0.0210) is less than 0.05 hence there is a statistically significant relationship between birth weight and caesarean birth rate. This is in agreement with Parrish et al, 1994 who found out in a study of Washington State caesarean rates that maternal age and birth weight accounted for a quarter of the rise in caesarean births.

## **5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

### **Summary;**

From the study it was established that there is a significant relationship between birth weight and the caesarean birth rate. It was established also that there is a significant relationship between maternal age and the caesarean birth rate.

**Conclusion;**

The study therefore concluded that there is a positive relationship between maternal age, birth weight and caesarean birth rates. Maternal age and birth weight have a significant effect in explaining caesarean birth rates as indicated by the adjusted R-squared value (0.523) which shows that approximately 52% of the variations in caesarean birth rates are explained by the maternal age and the child's birth weight.

**Recommendation;**

The study recommends that C-section should not be looked at as a pre-condition for child birth rather it should be looked at as a solution. C-section can prevent still births caused by the mother's fatigue, complications or failure to push the baby, and C-section should only increase with improvements in technology to avoid hemorrhage. However in order to minimize or curb the incidence of C-section among pregnant mothers due to the associated complications like breathing problems, hemorrhage and long stays in the hospital, mothers should be informed that vaginal birth is a better choice by health professionals. Women should be sensitized on the advantages of producing early than wait when they are too old. Seeking antenatal care may also be of help to monitor the baby's weight and find solutions early. Women should do exercises such as pelvic floor exercise which can help them maintain their pelvic tightness which will help during vaginal births.

**REFERENCES**

- Adashek J.S, Peacemen A.M, Lopez-zeno J.A (1993). Factors contributing to the increased caesarean birth rate in older parturient women. *American journal of obstetrics and gynecology* 169, 936-940.
- Agency for Health Care Research and Quality (AHRQ), US Department of Health and Human services (2008). Outcomes of maternal weight gain.
- Aliyu M.H, Salihu H.M, Wilson R.E, Alio A.P, Kirby R.S, (2008). The risk of intrapartum still birth among smokers of advanced maternal age. *Archives of Gynecology and obstetrics* 278, 39-45.
- Astolfi P, De Pasquale A, Zonta L, (2005). Late childbearing and its impact on adverse pregnancy outcome; stillbirth, preterm delivery and low birth weight. *Revue d' Epidemiologie et de Santé Publique* 53, 97-105.

Australian Bureau of Statistics (ABS), (2007). Births Australia.

Bell J.S, Campbell D.M, Graham W.J, Penney C.B, Ryan M, Hall M.H, (2001).Can obstetric complications explain the high levels of obstetric interventions and maternity service use among older women? A retrospective analysis of routinely collected data. *International journal of obstetrics and gynecology* 108, 910-918.

Bre'art G, Barros H, Wagener Y, Prati S, (2003). Characteristics of the childbearing population in Europe. *European Journal of Obstetrics and gynaecology* 111,S45-S52.

Carolan M., Frankowska D, (2010). Advanced maternal age and adverse perinatal outcome: A review of the evidence.

Carolan M.C, (2003).The graying of the obstetric population. Implications of the older mother. *Journal of obstetrics, gynecology and neonatal nursing* 32, 19-27.

Cnattingius S, Forman M.R, Brendes H.W, Isotalo L, (1992).Delayed childbearing and risk of adverse perinatal outcome. A population based study. *Journal of the American Medical Association* 268.

Cunningham, Gant, Leveno, Gilstrap and Wenstrom (2001).

Davey M.A, Taylor O, Oats J.J.N, Riley M, (2008).Births in Victoria 2005 and 2006.Victorian perinatal data collection unit.

Delbaere I, Verstraelen H, Geotgeluk S, De Backer G, (2007). Pregnancy outcome in primiparae of advanced maternal age. *European Journal of Obstetrics, Gynecology and Reproductive Biology* 135, 41-46.

Diejomaoh M.F.E, Al-Shamali I.A, Al-Kandari F, Al-Qenae M, Mohd A.T, (2006).The reproductive performance of women at 40 years and above. *European Journal of Obstetrics, Gynecology and reproductive biology* 126, 33-38.

Felkin R.W, (1884).Notes on labor in Central Africa.*Edinburgh Medical Journal* 20, 922-930.

Fretts R, Usher R.H, (1997).Causes of fetal death in women of advanced maternal age. *Obstetrics and Gynecology.* 89, 40-45.

- Hammarberg K, Clarke V.E, (2005). Reasons for delaying childbearing- a survey of women aged over 35 years seeking assisted reproductive technology. *Australian Family Physicians* 34, 187-189.
- Hoffman M, Jeffers S, Carter J, Duthely L (2007). Pregnancy at or beyond 40 years is associated with increased risk of fetal death and other adverse outcomes. *American journal of Obstetrics and Gynecology* 196, e11-13S.
- Janssens S, Wallace K.I, Chang A.M.Z, (2008). Prepartum and intrapartum caesarean section rates at Mater mother's hospital Brisbane 1997-2005.
- Johnson T, Coory M, (2006). Increase in caesarean section rates among low risk women in Queens Island 1990-2004. *Medical journal of Australia* 185, 404-405.
- Kim Keen, (2004). Factors influencing differences in primary caesarean section rates in midwife compared to physician practices.
- Kozinsky Z, Orvos H, Zoboki T (2002). Risk factors for caesarean section of primiparous women aged over 35 years.
- Lavender T, Kingdon C, Hart A, Gyte G, Gabbay M, Neilson JP, (2005) Could a randomised trial answer the controversy relating to elective caesarean section? *National survey of consultant obstetricians and heads of midwifery.*331490–1.1.
- Lee H.C, Gould J, (2006). Survival advantage associated with caesarean delivery in very low birth weight vertex neonates.
- Montan S, (2007), Increased risk in the elderly parturient. *Current opinion in obstetrics and gynecology.*19, 110-112.
- Panagopoulos P, Economou A, Tagia M, (2006).Pregnancy outcome in nulliparous women at age >35 in comparison to younger nulliparous women.*GiornaleItaliano di Obstetricia e Ginecologia* 28, 479-482.
- Prysak M, Lorenz R.P, Kisly A, (1995). Pregnancy outcome in nulliparous women 35 years and older. *Obstetrics and Gynecology* 85, 65-70.
- RiskinA, Riskin M.S, Lusky A, Reichman B, (2004). The relationship between delivery mode and mortality in very low birth weight singleton vertex-presenting infants

Smit Y, Scherjon S.A, Treffers P.E, (1998). Obstetric outcome of elderly low risk nulliparae  
International Journal of Gynecology and Obstetrics 63, 7-14.

Stewart- Hall, K, (2000). An analysis of risk factors associated with high rates of caesarean  
births in three selected Northeast Tennessee hospitals.

The reproductive care programme of Nova Scotia, (2008). Best practices in the use of caesarean  
sections in Nova Scotia.

Ventura S.J, Joyce M.A, Abma C, Mosher W.D, Henshaw S.K, (2009). National vital statistics  
reports, vol.58. Estimated pregnancy rates for United States.

Wildschut H.I.J, (1999). Social demographic factors; age, parity, social class and ethnicity in  
high risk pregnancy.