CAESAREAN SECTION AND OLDER MOTHERS: TRENDS, CAUSES AND CONSEQUENCES

Report of a Short Term Scientific Mission (STSM) for COST action ISO907

Investigator: Dr Lucy Frith – University of Liverpool, UK.
Host: Prof Katri Vehvilainen-Julkunen – University of Eastern Finland, Finland

PURPOSE OF THE STSM

This STSM examined the literature in the area of maternal age and caesarean delivery and developed plans for a future project to analyse data on this from England and Finland.

DESCRIPTION OF THE WORK CARRIED OUT

Introduction

The postponement of motherhood is, alongside obesity, seen as a particularly 21st Century health problem. Delaying childbirth is not viewed as a legitimate life choice, but as a foolish and possible dangerous course of action that could lead to infertility, risks to the baby and mother and increased health costs (Tromp et al, 2011). A special issue of the journal *Reproductive BioMedicine Online*, ‘Cassandra’s Prophecy, focussed on the issues raised by delaying motherhood and considered ways to encourage women to have their children earlier, when they are at optimal fertility (Everywoman, 2013). A another public health issue is the rising rate of births by caesarean delivery (Peristat, 2013) and the variation between both countries (WHO) and institutions (Bragg et al, 2010). These two issues are linked as older mothers are more likely to have a caesarean delivery than younger women and the increasing age of mothers at childbirth is often pointed to as one of the reasons for the increasing caesarean rate.


**Background**

*Demographics of childbearing*

The definition of ‘older mother’ or ‘advanced maternal age’ is something that is open to debate and there is no agreed point when one becomes ‘an older mother’. Cooke et al (2010) in their meta-synthesis of qualitative studies on women's experiences of older motherhood found a range of cut off points in the literature with some studies defining it as 30≤, some 32 ≤ and one 37 ≥. In the literature most authors define it as 35≤ and with very advanced maternal age defined as 45≤ (Carolan et al, 2013).

In the England and Wales\(^1\) the age of first time motherhood is rising: in 2012 the average age of women having their first baby was 28.1 years compared to 26.8 in 2002 and the average age of all mothers was 29.8. Numbers of births to women over 35 have been increasing since the mid-1970s: in 2012 19.8% of births were to those over 35 (35-39 = 15.7%; 40-44 = 3.8; 45 and over 0.3%), slightly less than 2011 – 20% of births to those 35≥. While this may seem high, it is interesting to note that in 1938 (the first year included in the National Statistics) the figure was 16.7% rising to 19.7% in 1945. After the war this percentage decreased steadily until the mid-1970s (where the percentage was at its lowest, 5.5, in 1977), after this it began to rise to reach current levels (that are not that dissimilar from those in the mid 20\(^{th}\) Century) (UK National Office of Statistics, 2013). There are regional differences in maternal age in England: ‘London accounted for the greatest number of deliveries according to population size at 19.1 per 1,000 of the population for mothers aged 40 to 44 and 1.5 per 1,000 of the population for mothers aged 45 to 49. One in twenty of all deliveries (5.1 per cent) in this region were to mothers aged 40 to 49 - the highest percentage of any region. London also recorded the greatest actual number of deliveries for

---

\(^1\) In this paper figures will be used for England predominately, except where English statistics are included with other countries (such as in the case of the National Office of Statistics - Wales).
this age group - at 6,260.’ (NHS Maternity Statistics, Press Release, 2012) In Finland the demographics of maternal age are very similar to England and Wales. The mean age for first birth was 28.4 in 2011 and births to those over 35 was 18.7% (35-39 = 15.1%; 40-44 = 3.4; 45 and over 0.2%) compared to 13.3% in 1987.

There is a growing literature on the problems encountered by having children later. The risks of pregnancy and childbirth are higher for women over 35 (Jolly et al, 2000) and these increase sharply for the over 40 age group (Carolan et al, 2013. Favilli et al 2012). Potential risks can be put in the following groups: pregnancy complications (increased levels of gestational diabetes etc); poor outcomes for the baby (low birth weight etc); increased interventions in birth – induction, caesarean (both elective and emergency) and operative vaginal delivery; and. poor outcomes for the mother (postpartum haemorrhage) (see Balashch & Gratacos, 2012 for an overview of these risks). This project will focus on one aspect of this, caesarean delivery.

Demographics of caesarean deliveries

While the demographics of maternal age maybe similar between Finland and England, the caesarean rates differ. In Finland 16.3% births are by caesarean, with 6.2% planned. In England the caesarean rate has been steadily rising from 9.1% in 1980 to 25% of all births in 2011-12, with less elective than emergency caesareans (10.2% elective and 14.8% emergency in 2011-12) (NHS Maternity Statistics, 2011). This puts Finland among the lower end of caesarean rates (under 20%) with England almost on the EU median of 25.2% (Peristat, 2013). There is international concern over the rising levels of caesarean deliveries (Declercq, et al 2011) that are generally over the WHO recommended range of 10-15%

---

2 This is the 2011 Report, the latest one has just been released (in September 2013) but the English translation has not been. So this version will be used in this Report.
3 This is comparing figures for England in 2011-12 with the earlier Peristat 2010 figures.
Caesarean deliveries have increased morbidity than vaginal deliveries and therefore high levels of such deliveries are a cause for concern (Paranjothy et al, 2005).

There is a dual concern that caesarean rates are rising (although in Finland they have fallen slightly) and that there is unwarranted variation in practice both between countries and between birth settings within countries. Internationally, Cyprus has the highest rate, 52.2% with Iceland having the lowest, 14.8% (Peristat, 2013). There has been a significant amount of discussion over whether such variation is warranted. Bragg et al, (2010) compared caesarean rates between English Trusts found that after adjusting for the characteristics of women who gave birth there was still a considerable variation in caesarean rates. Essex et al (2013) found that the socio-demographic characteristics of women predicted mode of birth (after adjustment). For example women from lower occupational status households were more likely to have a planned caesarean and Gareen et al, 2003 found Afro-American were more likely to deliver in this way. Carolan et al, (2011) found, in Australia, that women giving birth in private hospitals were more likely to deliver by caesarean than those in public hospitals. A Finnish study (Pallasmaa et al 2013) found that the variation between unit’s caesarean rates was not related to maternal complications.

**STSM PROJECT DEVELOPMENT**

The first stage of the STSM was to see consider the demographic information and then to do a literature review of the area, an initial scoping review, to see what had been written on this topic and gaps in the literature.
**Scoping review**

To get a sense of the current literature in the area I conducted a preliminary review using the search terms that Bayrampour & Heaman (2010) developed in their systematic review of the relationship between advanced maternal age (defined as 35 and over) and caesarean section among nulliparous and multiprous women. This review was conducted on articles published between 1995 and March 2008, so I searched from 2008 onwards to capture more recently published work. Scopus and PsycINFO were searched using the terms “advanced maternal age”; and “older maternal age” AND caesarean OR caesarean. This produced 138 articles (removing for duplicates). Articles were selected by Bayrampour & Heaman’s inclusion and exclusion criteria: they excluded studies from developing countries (due to complexities in comparing caesarean rates); those not in English; and those that did not take advanced maternal age to be over 35 or produced that as a category and did not present the number of participants and number of caesareans for each group.

The search produced 7 studies that fulfilled the criteria set by Bayrampour & Heaman (Carolan et al, 2011. Kenny et al, 2013. Klemetti et al, 2013. Ludford et al, 2012. Roos et al, 2010. Waldenstrom et al, 2012. Wang et al, 2011). Bayrampour & Heaman note that it was not possible to conduct a meta-analysis in their review due to the heterogeneity of the studies and such an analysis was not conducted in this review as this was only a preliminary review. A possible direction for further research would be to replicate Bayrampour & Heaman’s review in full: both to appraise the literature in a systematic way and to compare the rates of caesarean section across a 20 year period to detect possible changes (i.e. the rise in births to women 40≤), For example, Waldenstrom et al (2012) study shows that caesareans have fallen in the age groups 35-39 and 40≥ but increased in 30-34 age group between 1973 and 2008 in Sweden and Norway.
All the studies in the scoping review found that caesarean rates increased with maternal age and therefore age is a key risk factor for caesarean delivery, with significantly higher rates in the over 40 group (Carolan et al, 2011. Kenny et al, 2013. Klemetti et al, 2013. Ludford et al, 2012. Roos et al, 2010. Waldenstrom et al, 2012. Wang et al, 2011). Carolan et al’s (2011) Australian study, for example, compared birth intervention rates in women 35-44 years (divided these into 35-39 and 40-44) and 25-29 in Australia and found that the caesarean rate was nearly twice as high for women aged 40-44 than for women aged 25-29.\(^4\) Bayrampour & Heaman’s (2010) original review also found a correlation between caesarean rates and advanced maternal age and in an earlier English study Jolly et al (2000) found that women 35 and over were at greater risk of having both an emergency and elective caesarean.

Figures for caesarean rates in England also support the research found in the scoping review – that rates increase with maternal age. In the accompanying Press Release (2012) of the 2011-12 NHS Maternity Statistics the data on age and caesarean deliveries is summarised as follows:

‘Just over one in three mothers aged 35 and over had a caesarean (35.3 per cent, or 44,700), compared to one in four women aged 25 to 34 (24.7 per cent, or 91,100) and just under one in six of women aged under 25 (16.6 per cent, or 25,700). These rates have changed little in recent years. Just under one in five of women aged 35 and over (17.6 per cent, or 22,300) had an elective caesarean compared to one in 10 women aged 25 to 34 (9.8 per cent, or 36,300) and one in 20 of under 25s (4.6 per cent, or 7,100). By region of treatment the highest overall caesarean rate was in London at 28.5 per cent (36,100), while the lowest was in Yorkshire and the Humber at 22.6 per cent (14,800).’ \(^5\)

\(^4\) These are figures for public hospitals, the rates were higher for those delivering in private hospitals. 
\(^5\) Possibly related to the larger numbers of older mothers in London (see earlier discussion).
Hospital deliveries by age and number of caesareans, 2011-12:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of deliveries</td>
<td>629,207</td>
<td>649,837</td>
<td>652,638</td>
<td>652,377</td>
<td>668,195</td>
<td>668,936</td>
</tr>
<tr>
<td>Deliveries for women aged 19 and under</td>
<td>43,063</td>
<td>42,671</td>
<td>42,084</td>
<td>40,010</td>
<td>37,112</td>
<td>33,621</td>
</tr>
<tr>
<td>Deliveries for women aged 20 - 24</td>
<td>121,300</td>
<td>124,789</td>
<td>126,328</td>
<td>125,924</td>
<td>126,922</td>
<td>124,213</td>
</tr>
<tr>
<td>Deliveries for women aged 25 - 29</td>
<td>163,333</td>
<td>172,650</td>
<td>178,333</td>
<td>179,522</td>
<td>183,912</td>
<td>185,549</td>
</tr>
<tr>
<td>Deliveries for women aged 30 - 34</td>
<td>175,660</td>
<td>176,789</td>
<td>175,436</td>
<td>176,780</td>
<td>187,284</td>
<td>190,910</td>
</tr>
<tr>
<td>Deliveries for women aged 35 - 39</td>
<td>102,335</td>
<td>105,918</td>
<td>103,770</td>
<td>103,635</td>
<td>105,289</td>
<td>102,950</td>
</tr>
<tr>
<td>Deliveries for women aged 40 - 44</td>
<td>21,202</td>
<td>22,045</td>
<td>22,651</td>
<td>22,970</td>
<td>23,740</td>
<td>24,285</td>
</tr>
<tr>
<td>Deliveries for women aged 45 - 49</td>
<td>977</td>
<td>1,043</td>
<td>1,157</td>
<td>1,231</td>
<td>1,314</td>
<td>1,348</td>
</tr>
<tr>
<td>Total number of caesareans</td>
<td>145,051</td>
<td>153,406</td>
<td>154,814</td>
<td>157,356</td>
<td>162,512</td>
<td>163,859</td>
</tr>
</tbody>
</table>

(NHS Maternity Statistics, 2011-12)

Discussion

There seems little doubt that high maternal age is an indication for caesarean delivery but why this might be so is less understood. This is an important question for health care providers as unless mechanisms for such levels are understood it is not possible to determine if they are too high and if so, how to reduce them. While the link between age and caesarean rates are now well documented in the literature, the reasons for this are not well understood and most articles simply speculate on why there might be such a link.

Bayrampour & Heaman (2010) in their systematic review concluded that although the link is there, the reasons for this are not clear and more research is needed on the physiological and anatomical determinants and on doctors’ and women’s perceptions of risk.
Carolan et al (2011) argue that advanced maternal age can be conceptualised as either a predictor of adverse maternal and fetal outcome or as a predictor of risk.

‘What is clear from the literature is that increasing intervention among women aged 35 years or older is a complex problem without a single satisfactory explanation….Interventions in labor and birth increased with maternal age, and this effect was seen particularly for caesarean section among women admitted privately. These findings were not fully explained by the complications we considered (preeclampsia, gestational diabetes, placenta previa, multiple birth, nonvertex presentation, and extremes of birth-weight) which raises concerns for maternal health and for future service provision.’ (Carolan et al, 2011:28)

Suggestions for why increasing age results in more caesarean deliveries are both socio-cultural and physiological. Jolly et al (2000) speculate that obstetricians may have ‘a lower threshold for intervention’ in older women, but also advance a physiological explanation that caesareans might be needed due to the decrease in myometrial function with age. Smith et al (2008) considered this and argued, ‘increasing maternal age was associated with reduced spontaneous activity and increased likelihood of multiphasic spontaneous myometrial contractions.’ And conclude that the increase in caesarean for older women has a biological basis. However Arrowsmith et al (2012) argue that there is little evidence of a decrease in contractibility in older pregnant women and oxytocin responses might be more affected by age.

Bragg et al (2010) found there was a higher level of variance in emergency than elective caesareans and suggest that this might be due to lack of precise definitions for fetal distress and dystocia resulting in differential practice. In their study of the link between maternal age and caesareans, Gareen et al (2003), highlighted the importance of the subjective nature of the diagnosis of dystocia and argue that doctors might not let the older mother labour as long and they are more cautious in their management strategies for this group. They conclude that there is room for reducing caesarean rates for older mothers, as the higher rate is not solely a result of clinical indicators.
Thus the social context and perceptions of mothers, obstetricians and midwives can play a part in elevating caesarean levels (Monari et al, 2008).

Previous studies have shown that labelling as a 'high-risk pregnancy' and maternal anxiety may influence clinician decisions and advice regarding mode of delivery and interventions. Increased rates of intervention in labour and caesarean birth could also be explained by increased risk (or perception of risk) of intrapartum fetal compromise with advancing age. (Mills & Lavender, 2011:110)

As has been found in other studies (Kennedy et al, 2013), the ‘need’ for a caesarean is a made up of a complex coming together of ‘biological’ signs, socialized interpretation of potential indicators by the mother, obstetrician and midwife these indicators can be misunderstood (Tully et al, 2013).

FUTURE COLLABORATIONS

This STSM was designed to scope and develop the possibility of doing an analysis on publically available data on the caesarean deliveries and maternal age in England and Finland. Finland is a country that has a lower rate of caesarean deliveries than England, as maternal age is seen as an indication for caesarean delivery we want to compare the levels in the older age group across the two countries. The research question is:

Does this difference in caesarean delivery rates remain the same across the different age groups in the two countries?

A preliminary search of the available data has found publically available data sets for both countries. In Finland the National Institute for Health and Welfare produces annual maternity statistics that include maternal age and caesarean rates (this data has been used in publications on this and other issues, see Klemetti et al, 2013). In England, the Hospital Episode Statistics includes data on maternity. This has been used in Bragg et al’s paper (2010) to compare the rates of caesarean deliveries across different English Trusts. Issues raised by using these data sets provided by the NHS and the possible concerns over quality
have been discussed by Knight et al (2013). The mode of delivery is recorded in two places: in the procedure fields and what had been called be called the ‘maternity tail’ that includes data specifically on maternity care and there is no indication as to what is the preferred set and how the two sets related to each other. Knight et al provide a useful overview of how the two sets can be compared and this will be used to inform our analysis of the data. They found that there were discrepancies between the two data sets in elective and emergency caesareans; however they conclude that although there might be inconsistencies between individual Trusts, nationally these had a small effect on the overall statistics.

Projects

We will investigate ways of taking the following projects forward by finding collaborators and possibly funding.

1. Collaborate with a statistician to conduct the statistical analysis of the two country’s data sets and from this produce a peer reviewed journal article.

2. Conduct a systematic review that would build on and up data Bayrampour & Heaman’s (2010) review; this could be used to track trends in caesarean levels for older mothers.

3. Consider the qualitative literature on women’s experiences and those of midwives and obstetricians on older motherhood and risk.

4. Projects 1-3 could form the basis of a proposal for research funding to conduct the statistical analysis, the systematic reviews and conduct some comparative qualitative research.

5. LF will collaborate on a paper on BMI and childbirth with KV-J and colleagues.
CONFIRMATION BY THE HOST INSTITUTION OF THE SUCCESSFUL EXECUTION OF
THE STSM

Dr. Lucy Frith's STSM was highly important to scope the research agenda for further
collaboration in the field as listed in Dr. Frith's report. This activity will support COST action,
too. In conclusion, it was great to have Dr. Frith to visit the University of Eastern Finland to
set up the focus and steps to our further research activity.

Yours sincerely, Katri Vehvilainen-Julkunen

REFERENCES

Arrowsmith, S., Robinson, H., Noble, K. & Wray, S. 2012, "What do we know about what
happens to myometrial function as women age?", Journal of muscle research and cell

Balasch, J. & Gratacós, E. 2012, "Delayed childbearing: Effects on fertility and the outcome
of pregnancy", Current Opinion in Obstetrics and Gynecology, vol. 24, no. 3, pp. 187-
193.

Bayrampour, H. & Heaman, M. 2010, "Advanced maternal age and the risk of cesarean

Van Der Meulen, J.H. 2010, "Variation in rates of caesarean section among English
NHS trusts after accounting for maternal and clinical risk: Cross sectional study", BMJ
(Online), vol. 341, no. 7777, pp. 818.

Carolan, M., Davey, M.-., Biro, M.A. & Kealy, M. 2011, "Older Maternal Age and Intervention
in Labor: A Population-Based Study Comparing Older and Younger First-Time Mothers

Carolan, M.C., Davey, M.-., Biro, M. & Kealy, M. 2013, "Very advanced maternal age and
morbidity in Victoria, Australia: A population based study", BMC Pregnancy and

Cooke, A., Mills, T.A. & Lavender, T. 2010, "'Informed and uninformed decision making'-
Women's reasoning, experiences and perceptions with regard to advanced maternal
age and delayed childbearing: A meta-synthesis", International journal of nursing
studies, vol. 47, no. 10, pp. 1317-1329.

Declercq, E., Young, R., Cabral, H. & Ecker, J. 2011, "Is a rising cesarean delivery rate
99-104.
Essex, H.N., Green, J., Baston, H. & Pickett, K.E. 2013, "Which women are at an increased risk of a caesarean section or an instrumental vaginal birth in the UK: An exploration within the Millennium Cohort Study", BJOG: An International Journal of Obstetrics and Gynaecology, vol. 120, no. 6, pp. 732-742.

Everywoman, J. 2013, "Cassandra's prophecy: Why we need to tell the women of the future about age-related fertility decline and 'delayed' childbearing", Reproductive BioMedicine Online, vol. 27, no. 1, pp. 4-10.


