Institution: The University of Edinburgh

Unit of Assessment: 1

Title of case study: J: Elective delivery of pregnant women reduces perinatal mortality, particularly in mothers over 40 years of age

1. Summary of the impact (indicative maximum 100 words)

Impact: Health and welfare; healthcare guidelines on elective induction of labour. The research showed that elective induction at time points from 37 weeks' gestation progressively reduces perinatal mortality. UK guidelines now recommend routine induction at 39 weeks in mothers >40 years of age.

Significance: Implementation of the guidelines for mothers >40 years of age is estimated to prevent the stillbirth of 17 babies per year in the UK.

Beneficiaries: Pregnant women, policy makers and healthcare providers.

Attribution: The work was led by Jane Norman with Sarah Stock at UoE, in collaboration with NHS Information Scotland.

Reach: UK, Europe, North America. Applies to all pregnant women, especially those over 40 years of age.

2. Underpinning research (indicative maximum 500 words)

Professor Jane Norman (Professor of Maternal and Fetal Health, UoE, 2008–present) and Dr Sarah Stock (Clinical Lecturer, UoE, 2008–present), with colleagues from NHS Information Scotland, showed that routine induction of labour would prevent unnecessary perinatal death, particularly in women of >40 years of age.

Induction of labour at term is one of the most common obstetric interventions, occurring in over 20% of pregnant women. "Elective" induction of labour on "maternal request" and in the absence of a specific complication is increasingly asked for by women, but the risks and benefits are unclear. Randomised trials are unlikely to be sufficiently large to determine the effects on perinatal mortality.

Induction of labour at term in women without a previous caesarean section
In a retrospective cohort study of an unselected population database of over 1.2 million pregnant women at term, conducted between 2008 and 2011, Norman and colleagues compared the outcomes of elective induction of labour at term (in women without caesarean section) at 37, 38, 39, 40 and 41 weeks' gestation with those of expectant management (continuation of pregnancy to either spontaneous labour, induction of labour or caesarean section at a later gestation). The team found that elective induction of labour (compared with expectant management) decreased the odds of perinatal mortality (adjusted odds ratio at 40 weeks' gestation was 0.39 [99% confidence interval (CI) 0.24–0.63]), without a reduction in the odds of normal vaginal delivery [3.1]. Given that older women are at higher risk of experiencing perinatal fetal death, guidelines from the Royal College of Obstetricians and Gynaecologists (RCOG) have recommended that induction of labour at 39 weeks should be routinely offered to older women.

Induction of labour in women with one previous caesarean section
In a subsequent study, conducted between 2008 and 2012, Norman and colleagues analysed the effects of induction of labour in women with one previous caesarean section, where induction of labour is considered by some to pose unacceptable risks to both mother and baby. In contrast to the prevailing view, the team found that induction of labour (compared with expectant management) was associated with a lower odds of caesarean delivery (adjusted odds ratio at 39

weeks was 0.81 [95% CI 0.71–0.91] with no effect on perinatal mortality [3.2]. In contrast, elective repeat caesarean delivery was associated with lower perinatal mortality than expectant management (adjusted odds ratio at 39 weeks was 0.23 [95% CI 0.07–0.75]). Hence, a more liberal policy of induction of labour at term in women with previous caesarean delivery would reduce repeat caesarean delivery; but repeat caesarean delivery is optimal in reducing perinatal death.

Elective preterm delivery

In a parallel study of women delivering preterm in Scotland conducted between 2007 and 2009, again using record linkage of population-based data, Norman and team showed a progressive increase in the rate of elective preterm birth for infants between 28 and 37 weeks' gestation during the period 1980 to 2004. During this time, there was a reduction in stillbirth and extended perinatal mortality rates for electively born but not spontaneous preterm infants. These data contribute to a growing understanding that a high rate of indicated late preterm birth is associated with a lower rate of stillbirth and neonatal death [3.3].

3. References to the research (indicative maximum of six references)

3.1 Stock S, Ferguson E, Duffy A,…Norman J. Outcomes of elective induction of labour compared to expectant management: a population based study. BMJ. 2012;344:e2838. DOI: 10.1136/bmj.e2838. *[downloaded approximately 25,000 times by census date].*

3.2 Stock S, Ferguson E, Duffy A, Ford I, Chalmers J, Norman J. Outcomes of induction of labour in women with previous caesarean delivery: a retrospective cohort study using a population database. PLoS One. 2013;8:e60404. DOI: 10.1371/journal.pone.0060404.

3.3 Norman J, Morris C, Chalmers J. The effect of changing patterns of obstetric care in Scotland (1980–2004) on rates of preterm birth and its neonatal consequences. Perinatal Database Study. PLoS Med. 2009;6:e1000153. DOI: 10.1371/journal.pmed.1000153.

Grants

Norman J, Chalmers J, Shanks E. Temporal trends and outcomes associated with obstetric causes of preterm birth in Scotland. Chief Scientist Office, Scottish Executive, 2007–2008, £10,051. This grant (and the one below) were awarded to Jane Norman shortly before she left the University of Glasgow; the work was conducted by Jane Norman and Sarah Stock at the University of Edinburgh in collaboration with Information Services Division, NHS National Services Scotland.

Ferguson E, Norman J, Chalmers J, Shanks E, Finlayson A. Investigation of the beneficial and adverse effects of induction of labour. Chief Scientist Office, Scottish Executive, 2008–2009, CZG/2/292 £10,651.

Reference [3.1] informed guidelines Norman is introducing in a stepped wedge cluster randomised trial of stillbirth prevention, AFFIRM (£330,000), funded by the Chief Scientist Office of the Scottish Executive, Tommy's and SANDS, which will be conducted in Scotland, Wales and Ireland starting late 2013.

4. Details of the impact (indicative maximum 750 words)

Impact on health and welfare

An international comparison of preterm birth using the UoE data [3.3] together with data from Europe, the USA and Canada confirmed that higher rates of elective preterm birth are associated with lower rates of stillbirth and neonatal death [5.1].

The work is partly responsible for the fall in stillbirth and perinatal mortality rates in Scotland from 5.3 and 7.36 per 1000 (respectively) in 2009 to 4.9 and 6.94 per 1000 in 2010 [5.2].

Women can now make a more informed choice about the timing of birth. Additionally, there is an emotional benefit of early induction if the woman requests it, rather than waiting until spontaneous

labour starts.

Impact on public policy
Reference [3.1] was cited in the 2013 RCOG Scientific Impact Paper, which endorses elective induction of labour from 39 weeks' gestation in pregnant women of 40 years of age and older [5.3]. Routine induction of labour at 39 weeks for all women is calculated to prevent the perinatal death of 500 babies per year. The RCOG guidelines suggest the strategy of elective induction at 39 weeks should be targeted to those at highest risk (women of 40 years or more) and calculate this will prevent the stillbirths of 17 UK babies per year.

The research led to appointment in 2012 of Jane Norman as Chair of the Guideline Development Group [5.4] for the National Institute for Health and Care Excellence (NICE) Guideline on Preterm Labour and Birth.

Impact on clinical practice
Despite its very recent publication (May 2012), the compelling data have resulted in an immediate change in practice internationally, as attested by leaders in the field from, for example, Canada [5.5]. The paper [3.1] has been downloaded approximately 25,000 times from the BMJ website, confirming both the interest generated among obstetric clinicians of targeting elective induction and the early impact on management.

Impact on society
Public awareness and public involvement in research has been increased by reference to the work in the media including Scottish Television, BBC Scotland, BBC Radio 4's Today Programme, BBC Radio 1, BBC Radio 5 Live, BBC Radio Scotland and Radio Forth, Daily Telegraph in September 2009; and the Scotsman, Daily Mail, The Herald (combined circulation over 2 million) and the BBC news website [5.6] (all on 11th May 2012).

Additionally, the data were referred to in a public lecture given by Jane Norman "The mysteries of birth – far from elementary my dear Watson" in October 2010, which has been accessed over 2,700 times on YouTube [5.7].

5. Sources to corroborate the impact (indicative maximum of 10 references)

5.1 Lisonkova S, Sabr Y, Butler B, Joseph K. International comparisons of preterm birth: higher rates of late preterm birth are associated with lower rates of stillbirth and neonatal death. BJOG. 2012;119:1630–9. DOI: 10.1111/j.1471-0528.2012.03403.x.

5.2 Scottish Perinatal and Infant Mortality and Morbidity Report (2010). Healthcare Improvement Scotland, NHS National Services Scotland. http://www.healthcareimprovementscotland.org/default.aspx?page=14046.

5.3 RCOG (2013). Induction of labour at term in older mothers. Scientific Impact Paper no 34. London. http://www.rcog.org.uk/files/rcog-corp/1.2.13%20SIP34%20IOL.pdf.

5.4 NICE, Preterm Labour and Birth, Guideline Development Group Membership List. http://www.nice.org.uk/nicemedia/live/14004/64412/64412.pdf.

5.5 Letter from Chief of Maternal-Fetal Medicine, Sunnybrook Hospital, Toronto. *[Available on request. States that the research has changed clinical practice in Ontario, Canada, and provided the impetus for a $12M randomised controlled trial.]*

5.6 BBC News website (11 May 2012). "Induction cuts risk of babies dying, researchers say". http://www.bbc.co.uk/news/health-18018067.

5.7 The mysteries of birth – far from elementary my dear Watson (2010). http://www.youtube.com/watch?v=TC43j2UJ-GI.