

Caesarean Section in Scotland 1994/5: a National Audit

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Summary

- Objective:** To describe current practice in relation to delivery by caesarean section in Scotland and to explore the feasibility of developing clinical practice guidelines.
- Design:** A prospective audit of all Caesarean sections during an 18 month period in 1994 and 1995. A computer and a specifically designed database were given to each participating unit to obtain information as near to the time of the procedure as possible. Findings from the first 12 months of audit were presented to participating obstetricians and consensus on five specific aspects of practice obtained. Findings from the final six months of audit relating to these five specific areas were compared with those of the first year.
- Setting:** 23 of the 24 consultant-led maternity units in Scotland.
- Participants:** All obstetricians in the 23 units.
- Results:** Prospective audit data were collected for 87% of all Caesarean sections undertaken in 1994 (8369 cases) and for 78% of all Caesarean sections undertaken in the first half of 1995 (3526 cases).

Comparison of 1994 with 1975

Data from the prospective audit were combined with data collected routinely through SMR 02 (Scottish Morbidity Record - Maternity) to provide an overview of all 9573 Caesarean sections performed in Scotland in 1994. This permitted comparison with an overview, based on SMR 02 data, of the 5491 operations performed in 1975. The Caesarean section rate was 16% in 1994, compared with 8.5% in 1975. The contributions of differences in obstetric population and differences in clinical practice to this increase in rate were examined. It appeared that 40% of the increase in Caesarean section rate was attributable to a change in the pregnant population, mainly due to an increase in the proportion of women with a previous section, and 60% to change in practice.

Caesarean section in 1994

Caesarean section rate varied by maternal age, parity and gestation but not by deprivation category. Sixty-one percent of operations covered by the audit were emergency procedures (14% before labour and 47% during labour) and 39% elective.

The timing of emergency procedures showed little variation by time of day or day of the week whereas, among elective sections, 95% took place between the hours of 09.00 and 18.00 and only 4.3% took place at weekends. A consultant or senior registrar was present at 23% of emergency and 43% of elective operations. The median time taken to arrange emergency caesarean sections was 60 minutes for procedures before labour and 40 minutes for those during labour. General anaesthesia was used in 13% of elective and 26% of emergency sections. Variation was observed among the 23 hospitals for all parameters.

Fifty-one percent of the caesarean sections covered by the audit were in primigravidae, 31% were in parous women with a history of previous section, and 18% in parous women with previous vaginal deliveries only.

Indications for caesarean section

The four indications detailed below, in the absence of other recorded complications, accounted for 60% of all singleton sections:

1. Elective sections for breech presentation (11% of all sections)
2. Emergency section before labour for fetal distress and/or intrauterine growth retardation (3% of all sections)
3. Emergency section during labour for fetal distress and/or failure to progress (30% of all sections)
4. Repeat sections for reasons other than above (16% of all sections)

The consensus view of all Scottish obstetricians on the following five statements was sought by questionnaire survey. These statements were based on literature review and discussion among hospital-based obstetrician co-ordinators. They relate to elements of practice which might be expected to reduce the rate of caesarean section for the above indications:

1. External cephalic version (ECV) should be used in an attempt to correct a breech presentation in a woman at term (when there are no contraindications) in order to try to avoid a caesarean section

Summary

2. Scalp pH should be attempted to confirm a CTG diagnosis of fetal distress in labour when it is technically possible to do so
3. A tight definition of failure to progress should be used before the decision is made for caesarean section
4. An attempt should be made to achieve vaginal birth after caesarean section when it is considered safe to do so
5. When failure to progress is diagnosed in a primiparous woman in the second stage, syntocin should be used when it is appropriate and safe

The consensus survey achieved a response rate of 88/114 (77%). All five statements were supported by over 75% of responders. The results of the questionnaire survey were fed back to all participants prior to the final six months of the prospective audit.

Re-audit of practice in 1995

During six months of 1995, data were collected about all caesarean sections and findings related to the five consensus statements compared with the equivalent findings from the 1994 audit period. Between the two time periods in relation to:

- 1) *attempting ECV at term in women with a breech presentation and no other complication*: ECV was 16.9%

(118/700) of cases in 1994 and 24.4% (73/299) of cases in 1995.

2) *careful assessment of primigravid women in labour with no other complications*: ineffective labour was recorded in 21.3% (195/914) of cases of failure to progress in 1994 and 16.1% (53/330) of cases in 1995.

3) *ensuring that where practical the diagnosis of fetal distress is confirmed by fetal blood sampling*: there was a slight decrease in the use of fetal blood sampling in the two time periods i.e. from 31.2% (213/682) of cases in 1994 to 29.1% (78/268) of cases in 1995.

4) *determining whether there might be scope for increasing the vaginal delivery rate after one previous section (lower uterine scar) in women with vertex presentation where the current operation was elective*: in the repeat caesarean sections for no other reason, vaginal delivery was not attempted in 55.5% (729/1313) of cases in 1994 compared with 53.1% (322/606) of cases in 1995.

Conclusions:

The findings of the national audit of caesarean section suggest that there is scope for some reduction in the rate of caesarean section in Scotland. Specific areas on which clinical practice guideline development could focus have been identified. Following development, dissemination and implementation of such guidelines, the audit should be repeated.

Introduction

A rise in the rate of caesarean section has been observed throughout the western world^{1,2}. In Scotland where, unlike most countries including the other countries of the United Kingdom, there is routinely collected data about all births (SMR 02), the caesarean section rate rose from 5% in 1970 to 15% in 1992. Concern about this rise has been expressed by women as well as those commissioning and providing maternity services^{3,4}. In the United States⁵, where the average caesarean section rate is estimated to be 25%, strategies for controlling the rising rate have included:

- education and peer review;
- external review;
- public dissemination of caesarean section rates;
- changes in physician/hospital payments;
- medical malpractice reform.

Audit proposed

There is no 'correct' rate of caesarean section although there is a general feeling that the national rate is too high. Without knowing, however, which groups of women are being delivered by caesarean section and what the indications for operation are, obstetricians in Scotland did not feel that they were in a position to comment meaningfully on the current rate without having a greater understanding of who was being delivered by caesarean section and why the operation was being performed. Once that information was available and there was agreement that there was scope for change, guidelines could be developed. A proposal was therefore presented to the Clinical Resource and Audit Group (CRAG) of the Scottish Office Department of Health in 1993 to review caesarean sections in Scotland with a view to developing clinical guidelines if this was feasible.

Stages of the audit:

There were four stages to the audit, these were:

- describing caesarean section practice in Scotland from 1975 - 1994 using routinely collected data;
- determining the indications for caesarean section in 1994;
- presenting the findings to the local co-ordinators and assessing the level of agreement of all the obstetricians in

- Scotland about five areas of practice recommended by the co-ordinators which might have an effect on the rate of caesarean section; and
- re-auditing for six months in 1995.

The findings from the four stages of the audit are presented in the following chapters along with recommendations for future practice.

Methodology

Data sources:

Routine data

Information about all births in Scotland is provided by each maternity unit on the standard morbidity record form (SMR 02) and held centrally at the Information and Statistics Division of the Common Services Agency of the National Health Services in Scotland (SMR 02).

Audit

The medical staff of 23 of the 24 consultant maternity units in Scotland agreed to participate in a prospective audit of caesarean sections performed during 1994 and the first half of 1995 (one small unit was not included, due to an administrative oversight). Clinicians from each unit were invited to participate in two workshops during the design phase of the audit where the specific items for audit were decided upon and refined.

A database (Symantec Q&A version 4) on a specially installed personal computer (IBM clone 486SX25) was used in each operating theatre or adjacent labour ward. Standardisation of definitions for terms used in the database were decided upon at the workshops, and incorporated into the 'help' facility and field restrictions in the database.

The clinician entering the data was usually directly involved in the decision-making process for caesarean section and/or in the performance of the operation. The study was piloted in four maternity units for a three month period before the main audit began in January 1994. In January 1995, at the end of the 12 month survey period, the results were disseminated to all clinicians in each participating unit. The audit continued until the end of July 1995.

In order to encourage compliance, as well as to provide short-term feedback to clinicians, access and analyses by the unit of their own data was possible and encouraged. This provided a source for 'in-house' audit. The Pregnancy and Childbirth Module of the Cochrane Database of Effective Reviews⁶ was also included in the software. This was an effort to disseminate principles of effective care to the staff in the location where it was needed most, on as wide a scale as possible, as well as to provide a tangible reward for the clinicians involved in the audit.

Change in the obstetric population and the caesarean section rates between 1975 and 1994

Births in Scotland

In Scotland, a country with a population of 5 million people, there were 62,037 babies born in 1994 to 61224 women (Registrar General Scotland). All but 193 babies were born in hospital⁷. Additional information about 59,892 mothers was available from summary data (SMR 02), collected by the Information and Statistics Division of the Scottish Health Service's Common Services Agency.

Time trends

During the past 20 years there have been considerable changes in obstetric outcome and practice in Scotland, although the two are not necessarily linked. There has been a 9.7% fall in the number of total (live and still) births from 68,708 in 1975 to 62,037 in 1994 and, during the same period, the caesarean section rate has risen from 8.5 per 100 women delivering (maternities) in 1975 to 16.0 per 100 in 1994 - an increase of 88%. This increase is partly due to changes in the pregnant population and partly to actual changes in clinical practice.

Table One: Maternities by parity, previous caesarean section and gestation; 1975 and 1994: number and percentage distribution

	Preterm		Term		Not Known		Total	
	1975	1994	1975	1994	1975	1994	1975	1994
Parity 0	1659 (2.6%)	1977 (3.3%)	24531 (38.2%)	24244 (40.5%)	1251 (1.9%)	79 (0.1%)	27441 (42.7%)	26300 (43.9%)
Parity 1+ (no prev CS)	1631 (2.5%)	1537 (2.6%)	31382 (48.8%)	26946 (45.0%)	1853 (2.9%)	126 (0.2%)	34866 (54.2%)	28609 (47.8%)
Parity 1+ (prev CS)	111 (0.2%)	382 (0.6%)	1816 (2.8%)	4552 (7.6%)	49 (0.1%)	9 (0.0%)	1976 (3.1%)	4943 (8.3%)
Total	3401 (5.3%)	3896 (6.5%)	57729 (89.9%)	55742 (93.1%)	3153 (4.9%)	214 (0.4%)	64283 (100.0%)	59852 (100.0%)

Source: SMR 02

When the two years, 1975 and 1994, are compared, it can be seen that there are differences in the distribution of total births i.e. in the Scottish maternity population. There has been a slight increase in the percentage of women having their first baby (from 42.7% to 43.9%) and those delivering before 37 weeks gestation (5.3% to 6.5%) but a marked increase in the proportion of parous women with a previous caesarean section (3.1% to 8.3%) These are the groups at greater risk of having a caesarean section, and so, even if the section rates had remained unaltered within these parity and gestation groups, the overall number and caesarean section rate would have risen. Clinical practice has, of course, also changed in the past 20 years, and section rates have risen in most parity and gestation groups. The only group in whom the section rate has fallen is women at term, having a repeat section. (63.2% to 55.8%).

Table Two: Caesarean sections by parity, previous caesarean section and gestation, 1975 and 1994: number and rate/100 deliveries

	Preterm		Term		Not Known		Total	
	1975	1994	1975	1994	1975	1994	1975	1994
Parity 0	197 (11.9%)	705 (35.7%)	2511 (10.2%)	4067 (16.8%)	104 (8.3%)	11 (13.9%)	2812 (10.2%)	4783 (18.2%)
Parity 1+ (no prev CS)	184 (11.3%)	421 (27.4%)	1193 (3.8%)	1553 (5.8%)	59 (3.2%)	2 (1.6%)	1436 (4.1%)	1976 (6.9%)
Parity 1+ (prev CS)	64 (57.7%)	266 (69.6%)	1147 (63.2%)	2543 (55.8%)	32 (65.3%)	5 (55.6%)	1243 (62.9%)	2814 (56.9%)
Total	445 (13.1%)	1392 (35.7%)	4851 (8.4%)	8163 (14.6%)	195 (6.2%)	18 (8.4%)	5491 (8.5%)	9573 (16.0%)

Source: SMR 02

In order to separate the two factors, population and clinical practice, the influence of the population changes between 1975 and 1994 were neutralised by applying the 1975 percentage distribution to the 59,852 maternities in 1994, to derive an 'expected' population (Table 3). The 1994 caesarean section rates within the parity and gestation groups were then applied to the 'expected' population to obtain 'expected' numbers of caesarean sections.

Table 3: Expected number of deliveries and caesarean sections 1994

	Preterm		Term		Not Known		Total	
	Deliveries	Caesarean	Deliveries	Caesarean	Deliveries	Caesarean	Deliveries	Caesarean
Parity 0	1544.6	550.8	22840.1	3831.5	1164.8	162.2	25549.5	4544.5
Parity 1+ (no prev CS)	1518.6	416.0	29218.9	1684.0	1725.3	27.4	32462.7	2127.4
Parity 1+ (prev CS)	103.3	72.0	1690.8	944.6	45.6	25.3	1839.8	1041.9
Total	3166.5	1038.8	53749.8	6460.1	2935.7	214.9	59852.0	7713.8

The expected numbers of sections in Table 3 add up to 7,713.8 (giving a rate of 13.0%), compared with the actual number of 9,573 (16.0%). Clinical practice, therefore, was responsible for an increase of 4.5% (60% of the actual difference of 8.5 and 16.0 per 100 maternities between 1975 and 1994), while population change was responsible for the remaining 3.0% (40% of the difference). It must be noted however that population change and clinical practice are not independent, as the most important component of the population change - the number of women with a previous section - was obviously influenced by previous years of primary caesarean sections.

Setting the scene

The caesarean section rate varied from 19.3% in the second smallest obstetric unit to 12.9% in the fifth smallest. There was no apparent association between the number of deliveries and the section rate in Table 4, in which the hospitals are ranked by size.

Maternal age

Apart from the very small numbers of women who delivered at ages over 44 years or under 15 years, the caesarean section rate rose with increasing age. (Table 5)

Table 5: Age specific caesarean section rates Scotland 1994

Age (years)	Deliveries	Caesarean section	
	No.	No.	rate / 100 deliveries
0-14	26	4	15.4
15-19	4243	415	9.8
20-24	12287	1538	12.5
25-29	21180	3254	15.4
30-34	16213	2976	18.4
35-39	5162	1168	22.6
40-44	713	211	29.6
45+	28	7	25.0
Total	59852	9573	16.0

Previous pregnancies

Caesarean section rates were highest among women having their first baby, and fell with increasing parity. (Table 6)

Table 6: Caesarean section rate/100 deliveries by parity 1994

Parity	Deliveries number	Caesarean section number	Caesarean section rate/100 deliveries
0	26300	4783	18.2
1	21321	3091	14.5
2	8298	1198	14.4
3+	3933	501	12.7
Total	59852	9573	16.0

Table 4: Caesarean section rate/100 deliveries and total number of deliveries in consultant led units by hospital 1994

Hospital	Caesarean section rate/100 deliveries	Total number of deliveries
1	16.6	5599
2	15.9	4975
3	17.4	4813
4	17.2	3704
5	19.1	3583
6	14.6	3505
7	18.7	3472
8	17.3	3206
9	15.1	2783
10	17.1	2313
11	18.1	2273
12	15.3	2230
13	17.3	2197
14	15.8	2157
15	13.2	1675
16	16.5	1595
17	13.9	1542
18	15.2	1403
19	14.4	1260
20	12.9	1100
21	16.3	1092
22	14.0	1055
23	19.3	254
24	18.0	245

Parous women were divided into those with, and those without a previous section. Section rates for women without a previous scar on the uterus did not differ significantly with increasing parity (Table 7). Those with a previous scar appeared to have a decreasing risk of having a repeat section with increasing parity.

Table 7: Caesarean section rate/100 deliveries by parity and previous section 1994

Parity	No Previous Section			Previous Section		
	Deliveries (No.)	C.S. (No.)	Rate	Deliveries (No.)	C.S. (No.)	Rate
1	18219	1263	6.9	3102	1828	58.9
2	7036	462	6.6	1262	736	58.3
3+	3354	251	7.5	579	250	43.2
Total	28609	1976	6.9	4943	2814	56.9

Gestation at delivery

Almost a quarter of all women delivering before 28 weeks gestation were delivered by caesarean section, this rose to 56.9% between 28-31 weeks, but the section rates fell thereafter to 14.6% at term. After 41 weeks the rate rose slightly to 15.6% (Table 8).

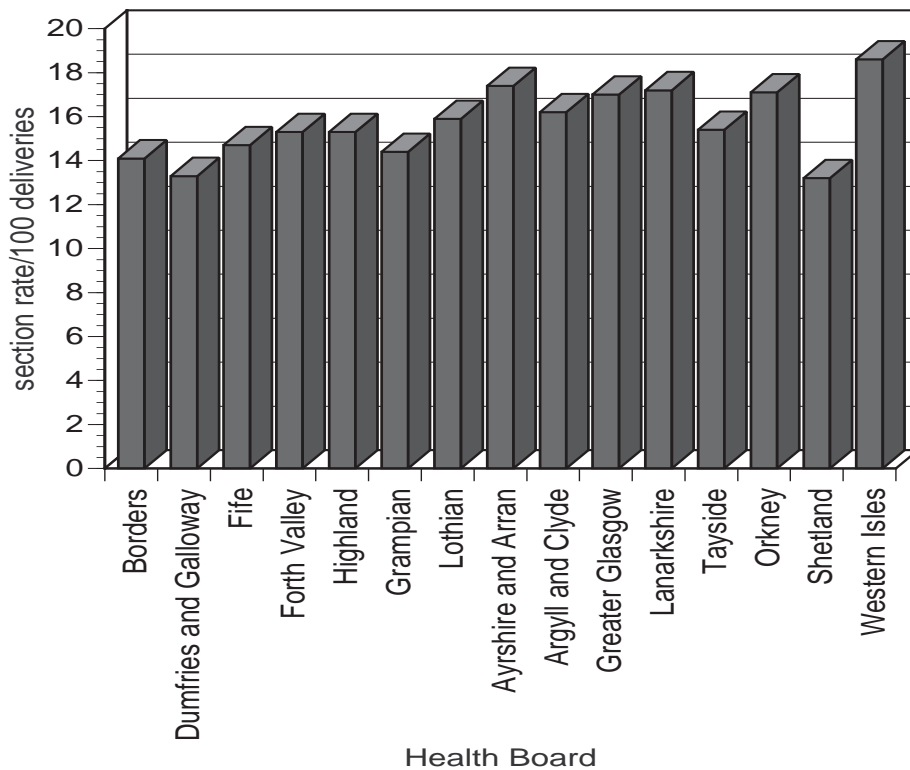
Table 8: Gestation specific deliveries and caesarean section rates Scotland 1994

Gestation (weeks)	Deliveries (No.)	% All Deliveries	C.S. (No.)	% All C.S.	Rate/100 Deliveries
<27	274	0.5	66	0.7	24.1
28-31	476	0.8	271	2.8	56.9
32-36	3146	5.3	1055	11.0	33.5
37-41	52855	88.3	7714	80.6	14.6
42+	2887	4.8	449	4.7	15.6
N.K.	214	0.4	18	0.2	8.4
Total	59852	100.0	9573	100.0	16.0

Health board of residence

When the caesarean section rates were reviewed by health board of residence, it could be seen that the rates were higher in the four health boards (Ayrshire and Arran, Argyll and Clyde, Greater Glasgow and Lanarkshire) in the former Strathclyde region in the west of Scotland (Chart 1).

Chart 1: Caesarean section rate/100 deliveries by health board 1994



The rate of deprivation is greater in the west of Scotland and this might be expected to have an effect on the caesarean section rate. It was interesting to find (Table 9), therefore, that there was no demonstrable association between high section rates and deprivation, as measured by census variables.

Table 9: Caesarean section rates by deprivation category Scotland 1994

	1	2	3	4	5	6	7	NK	Total
Scotland	16.7	15.8	15.9	15.6	15.7	16.5	16.6	22.3	16.0

Management of Scottish caesarean sections 1994

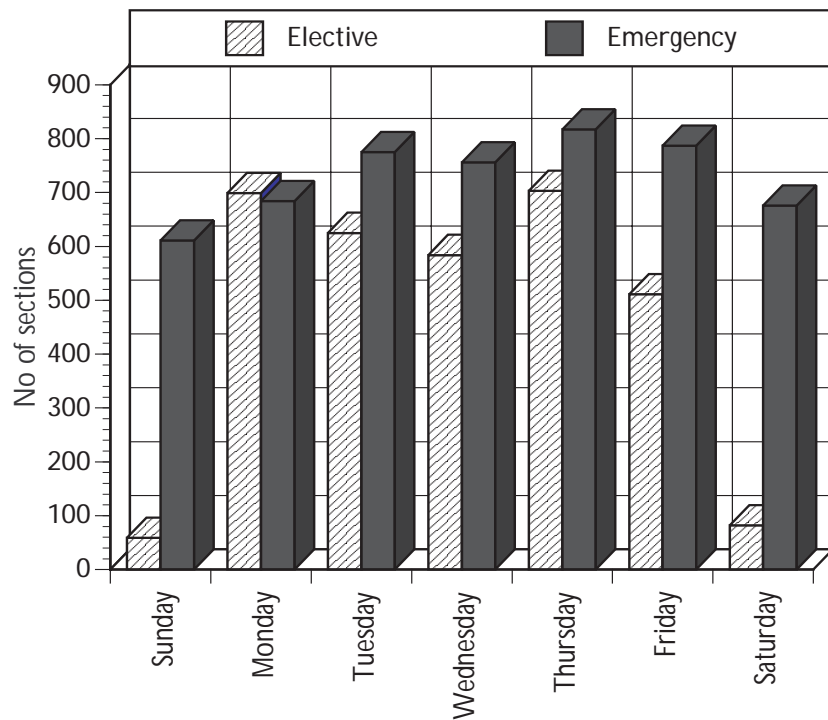
Type of caesarean sections

Thirty-nine percent (3,263) of sections in the audit were elective, 14.1% (1,177) were emergency sections before the onset of labour and 46.9% (3,929) were emergency sections during labour.

Day of the week of operation and type of section

Only 4.3% of elective operations were carried out at the weekend. As might be expected, there was no such difference for emergency sections. (Chart 2)

Chart 2: Day of the week for elective and emergency section Scotland 1994



Time of day of operation and type of section

The time of day at which the sections were performed also showed marked differences between elective and emergency sections. Over half of elective sections were carried out in the morning, with another 40% between noon and 6pm. Sections which had been scheduled as elective, but which had to be carried out as an emergency when the woman went into labour unexpectedly were included, and this explains the apparent oddity of elective sections being undertaken during the night. (Table 10)

Table 10: Time of day for elective and emergency section Scotland 1994

Time of Day (hours)	Elective		Emergency	
	No	%	No.	%
0 - < 3	29	0.9	625	12.2
3 - < 6	18	0.6	512	10.0
6 - < 9	31	1.0	415	8.1
9 - <12	1779	54.6	626	12.3
12 - <15	889	27.2	683	13.4
15 - <18	431	13.2	743	14.6
18 - <21	47	1.4	758	14.8
21 - <24	39	1.2	744	14.6
Total	3263	100.0	5106	100.0

Authorisation for caesarean section

Consultants authorised at least 70.7% of the elective sections in 1994. This is most likely an underestimate because the grade of staff authorising the section was not noted in 22.2% of cases. (Table 11)

Table 11: Most senior person authorising caesarean section by type of section Scotland 1994

Grade	Elective		Emergency	
	No.	%	No.	%
Consultant	2306	70.7	3353	65.7
Staff grade	25	0.8	69	1.4
G.P.	0	0.0	2	0.0
Senior Registrar	145	4.4	1120	21.9
Registrar/SHO3	60	1.8	88	1.7
SHO	0	0.0	0	0.0
N.K.	727	22.2	474	9.3
Total	3263	100.0	5106	100.0

Most senior person present in theatre

Almost half (47.0%) of elective and two-thirds of emergency sections were undertaken with registrars or SHO3s being the most senior person present in theatre. Consultants were present in 32.3% of elective and 13.2% of emergency sections. (Table 12)

Table 12: Most senior person present in theatre by type of section Scotland 1994

Grade	Elective		Emergency	
	No.	%	No.	%
Consultant	1054	32.3	673	13.2
Staff grade	264	8.1	455	8.9
G.P.	2	0.0	14	0.3
Senior Registrar	339	10.4	537	10.5
Registrar/SHO3	1533	47.0	3286	64.6
SHO	6	0.2	17	0.3
N.K.	65	2.0	124	2.4
Total	3263	100.0	5106	100.0

Time taken to arrange a caesarean section

The average length of time taken to arrange a caesarean section (time from decision to operation) was 98.6 minutes in an emergency before the onset of labour (range 64.1 minutes to 139.4 minutes). The corresponding time for emergencies in labour was 45.2 minutes (range 37.2 to 69.8 minutes). The median time to arrange an emergency section before labour was 60 minutes (range 37.5 to 85 minutes) and during labour was 40 minutes (range 30 to 60 minutes) (Table13).

Table 13: Time (in minutes) from decision to performance of emergency section Scotland 1994

Hospital	CS before labour		CS during labour	
	Mean time	Median time	Mean time	Median time
1	74.6	42.5	37.5	35.0
2	77.3	60.0	42.9	40.0
3	93.9	60.0	44.6	40.0
4	88.9	60.0	41.2	39.0
5	85.0	85.0	55.5	54.5
6	114.8	60.0	41.5	37.0
7	111.5	37.5	39.5	30.0
8	77.4	60.0	69.8	55.0
9	139.4	64.0	41.7	40.0
10	90.8	60.0	58.7	60.0
11	74.6	40.0	38.9	30.0
12	111.2	60.0	48.5	45.0
13	100.7	58.0	46.0	40.0
14	66.5	40.0	42.5	35.0
15	67.3	51.0	42.0	32.0
16	116.8	62.5	37.2	30.0
17	66.5	60.0	46.3	44.0
18	102.1	49.0	49.2	43.0
19	70.8	57.0	49.7	45.0
20	64.1	40.0	39.3	33.0
21	104.9	60.0	43.1	40.0
22	111.8	72.5	46.9	42.0
23	110.2	77.5	54.8	50.0
Total	98.6	60.0	45.2	40.0

Type of anaesthesia

Most elective sections (86.1%) were carried out under regional anaesthesia, the great majority being spinal. In emergency sections, in which more women would already have been in labour with an epidural for analgesia, the regional anaesthesia rate of 70.5% was almost equally divided between epidural (34.6%) and spinal (35.9%) (Table 14).

The use of general anaesthesia varied widely by hospital, which may indicate the availability of anaesthetists skilled in epidural or spinal block in labour wards. (Table 15) In all but one hospital a greater proportion of emergency sections than elective sections were carried out under general anaesthetic .

Table 15: Proportion of caesarean sections performed under general anaesthetic* by type of section, by hospital Scotland 1994

Hospital	Elective(%)	Emergency(%)
1	9.8	17.1
2	8.2	26.7
3	12.9	17.9
4	6.3	20.1
5	15.4	40.0
6	7.9	18.4
7	14.0	30.2
8	2.5	15.8
9	1.5	7.5
10	34.7	66.2
11	10.3	34.2
12	13.4	26.9
13	26.7	49.4
14	4.8	3.2
15	17.1	30.1
16	35.1	62.5
17	19.7	40.8
18	22.1	32.1
19	40.2	65.9
20	15.0	29.4
21	10.0	20.1
22	6.9	16.5
23	4.0	12.6
Total	12.5	26.4

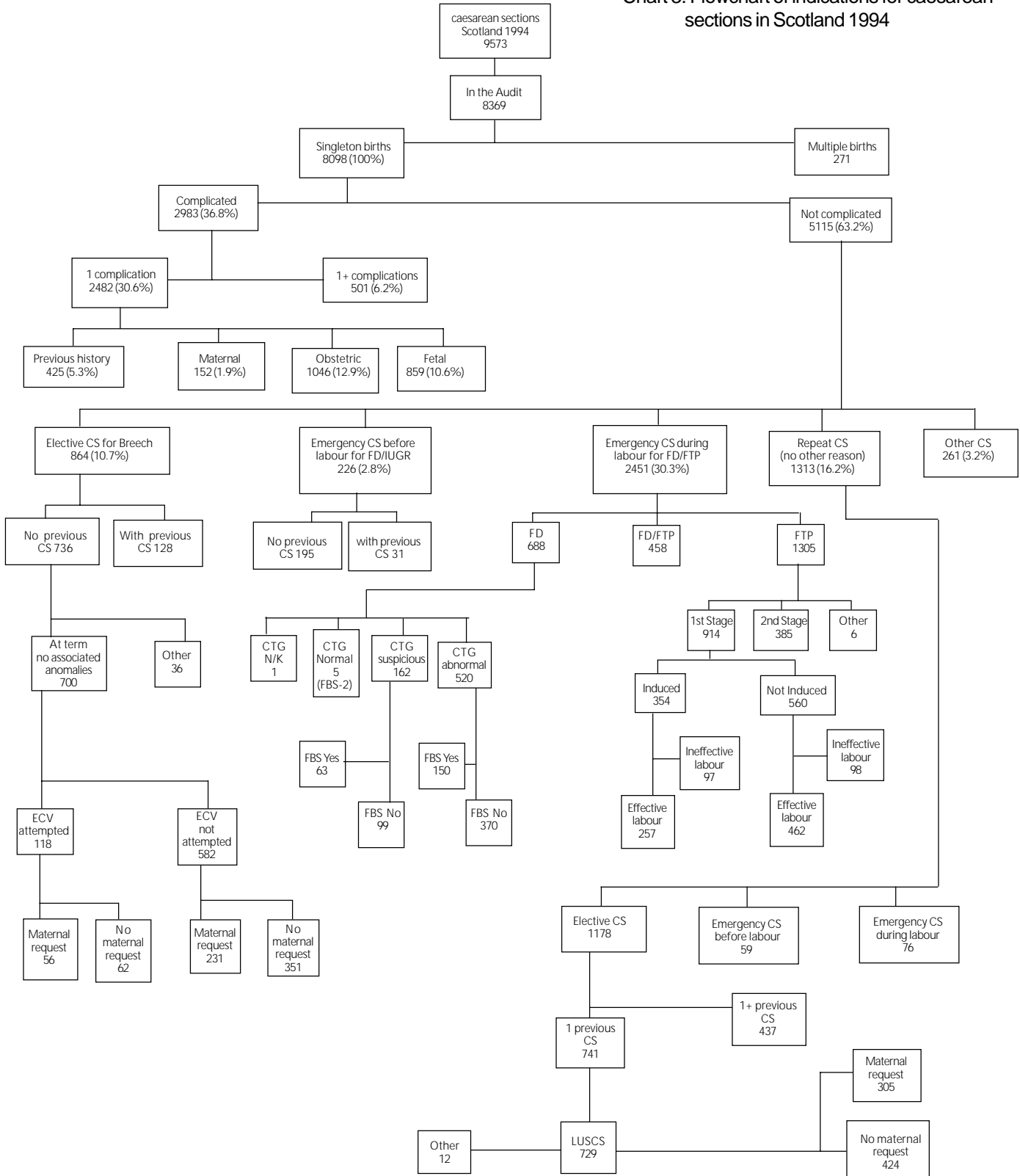
*G.A. after failed spinal or epidural omitted

Table 14: Anaesthesia by type of section Scotland 1994

Anaesthesia	Elective		Emergency	
	No.	%	No.	%
Epidural	155	5.7	1767	34.6
Spinal	2623	80.4	1834	35.9
General *	455	13.9	1505	29.5
N.K.	30	0.9	0	0
Total	3263	100.0	5106	100.0

* Includes G.A. after failed spinal or epidural

Chart 3: Flowchart of indications for caesarean sections in Scotland 1994



Parity groups delivered by caesarean section and section types

The distribution of sections by three parity groups (women having their first baby; parous women previously delivered vaginally and parous women previously delivered by caesarean section) and three types of section (elective and emergency before and during labour) is shown in Table 16.

Indications for delivery by parity groups

Table 16: Caesarean sections Scotland 1994 by type of section and parity (%)

	Parity 0	Parity 1+ (no prev cs)	Parity 1+ (prev cs)	Total
Elective	933 (11.1)	606 (7.2)	1724 (20.6)	3263 (39.0)
Emergency (before labour)	616 (7.4)	312 (3.7)	249 (3.0)	1177 (14.1)
Emergency (during labour)	2682 (32.0)	652 (7.8)	595 (7.1)	3929 (46.9)
Total	4231 (50.6)	1570 (18.8)	2568 (30.7)	8369 (100.0)

Fifty-one percent (4231/8369) of sections were undertaken in women having their first baby, 18.8% (1570/8369) in parous women with no previous section and 30.7% (2568/8369) in women who had a previous caesarean section. Most sections - 46.9% (3929/8369) - were performed as emergencies during labour. A further 39.0% (3263/8369) were undertaken as elective procedures and 14.1% (1177/8369) were emergency operations before labour. On 271 (3%) occasions there was more than one baby. The following analyses relate only to the 8098 caesarean sections on the CS audit database relating to singleton pregnancies.

Caesarean sections in singleton pregnancies

The distribution by parity and type of caesarean section in singleton pregnancies as shown in Table 17 is the same as that for all sections. Most sections - 32.3% (2616/8098) - were performed as emergencies during labour on primigravidae. A further 20.9% (1695/8098) were undertaken as elective procedures on women with a previous caesarean section.

Table 17: Caesarean sections Scotland 1994. Singleton pregnancies by type of section and parity (%).

	Para 0	Para 1+ (no prev cs)	Para 1+ (prev cs)	Total
Elective	884 (10.9)	571 (7.1)	1695 (20.9)	3150 (38.9)
Emergency (before labour)	592 (7.3)	293 (3.6)	242 (3.0)	1127 (13.9)
Emergency (during labour)	2616 (32.3)	617 (7.6)	588 (7.3)	3821 (47.2)
Total	4092 (50.5)	1481 (18.3)	2525 (31.2)	8098 (100.0)

The effect of complications before labour

Information about maternal complications relating to each woman's previous history (poor obstetric outcome, previous traumatic delivery, previous infertility, advanced maternal age), medical (maternal medical disease; herpetic vulval/vaginal infection) and obstetric problems in the current pregnancy experienced by the woman (pre-eclampsia; placenta praevia; diabetes; very preterm delivery; other obstetric complications) or complications in the fetus (malpresentation/unstable lie; rhesus disease) were recorded by the obstetricians. Complications were experienced by 36.8% (2983/8098) of women. This rate varied from 28.4% (718/2525) of women with a previous history of caesarean section, to 34.5% (1413/4092) of primigravidae and 57.5% (852/1481) of parous women with no previous history of section (Table 18).

Table 18: Caesarean sections Scotland 1994 other complications (apart from the 4 main indications*) by parity (%)

	Para 0	Para 1+ (no prev cs)	Para 1+ (prev cs)	Total
1 complication	1198 (29.3)	698 (47.1)	586 (23.2)	2482 (30.6)
> 1 complications	215 (5.2)	154 (10.4)	132 (5.2)	501 (6.2)
no complications	2679 (65.5)	629 (42.5)	1807 (71.6)	5115 (63.2)
Total	4092 (100.0)	1481 (100.0)	2525 (100.0)	8098 (100.0)

* The 4 main indications for section are: breech presentation; fetal distress or IUGR before labour; failure to progress in labour; fetal distress in labour; and repeat caesarean section (no other reason).

In women with only one complication, the type of complication is given by parity in Table 19. Obstetric complications were the most numerous in all parity groups, followed by fetal complications. Previous history was important in one fifth of the women who had had a previous section.

Table 19: Caesarean sections Scotland 1994 type of complication by parity (%)

	Para 0	Para 1+ (no prev cs)	Para 1+ (prev cs)	Total
One complication:				
Prev history	137 (9.7)	142 (16.7)	146 (20.3)	425 (14.2)
Medical	88 (6.2)	23 (2.7)	41 (5.7)	152 (5.1)
Obstetric	575 (40.7)	234 (27.5)	237 (33.0)	1046 (35.1)
Fetal	398 (28.2)	299 (35.1)	162 (22.6)	859 (28.8)
> 1 complication	215 (15.2)	154 (18.1)	132 (18.4)	501 (16.8)
Total	1413 (100.0)	852 (100.0)	718 (100.0)	2983 (100.0)

Major reasons given for caesarean section

Previous studies have indicated that the four main indications for caesarean section are:

- breech presentation in relation to elective sections;
- intra-uterine growth retardation (IUGR) or antenatal fetal distress in emergency caesarean sections performed before labour;
- failure to progress and/or fetal distress in emergency caesarean sections performed during labour; and
- repeat caesarean sections⁸.

The contribution of these four indications was examined by type of section and parity (Table 20).

Table 20: The four indications for caesarean section, by type of section and parity

	Para 0	Para 1+ (no prev cs)	Para 1+ (prev cs)	Total
Elective CS for breech	585	298	154	1037 (12.8%)
Fetal distress or IUGR before labour	311	145	86	542 (6.7%)
Fetal distress or failure to progress in labour	2351	428	441	3220 (39.8%)
Previous CS only	-	-	1844	1844 (22.8%)
Total	3247	871	2525	6643 (82.0%)

() = % of all 8098 singleton sections.

It can be seen from Table 20 that these four indications accounted for 82.0% (6643/8098) of sections in singleton pregnancies. When all the sections with recorded complications were excluded there remained 4854 caesarean sections which fulfilled the four criteria accounting for 59.9% (4854/8098) of all singleton caesarean sections (Table 21).

Table 21: The four main indications for caesarean section by type of section and parity (not necessarily at term)

	Para 0	Para 1+ (no prev cs)	Para 1+ (prev cs)	Total
Elective CS for breech	506 (6.2%)	230 (2.8%)	128 (1.6%)	864 (10.5%)
Fetal distress or IUGR before labour	138 (1.7%)	57 (0.7%)	31 (0.4%)	226 (2.8%)
Fetal distress or failure to progress in labour	1848 (22.8%)	268 (3.3%)	335 (4.1%)	2451 (30.2%)
Previous CS only	-	-	1313 (16.2%)	1313 (16.2%)
Total	2492 (30.8%)	555 (7.0%)	1807 (22.3%)	4854 (59.9%)

() = % of all 8098 singleton sections (excludes 261 CS's performed for other reasons)

In summary, 22.8% (1848/8098) of all singleton caesarean sections were performed in women having their first baby as an emergency during labour because of fetal distress and failure to progress. A further 16.2% (1313/8098) were undertaken in women who had had a previous section, but in whom no other reasons were recorded.

The reasons for the 4854 caesarean sections which fulfilled the four criteria were:

- elective caesarean section and breech presentation (n = 864);
- emergency caesarean section before labour because of fetal problems (either fetal distress, growth retardation or a combination of both) (n = 226);
- emergency caesarean section during labour because of fetal distress, failure to progress or a combination of both (n = 2451); and
- repeat elective caesarean sections with no other reasons recorded (n = 1313).

Elective caesarean section and breech presentation

There were 864 women who had an elective caesarean section associated with breech presentation in whom there were no other reasons recorded on the database (10.5% of all singleton sections). Excluding the women who had had a previous section and those where the fetus was abnormal or where the delivery was before 37 weeks of gestation (164 cases), the records of the remaining 700 cases were reviewed to find out if external cephalic version (ECV) had been attempted, and whether maternal request for delivery by caesarean section was recorded (Table 22).

Table 22: Elective CS in breech presentation at term: attempted ECV and maternal request, by parity, in women with no other complications (37-41 weeks); no fetal abnormalities

	Para 0				Para 1+ no prev cs			
	Maternal request		All	%	Maternal request		All	%
	Yes	No			Yes	No		
ECV attempted	28	43	71	14.8	28	19	47	21.3
ECV not attempted	157	251	408	85.2	74	100	174	78.7
All	185	294	479	100.0	102	119	221	100.0
%	38.6	61.4	100.0		46.2	53.8	100.0	

ECV had been attempted in 14.8% (71/479) of women having their first baby and in 21.3% (47/221) of parous women with no previous section. The section was associated with maternal request for the operation in 38.6% (185/479) of women having their first baby and in 46.2% (102/221) of parous women. Request for operative delivery was slightly higher in women in whom ECV had been attempted. There remained, however, 251 women (3% of all singleton sections) in whom ECV had not been attempted, who delivered at term and who did not request an operative delivery.

Emergency caesarean section before labour because of fetal problems.

There were 226 women who had an emergency section before the onset of labour because of problems detected in the fetus (2.8% of all singleton sections). It was not felt possible from the information available to make any comment as to whether a vaginal delivery would have been more appropriate. The data in women with no other complications was reviewed by parity group and gestational age at delivery (Table 23).

Table 23: Emergency CS before labour: fetal distress/IUGR by gestational age in women

Gestational age	Para 0	Para 1+ (no prev cs)	Para 1+ (prev cs)	Total	%
<28	0	0	0	0	0.0
28-31	8	4	2	14	6.2
32-36	29	26	5	60	26.5
37-41	92	26	23	141	62.4
42+	9	1	1	11	4.9
Total	138 (61.1%)	57 (25.2%)	31 (13.7%)	226	100.0 (100%)

It can be seen that 61.1% (138/226) of sections before labour were performed on women having their first baby, 25.2% (57/226) in parous women with no previous section and 13.7% (31/226) in women with a previous section. Thirty-three percent of women were delivered before term and 4.9% were more than two weeks past their expected date of delivery.

Emergency caesarean section during labour and failure to progress or fetal distress

There were 2451 women who had an emergency caesarean section associated with failure to progress, fetal distress or a combination of both (30.2% of all singleton sections).

The data were analysed to determine whether the women had been in effective labour in relation to failure to progress and whether a fetal blood sample had been taken in relation to fetal distress. Seventy-five percent (1848/2451) of these sections were undertaken in women having their first baby with over half 53.0% (980/1848) being for failure to progress alone, 27.4% (506/1848) for fetal distress alone and 19.6% (362/1848) for a combination of fetal distress and failure to progress (Table 24).

Table 24: Emergency CS during labour: failure to progress (FTP) / fetal distress (FD) by parity

	Para 0	Para 1+ (no prev cs)	Para 1+ (prev cs)	Total
Fetal distress	506 (27.4)	102 (38.1)	80 (23.9)	688 (28.1)
Failure to progress	980 (53.0)	120 (44.8)	205 (61.2)	1305 (53.2)
FD/FTP	362 (19.6)	46 (17.2)	50 (14.9)	458 (18.7)
Total	1848 (100%)	268 (100.0)	335 (100.0)	2451 (100.0)

Eleven percent (268/2451) of sections in this group were performed on parous women with no previous section, with failure to progress being the commonest reason (44.8%: 120/268). Women with a previous section accounted for 13.7% (335/2451) of sections in this group with failure to progress without fetal distress accounting for 61.2% (205/335) of these caesarean sections.

Failure to progress alone

The 1305 cases of failure to progress alone were investigated further. Almost all the women were at term (89.6%: 1169/1305) and 9.1% (119/1305) were at least two weeks past their expected date of delivery. There was no difference by parity. In 70.0% (914/1305) of these women failure to progress was diagnosed during the first stage of labour (Table 25).

Table 25: Emergency CS during labour: failure to progress by stage of labour and parity

	Para 0	Para 1+ (no prev cs)	Para 1+ (prev cs)	Total
1st stage	679 (69.3)	76 (63.3)	159 (77.6)	914 (70.0)
2nd stage	298 (30.4)	41 (34.2)	46 (22.4)	385 (29.5)
N/K	3 (0.3)	3 (2.5)	0 (0.0)	6 (0.5)
Total	980 (100%)	120 (100.0)	205 (100.0)	1305 (100.0)

Of the 914 women who had a caesarean section in the first stage of labour for failure to progress, 38.7% (354/914) underwent induction of labour: 51.3% (39/76) in parous women who had not had a previous section to 38.7% (263/679) in women having their first baby and 32.7% (52/159) in parous women with a previous section.

We then considered whether the women were in effective labour (defined as:- established labour where there were contractions lasting at least 45 seconds occurring at least every 3 minutes, with ruptured membranes and at least 3 cm of cervical dilation). Of the women who had been induced, 27.4% (97/354) were recorded as being in ineffective labour compared with 17.5% (98/560) in women whose labour had started spontaneously. One hundred and ninety-five women (2.4%: 195/8098 of all singleton sections) had a caesarean section because of failure to progress without being in effective labour.

There were 719 women who were in effective labour but who had a caesarean section because of failure to progress. The reasons for the section are given by parity in Table 26.

Table 26: Emergency CS during labour, reason for CS in women in effective labour but failing to progress (no other complications)

	Para 0	Para 1+ (no prev cs)	Para 1+ (prev cs)	Total
Failed induction	19 (3.5)	4 (6.9)	4 (3.4)	27 (3.8)
Persistent occipito - posterior	162 (29.8)	17 (29.3)	10 (8.5)	189 (26.3)
Dysfunctional labour	81 (14.9)	1 (1.7)	23 (19.5)	105 (14.6)
Cephalo-pelvic disproportion	258 (47.5)	33 (56.9)	79 (66.9)	370 (51.5)
Face/brow	14 (2.6)	3 (5.2)	2 (1.7)	19 (2.6)
Not stated	9 (1.7)	0 (0.0)	0 (0.0)	9 (1.3)
Total	543 (100%)	58 (100.0)	118 (100.0)	719 (100.0)

Cephalopelvic disproportion was given as the main reason for the section in 51.5% (370/719) of cases: 66.9% (79/118) in women who had had a previous section; 56.9% (33/58) in parous women who had not had a previous section; and 47.5% (258/543) in primigravidae. Persistent occipito-posterior position of the head was the reason given for the section in 29.8% (162/543) of primigravidae and 29.3% (17/58) of parous women with no previous section, but the section was carried out in the first stage of labour.

Fetal distress alone

There were 688 women who had a caesarean section because of fetal distress and no other indication. Seventy-four percent (506/688) of these sections were performed on primigravidae, 14.8% (102/688) on parous women with no previous section and 11.6% (80/688) on women who had had a previous section. Eighty-eight percent (604/688) of the women were at term and 9.0% (62/688) were at least two weeks past their expected date of delivery. There was very little difference by parity. Information about cardiotocographic (CTG) findings and whether a fetal blood sample was done was available. The CTG was reported as abnormal or suspicious in 23.5% (162/688) and abnormal or indicating fetal distress in 75.6% (520/688) of cases. In the remaining six cases, the CTG result was not known in one instance and was reported as normal in the remaining five cases. Fetal scalp sampling was carried out in 31.3% (215/688) women and in 24.7% (53/215) of these women the result was normal. Two thirds (35/53) of these normal results were in women with abnormal CTG tracings and the remainder (18/53) were in women with suspicious CTG tracings. The reason given for fetal scalp sampling not being undertaken included 'not indicated' in 10.5% (72/688), 'no time' in 19.9% (137/688), and 'inadequate cervical dilatation' in 27.9% (192/688).

Repeat caesarean sections with no other indications

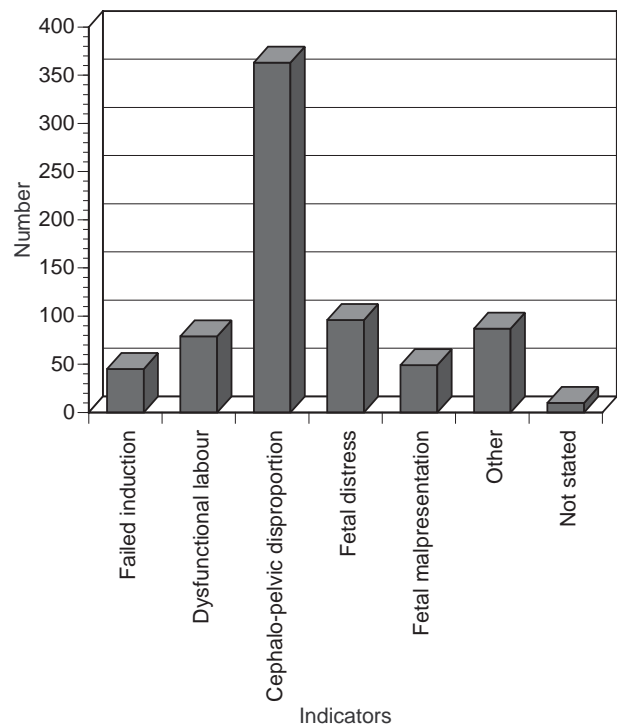
There were 1313 women who had a repeat caesarean section in whom no other indications were recorded. In 10.3% (135/1313) of the women the section was actually undertaken as an emergency before labour (59 women) or during labour (76 women). More than one previous section was reported in 437 of the remaining 1178 cases leaving 741 women who had one previous section and an elective operation this time. Twelve of these women did not have a lower uterine caesarean section last time and were therefore omitted from further analysis. This left 729 cases for further review. The indication for the first section in these cases is shown in Chart 4.

Cephalo-pelvic disproportion was the main indication in 49.8% (363/729). A repeat section in 41.8% (305/729) of the women was associated with maternal request.

Maternal request

The number of requests by the mother for delivery by elective caesarean section was analysed in two situations: elective section for breech presentation in normally formed infants (287 women); and elective sections in women at term with a history of one previous caesarean section and the fetus presenting by the vertex (305 women). In addition a further 31 women with no previous history of caesarean section and a vertex presentation requested delivery by caesarean section. Thus a total of 623 women, 7.7% (623/8098) of all singleton caesarean sections and 19.8% (623/3150) of elective singleton caesarean sections were reported to be associated with maternal request for the operation where a trial of labour may have been considered.

Chart 4: Indications for previous caesarean section in 729 women who had an elective caesarean section (no other complications)



Practice which might affect the caesarean section rate

Specific areas for consideration

Following a presentation of the findings of the first six months of the 1994 audit of caesarean sections in Scotland, a review of the literature and discussion with obstetrician co-ordinators in each hospital, it was agreed that the following five statements should be presented to all the obstetricians in Scotland. This was done by postal questionnaire. The five statements were as follows:

1. External cephalic version (ECV) should be used in an attempt to correct a breech presentation in a woman at term (when there are no contraindications) in order to try to avoid a caesarean section^{9,10}.
2. Scalp pH should be attempted to confirm a CTG diagnosis of fetal distress in labour when it is technically possible to do so.
3. A tight definition of fail to progress should be used before the decision is made for caesarean section.
4. An attempt should be made to achieve vaginal birth after caesarean section when it is considered safe to do so.
5. When failure to progress is diagnosed in a primiparous woman in the second stage, syntocin should be used when it is appropriate and safe.

Response to the questionnaire

A response rate of 77% to the questionnaire was obtained with 88 of the 114 obstetricians practising in the 23 maternity units replying. Replies were received from at least one obstetrician in all the units taking part in the audit.

The responses of the obstetricians to the five statements are shown in Table 27.

Table 27: Five statements: Level of Agreement (%)

	Agree	Neutral	Disagree
Use of ECV	78	9	13
Use of scalp pH	92	4	4
Vag. birth after CS	96	3	1
Definition of FTP	83	10	7
Syntocin in 2nd stage	79	12	9

Potential reduction

There therefore appeared to be the potential for reducing the rate of caesarean section in Scotland.

The findings of the questionnaire, illustrating the large area of agreement by Scottish obstetricians to the five statements, were sent to all obstetricians in Scotland. It was proposed to continue the audit for a further six months. It was never explicitly stated, however, to the obstetricians that particular attention would be paid to these five areas, instead, the objective of this re-audit was to determine whether change in practice occurred following discussion with the local co-ordinators and the various written communications the obstetricians had received from the project co-ordinator.

Re-audit to review practice in the five areas of consensus

Results

During the six month period February to July 1995 there were 4374 singleton caesarean sections in Scotland of which 3389 (77.5%) were included in the re-audit. Small changes in practice were noted between the two time periods in relation to:

- 1) *attempting ECV at term in women with a breech presentation and no other complication*: ECV was attempted in 16.9% (118/700) of cases in 1994 and 24.4% (73/299) of cases in 1995.
- 2) *careful assessment of primigravid women in labour with no other complications*: ineffective labour was recorded in 21.3% (195/914) of cases of failure to progress in 1994 and 16.1% (53/330) of cases in 1995.
- 3) *ensuring that where practical the diagnosis of fetal distress is confirmed by fetal blood sampling*: there was a slight decrease in the use of fetal blood sampling in the two time periods i.e. from 31.2% (213/682) of cases in 1994 to 29.1% (78/268) of cases in 1995.
- 4) *determining whether there might be scope for increasing the vaginal delivery rate after one previous section (lower uterine scar) in women with vertex presentation where the current operation was elective*: in the repeat caesarean sections for no other reason, vaginal delivery was not attempted in 55.5% (729/1313) of cases in 1994 compared with 53.1% (322/606) of cases in 1995.

Presentation of findings of the re-audit to obstetricians

A meeting to present the findings of the re-audit was held at the Royal College of Physicians and Surgeons of Glasgow in February 1996. The meeting was chaired by Dr. Naren Patel (President of the Royal College of Obstetricians and Gynaecologists) and attended by the obstetric co-ordinator and a second obstetrician from each hospital as well as others involved in obstetric and gynaecological audit. Prior to the meeting, four of the co-ordinators agreed to review the data from four different sections and present the findings at the meeting. The four areas for consideration were:

- Management of breech presentation at term;
- Repeat caesarean section;
- Failure to progress in labour;
- Fetal distress.

Areas for consideration defined by obstetricians

The meeting concluded that although it was difficult to determine exactly what changes might occur, there would be merit in the following:

Breech presentation at term:

- need for randomised controlled trial (R.C.T.) of external cephalic version at term;
- need for R.C.T. of elective caesarean section versus vaginal breech delivery;
- advice to leave operation of elective caesarean section for breech presentation as long as possible as a number will turn to vertex presentation; and
- consider/increase practice of external cephalic version.

Repeat caesarean section:

- ignore pelvimetry findings and estimated fetal weight;
- adopt a positive approach to vaginal birth after caesarean section (VBAC);
- reconsider the present common practice of a third section following two previous sections; and
- audit of discharge letter following delivery by caesarean section to determine whether recommendations for method of delivery in subsequent pregnancies is made.

Failure to progress:

- first stage - active management with oxytocin: there is wide variation in current practice and little evidence to substantiate which regime is best;
- second stage - there should be a trial of forceps or vacuum delivery, in theatre and by an experienced operator.

Fetal distress:

- the decision to perform emergency CS on CTG evidence should be supported by fetal blood sampling whenever this is technically feasible and in the absence of any other adverse factors;
- there should be a clear low birthweight policy on CTG monitoring;
- there should be a culture of open appraisal on the decision to perform CS; this should be multidisciplinary and at local level;
- the time between decision to perform emergency CS and operation should be minimised.

This, to our knowledge, is one of the first surveys that has attempted to capture information about all caesarean sections in a defined geographical area, as near in time to the operation as possible. Information about 87% of all sections performed in Scotland during 1994 was obtained. The excellent support given by Scottish obstetricians to this survey illustrates their interest in the subject and their desire to obtain an understanding at national level as to why caesarean sections are being performed. Many studies have suggested that the caesarean section rate should be reduced and have recommended certain categories of patients where this might be achieved^{11,12}. In this study it was possible to determine in which women there were no complications before labour and thus where there was potential for change.

Conclusions

Key areas with possibility for change

Using the crude caesarean section rate to monitor a maternity unit's performance is of very limited value. As a result of this audit it has been possible to capture information about caesarean sections as near to the time of operation as possible and to provide details about who is having the operation and for what indication. Reviewing

singleton caesarean sections in women with no recorded complications in previous history or during the current pregnancy - 60% (4,954/8,098) of singleton sections - the most important groups numerically were:

- emergency sections in women having their first baby for failure to progress and/or fetal distress - 23% (1,848/8,098) of all singleton sections;
- elective sections in women with a previous section and a vertex presentation this pregnancy - 16% (1,313/8,098) of all singleton sections;
- elective sections in women with a breech presentation having their first baby - 6% (506/8,098) of all singleton sections.

It is in these groups that there appears the greatest potential for reducing the rate of operative delivery.

Maternal request for delivery by caesarean section

It is important not to forget the contribution the mother will make to the decision to have an operative delivery. The opinion of the mother must also be considered¹³. In the 1994 audit in Scotland there were 623 women - 8% (623/8,098) of all singleton pregnancies and 20% (623/3,150) of all elective caesarean sections - in whom the method of delivery was associated with maternal request for the operation where no other problems were recorded. What is not known, however, is the level of information the woman had, at what stage in pregnancy she received the information and from whom. It is not known either how enthusiastic the obstetrician concerned was to deliver the women by caesarean section.

Acknowledging areas where change could take place is one thing but making change happen is much more difficult^{14, 15}. This study has described why obstetricians in a country with a population of over 5 million people perform caesarean sections, following which strategies have been proposed that have the potential to reduce the number of caesarean sections performed without increasing fetal morbidity or mortality.

Potential for guidelines ●

Specific areas have now been identified where guidelines could be developed and the audit repeated. The most important areas would be:

- management in labour of women having their first baby because it is the first caesarean section that will indicate the management of subsequent pregnancies and reducing the first section rate will be very important in lowering the overall section rate;
- attempted version of the breech at term; and
- vaginal delivery following a previous caesarean section.

In addition, it is important to gain a better understanding of the contribution the woman makes to her delivery by caesarean section. This requires special study and a research proposal should be developed to address this issue.

Specific audits

It will be important to audit specific caesarean section rates, particularly first sections, at regular intervals to ensure the rise is being contained and the operation is being performed for appropriate reasons. To this end obstetricians in Scotland have indicated their willingness to carrying out a second round of audit on the specific topics identified against guidelines. Before this takes place, it will be necessary to adapt the information system to address the problems identified in the review of the database (Appendix 1).

Recommendations for the future ●

Acknowledgements ●

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References

1. Francome, C., Savage, W.: 'Caesarean section in Britain and the United States. 12% or 24% is either the right rate?'. *Soc. Sci. Med.* (1993); 37;1199-1218 (1993).
2. Lomas, J., Enkin, M. 'Variations in operative delivery rates'. *Effective care in pregnancy and childbirth* (1988); vol. 3; 1181-1195.
3. McIlwaine, G.M., Cole, S.K., and Macnaughton, M.C. (1985). 'The rising caesarean section rate - A matter of concern?': *Health Bulletin*; 43; 301-305.
4. Savage, W., and Francome, C. (1993): 'British caesarean section rates: have we reached a plateau?' *Br. J. Obstet. Gynaecol.*; 100; 493-496.
5. Stafford, R.S.: 'Alternative strategies for controlling rising caesarean section rates'. *JAMA* (1990); 263; 683-687.
6. The Cochrane Pregnancy and Childbirth Database [computer program] Hofmeyr G.J., Enkin M.W., Kierse M.J.N.C., Renfrew M.J., Neilson J.P. editors. *Pregnancy and Childbirth Module of Systematic Reviews* London: BMJ publishing group (1995).
7. Annual Report of the Registrar General for Scotland 1995. Published by the Government Statistical Service.
8. Macara, L.M., and Murphy, K.W. (1994): 'The contribution of dystocia to the cesarean section rate'. *Am. J. Obstet. Gynaecol.*; 142; 1324-1325.
9. Hofmeyr, G.J.: 'External cephalic version at term (commentary)'. *Br. J. of Gynaecology* (1991); vol. 98; 1-3.
10. Chalmers et al.: 'Effective care in pregnancy and childbirth. Breech presentation and abnormal lie in pregnancy' (1989); 653-665.
11. Anderson G.M., Lomas J. 'Determinants of the increasing birth rate'. *N. Eng. J. Med.* (1984); 311: 887-892.
12. Anderson, G.M., Lomas, J.: 'Recent trends in Cesarean Section Rates in Ontario'; *Can. Med. Assoc.J.* (1989); 141; 1049.
13. Johnstone S.R., Elkins T.E., Strong C., Phelan J.P. 'Obstetric decision making: responses to patients who request cesarean delivery'. *Obstet. Gynecol.* (1986); 67: 847-850.
14. Grimshaw J, M. and Russell, I, T. (1993). Effect of clinical guidelines on medical practice: a systematic review of rigorous evaluations. *Lancet* 342, 1317-1322.
15. Farmer A. (1993). Medical practice guidelines: lessons from the United States. *BMJ* 307, 313-317.

Appendix 1: Review of the caesarean section database

The caesarean section database in 23 hospitals was used to collect data between late 1993 and July 1995. The database was split into three types, to address the different circumstances of:

- Elective caesarean section (database 1);
- Emergency caesarean section before the onset of labour (database 2);
- Emergency caesarean section during labour (database 3).

There were 86 questions in all (Appendix 1a), 38 of which were common to all three databases. A further two questions were common to two databases.

Problems encountered in analysis of the system

There were two main problems found in the course of analysis:

1. Inaccuracies in the data: there was no validation of the fields so that alpha characters could be entered in numeric fields, and vice versa; numbers outwith the range given for coded options could be entered; and, logical inconsistencies were allowed. For example, a woman said to have no previous pregnancies, could be recorded as having a previous section.

2. There was no priority given to multiple indications for caesarean section. The audit's main purpose was to examine four main circumstances associated with delivery by section. These were:

- a) breech presentation in a first pregnancy;
- b) a previous caesarean section scar;
- c) fetal distress;
- d) failure to progress in labour

The audits also aimed to test whether other options were considered in a) and b), and the means of diagnosis in c) and d). But there were

often positive answers given to questions which could in themselves be indications for doing a section. These problems could be solved, but the database would need to be rewritten. The key fields which contribute to the indication(s) for caesarean section (Appendix 1b) should be collected as at present, and then presented to the clinician with a request to prioritise them. Specifically:

- 1) field formats specified and only those formats allowed;
- 2) certain simple checks between data items;
 - a) parity and previous sections, if previous live births + previous stillbirths = 0, then previous section must = 0;
 - b) question groups (Appendix 1c);-*POH - previous obstetric history; prev CS - previous caesarean section; Elecasem - elective section done as emergency; Breech - singleton breech; Twins - twin pregnancy; FD - fetal distress; Induc - induction of labour; FTP - failure to progress in labour;* if number of previous pregnancies = 0, then all subsequent questions must = 0; if answer to lead question = Y(es) then all subsequent questions must be answered; if answer to lead question = N(o) then all subsequent questions must be blank.

A further problem in the database lay in the method of data extraction. Each time additional data were requested of the hospitals, which happened every few months, the whole file was extracted on to a floppy disk. This meant that either, any late additions to the number of caesarean sections in previous months would be lost, as the centre attempted to add on data only from those months since the last call for data, or,

corrections to errors in the data already received would be lost.

It is recommended that cases extracted for submission to the centre should be flagged and only unflagged cases should be eligible for future extraction.

Options for the future

(1) Do nothing

This option would mean that the last element in the audit loop would remain unclosed. The detail of the analysis presented at the clinical meeting on 3rd February, could not be repeated, as suggested, in another year's time. It would be possible to analyse the SMR 02 data for 1997/98 and this would show changes in section rates and in the indications for section, although the data would not be strictly comparable. The revised SMR 02, due to be implemented in all Scottish hospitals in 1996/97, contains additional information which would help to throw light on the main indication. The existing SMR 02 data was used to provide denominators in the analysis of the 1994/95 audit (to be published).

(2) Start collecting data next year using the existing data set

The existing data set would have to be checked before the exercise started again, as it could have become corrupted in the interim. It would be an effort to rekindle the enthusiasm and commitment required by individual clinicians, and a centre would have to be identified to co-ordinate the collection and analysis the data.

(3) Revise the existing data set to improve accuracy, as suggested above, and prepare to start data collection on a continuous basis by 1997

It may not be as simple as implied to introduce validation routines to the data set written by Dr Chris Wilkinson. Presumably, someone familiar with the software tools originally used, would have to be identified and a judgement would have to be made about the consequent increased size

of the file. It would be an advantage to the new centre which would collect and analyse the data to have the suggestions detailed above implemented, as the current experience showed that the data reception and analysis was time consuming and far from easy to interpret.

(4) Collect a reduced data set linked to data also collected by SMR 02

Twenty eight of the 86 items in the audit data set are already on the SMR 02. The common data items comprise 25 of 55 items in database 1 (45%), 23 of 45 items in database 2 (51%) and 26 of 64 items in database 3 (41%). Duplication of effort could be reduced by collecting only unique items.

This is not a simple option because it implies a successful linkage or data exchange between the audit data set and the SMR 02. The former is usually collected shortly after the operation, while the SMR 02 is only completed after discharge. There are no current links between the stand alone PC on which the audit data are collected, and the SMR 02, which is compiled differently in different hospitals - varying from a form filling exercise, to a partial derivation from pre-existing computerised data and eventual completion on screen. Elimination of the essential data items in Appendix 1d, would reduce the local utility of the audit data, and a foolproof method of identifying the patient would have to be assured.

Possibly this option will only be realistic when the SMR 02, is collected progressively throughout the woman's stay, from the patient administrative system, a labour ward system and a final discharge system.

Option 3 or 4 would be the most useful options to consider, although both require extra w

Appendix 1a: total data set of current database

(C S types key: 1= elective CS; 2 = emergency CS before labour; 3 = emergency CS during labour.)

No	Question	Abbrev	CS types
1	Hospital	Hosp	123
2	Medical record number	MRN	123
3	Date of birth	DOB	123
4	Postcode	Postcode	123
5	Height	Height	123
6	Booking weight	Weight	123
7	Interhospital transfer Y/N	Transfer	123
8	Decision for CS by 1 Cons: 2 Staff gr.: 3 GP: 4 SR: 5 Reg/SHO3: 6SHO: 7 M/w	Decision	123
9	Senior obst in theatre 1 Cons: 2 Staff gr.: 3 GP: 4 SR: 5 Reg/SHO3: 6SHO: 7 M/w	Authorise	123
10	Authorised by 1 Cons: 2 Staff gr.: 3 GP: 4 SR: 5 Reg/SHO3: 6SHO: 7 M/w	Senior	123
11	Gestation	Gest	123
12	Number of previous pregnancies 0=none: 1=1: 2=2: 3=3+	Para	123
13	Number of previous live births 0=none: 1=1: 2=2: 3=3+	LB	123
14	Number of previous terminations or miscarriages 0=none: 1=1: 2=2: 3=3+	MC-TOP	123
15	Number of previous stillbirths 0=none: 1=1: 2=2: 3=3+	SB	123
16	Has the patient had a prev. section Y/N	PrevCS	123
17	How many prev. sections 1=1: 2=2+	NuprCS	1
18	What type was last section 1= LUSCS: 2=other: 3=NK	TypeprCS	1
19	Was patient offered trial of scar instead of elective Y/N	Tosoffer	1
20	Was the main reason for this CS a prev. scar Y/N	MnrsprCS	1
21	What was indication for prev. CS 1=fai ed induct. 2=dysfunct. lab./POP 3=CPD: 4=fetal distress: 5=Malpres. 6=other: 7=NK	IndprvCS	1
22	Was CS performed as emergency because patient went into labour Y/N	Elecasem	1
23	What cervical dilation was reached	Cxdil	1
24	Was CS a singleton breech Y/N	Breech	1
25	What type of breech 1=frank: 2=complete: 3=other	Typebr	1
26	What was pre-op estimation of weight 1=>3.5kg: 2=<3.5 but >1.5kg: 3=<1.5kg: 4=not considered	Preoper	1
27	Was there any known fetal, placental or uterine abnormality Y/N	Abnormal	1
28	Was ECV attempted Y/N	ECV-try	1
29	Was patient offered a TOL Y/N	Brtoloffer	1
30	Was CS a twin pregnancy Y/N	Twins	123
31	What was twin1 presentation 1=ceph. 2= breech/transverse	Prtwin1	123
32	What was most sig. abnormality of twin preg. 1=fetal abn. 2= fetal compromise 3=mat. complication 4=other 5=none	Twinabn	123
33	Apgar score twin1 1 minute	Apg1tw1	123
34	Apgar score twin1 5 minute	Apg5tw1	123
35	Birth weight twin1	Weightt1	123
36	Apgar score twin2 1 minute	Apg1tw2	123
37	Apgar score twin2 5 minute	Apg5tw2	123
38	Birth weight twin2 Weightt2		123
39	Was maternal request significant in decision Y/N	Matreqst	1
40	Was a significant factor history of: 1=poor obst outcome 2=prev. traumatic vag. del. 3=prev infertility 4=adv. maternal age	History	123

No	Question	Abbrev	CS types
41	Was significant factor mat. complications 1=mat.medical disease 2=herpes vulva/vagina (3=diabetes)	Matcomp	123
42	Was significant factor fetal complications 1=malpres/unstable lie 2=rhesus disease (3=IUGR 4=cord prolapse 5=chor/amnionitis)	Fetcomp	123
43	Was significant factor obstetrical comp. 1=pre-eclampsia 2=P.Previa 3=diabetes 4=other	Obstcomp1	1
44	Was decision influenced by pelvimetry Y/N	Pelvmtry	1
45	Why was pelvimetry done 1=prev unsuccessful lab.?CPD 2=suspicion this preg of CPD 3=breech 4=prev diff. del. 5=other	Rsnpelv	1
46	Type of incision 1=trans. lower uterine 2=lat. extended lower uterine 3=T incision 4=classical	Incstype	123
47	Blood loss estimate 1=<500ml: 2=>500 - >1000ml: 3=<1000ml	Bldloss	123
48	Was blood transfusion necessary at time of op. Y/N	Bldtrans	123
49	Type of anaesthesia 1=epidural: 2=spinal: 3=GA: 4=GA after failed spinal/epidural	Anaesth	123
50	Birthweight	Babywt	123
51	Apgar at 1 minute	Apgar1	123
52	Apgar at 5 minute	Apgar5	123
53	Is the patient suitable for future trial of labour Y/N	Futtol	123
54	Date of delivery	Deldate	123
55	Time of delivery	Deltime 1	23
56	Was this emergency CS performed for fetal reasons Y/N	Emcsfetl	2
57	Was fetal distress present or suspected (Was fetal distress a major reason for CS) Y/N	Fetaldis	23
58	Was IUGR present or suspected Y/N	IUGR	2
59	What in order of importance were indications leading to diagnosis of fetal compromise: -Main* 1=reduced fetal movement 2=HH auscultation abnorm. 3= uterine palpation 4=CTG abnorm. 5=u/s biophysical profile abnorm. 6=u/s doppler wave form abnorm.	Rea1comp	2
60	What in order of importance were indications leading to diagnosis of fetal compromise: -Second* 1=reduced fetal movement 2=HH auscultation abnorm. 3= uterine palpation 4=CTG abnorm. 5=u/s biophysical profile abnorm. 6=u/s doppler wave form abnorm.	Rea2comp	2
61	What in order of importance were indications leading to diagnosis of fetal compromise: -Third* 1=reduced fetal movement 2=HH auscultation abnorm. 3= uterine palpation 4=CTG abnorm. 5=u/s biophysical profile abnorm. 6=u/s doppler wave form abnorm.	Rea3comp	2
62	Was significant factor obstetrical comp. 1=PE 2=PP 3=abruption 4=suspect/actual uterine rupture	Obstcomp	23
63	Was this labour started as an induction Y/N Induc 3	Rinduc	3
64	Why was labour induced 1=postdates 2=mat request/social 3=mat.med/obst reason 3=fetal reason	FTP	3
65	Was there failure to progress/failed forceps/vent. Y/N	Stlab	3
66	What stage of labour was decision taken 1=1: 2=2	Inlab	3
67	Was patient in active labour at decision for CS Y/N	Thcmdil	3
68	Was cx at least 3cm dilated Y/N	Contra	3
69	Was patient contracting every 2 - 3 minutes Y/N		

No	Question	Abbrev	Cstypes
70	Was strength of contractions 45 seconds & strong Y/N	Strngth	3
71	Were membranes ruptured Y/N	Rom	3
72	Had there been no change in cervical dilation or descent for at least 4 hrs of active labour Y/N	Prog	3
73	What cervical dilation was reached	Dilation	3
74	Was oxytocin used for augmentation Y/N	Oxytoc	3
75	How long was oxytocin used (hrs)	Timeoxy	3
76	Was there a failed instrumental delivery Y/N	Failfor	3
77	What was used 1=rotation forceps 2=forceps 3=rotation vacuum 4=vacuum 5=vacuum+forceps	Typefor	3
78	What was duration of labour from beginning of lab/induc. until decision for CS (hrs)	Tindtocs	3
79	What was probable underlying reason for FTP* 1=failed induction 2=POP 3=dysfunctional lab. 4=CPD 5=deflection face/brow	Rsnftp	3
80	Was meconium present at rupture of membranes Y/N	Mecrom	3
81	Was meconium present at decision for CS Y/N	Mecdel	3
82	Was CTG 1=normal 2=abnormal suspicious 3=abnormal indicating fetal distress	CTG	3
83	Was fetal scalp pH used 1=yes (FD) 2=yes (normal) 3=no (not indicated) 4=no (no time) 5=no (inadequate cx dil.) 6=no (not available)	Phreason	3
84	What was abnormal pH	Phresult	3
85	Was twin1 delivered vaginally	Vdtwin1	3
86	What was presentation of twin 2	Prtwin2	3

Appendix 1b: key fields which contribute to the indication(s) for caesarean section

No.	Question	CS types
20	Was the main reason for this CS a prev. scar Y/N	1
24	Was CS a singleton breech Y/N	1
39	Was maternal request significant in decision Y/N	1
32	What was most sig. abnormality of twin preg. 1=fetal abn. 2= fetal compromise 3=mat. complication 4=other 5=none	123
40	Was a significant factor history of: 1=poor obst outcome 2=prev. traumatic vag. del. 3=prev infertility 4=adv. maternal age	123
41	Was significant factor mat. complications 1=mat.medical disease 2=herpes vulva/vagina (3=diabetes)	123
42	Was significant factor fetal complications 1=malpres/unstable lie 2=rhesus disease (3=IUGR 4=cord prolapse 5=chor/amnionitis	123
43	Was significant factor obstetrical comp. 1=pre-eclampsia 2=P.Plevia 3=diabetes 4=other	1
62	Was significant factor obstetrical comp. 1=PE 2=PP 3=abruption 4=suspect/actual uterine rupture	23
57	Was fetal distress present or suspected (Was fetal distress a major reason for CS) Y/N	23
58	Was IUGR present or suspected Y/N	2

65	Was there failure to progress/failed forceps/vent. Y/N	3
32	What was most sig. abnormality of twin preg. 1=fetal abn. 2= fetal compromise 3=mat. complication 4=other 5=none	123

Appendix 1c: Proposed reduced dataset to link with data collected by SMR 02

Question	Indication	CS types
Number of previous pregnancies 0=none: 1=1: 2=2: 3=3+	POH	123
Number of previous live births 0=none: 1=1: 2=2: 3=3+	POH	123
Number of previous terminations or miscarriages 0=none: 1=1: 2=2: 3=3+	POH	123
Number of previous stillbirths 0=none: 1=1: 2=2: 3=3+	POH	123
Has the patient had a prev. section Y/N prev	CS	123
How many prev. sections 1=1: 2=2+ prev	CS	1
What type was last section 1= LUSCS: 2=other: 3=NK prev	CS	1
Was patient offered trial of scar instead of elective Y/N prev	CS	1
Was the main reason for this CS a prev. scar Y/N prev	CS	1
What was indication for prev. CS 1=faied induct. 2=dysfunct. lab./POP 3=CPD: 4=fetal distress: 5=Malpres. 6=other: 7=NK prev	CS	1
Was CS performed as emergency because patient went into labour Y/N	Elecasem	1
What cervical dilation was reached	Elecasem	1
Was CS a singleton breech Y/N	Breech	1
What type of breech 1=frank: 2=complete: 3=other	Breech	1
What was pre-op estimation of weight 1=>3.5kg: 2=<3.5 but >1.5kg: 3=<1.5kg: 4=not considered	Breech	1
Was there any known fetal, placental or uterine abnormality Y/N	Breech	1
Was ECV attempted Y/N	Breech	1
Was patient offered a TOL Y/N	Breech	1
Was CS a twin pregnancy Y/N	Twins	123
What was twin1 presentation 1=ceph. 2= breech/transverse	Twins	123
What was most sig. abnormality of twin preg. 1=fetal abn. 2= fetal compromise 3=mat. complication 4=other 5=none	Twins	123
Apgar score twin1 1 minute	Twins	123
Apgar score twin1 5 minute	Twins	123
Birth weight twin1	Twins	123
Apgar score twin2 1 minute	Twins	123
Apgar score twin2 5 minute	Twins	123
Birth weight twin2	Twins	123
Was twin1 delivered vaginally	Twins	3
What was presentation of twin 2	Twins	3
Was this emergency CS performed for fetal reasons Y/N	FD	2
Was fetal distress present or suspected (Was fetal distress a major reason for CS) Y/N	FD	23
Was IUGR present or suspected Y/N	FD	2
What in order of importance were indications leading to diagnosis of fetal compromise: -Main* 1=reduced fetal movement 2=FH auscultation abnorm. 3= uterine palpation 4=CTG abnorm. 5=u/s biophysical profile abnorm.		

6=u/s doppler wave form abnorm.	FD	2
What in order of importance were indications leading to diagnosis of fetal compromise: -Second* 1=reduced fetal movement 2=FH auscultation abnorm. 3= uterine palpation 4=CTG abnorm. 5=u/s biophysical profile abnorm. 6=u/s doppler wave form abnorm.	FD	2

Question

	Indication	CS types
What in order of importance were indications leading to diagnosis of fetal compromise: -Third* 1=reduced fetal movement 2=FH auscultation abnorm. 3= uterine palpation 4=CTG abnorm. 5=u/s biophysical profile abnorm. 6=u/s doppler wave form abnorm.	FD	2
Was meconium present at rupture of membranes Y/N	FD	3
Was meconium present at decision for CS Y/N	FD	3
Was CTG 1=normal 2=abnormal suspicious 3=abnormal indicating fetal distress	FD	3
Was fetal scalp pH used 1=yes (FD) 2=yes (normal) 3=no (not indicated) 4=no (no time) 5=no (inadequate cx dil.) 6=no (not available)	FD	3
What was abnormal pH	FD	3
Was this labour started as an induction Y/N	Induc	3
Why was labour induced 1=postdates 2=mat request/social 3=mat.med/obst reason 4=fetal reason	Induc	3
Was there failure to progress/failed forceps/vent. Y/N	FTP	3
What stage of labour was decision taken 1=1: 2=2	FTP	3
Was patient in active labour at decision for CS Y/N	FTP	3
Was cx at least 3cm dilated Y/N	FTP	3
Was patient contracting every 2 - 3 minutes Y/N	FTP	3
Was strength of contractions 45 seconds & strong Y/N	FTP	3
Were membranes ruptured Y/N	FTP	3
Had there been no change in cervical dilation or descent for at least 4 hrs of active labour Y/N	FTP	3
What cervical dilation was reached	FTP	3
Was oxytocin used for augmentation Y/N	FTP	3
How long was oxytocin used (hrs)	FTP	3
Was there a failed instrumental delivery Y/N	FTP	3
What was used 1=rotation forceps 2=forceps 3=rotation vacuum 4=vacuum 5=vacuum+forceps	FTP	3
What was duration of labour from beginning of lab/induc. until decision for CS (hrs)	FTP	3
What was probable underlying reason for FTP* 1=failed induction 2=POP 3=dysfunctional lab. 4=CPD 5=deflection face/brow	FTP	3

Appendix 1d : Questions also on SMR 02 which could be excluded from the revised data set

Question	Cstypes
Hospital	123
Medical record number	123
Date of birth	123
Postcode	123
Height 123	
Interhospital transfer Y/N	123
Authorised by 1 Cons: 2 Staff gr.: 3 GP: 4 SR: 5 Reg/SHO3: 6SHO: 7 M/w	123
Gestation	123
Number of previous pregnancies 0=none: 1=1: 2=2: 3=3+	123
Number of previous live births 0=none: 1=1: 2=2: 3=3+	123
Number of previous terminations or miscarriages 0=none: 1=1: 2=2: 3=3+	123
Number of previous stillbirths 0=none: 1=1: 2=2: 3=3+	123
Has the patient had a prev. section Y/N	123
How many prev. sections 1=1: 2=2+	1
Was CS a singleton breech Y/N	1
Was CS a twin pregnancy Y/N	123
What was twin1 presentation 1=ceph. 2= breech/transverse	123
Apgar score twin1 5 minute	123
Birth weight twin1	123
Apgar score twin2 5 minute	123
Birth weight twin2	123
Type of anaesthesia 1=epidural: 2=spinal: 3=GA: 4=GA after failed spinal/epidural	123
Birthweight	123
Apgar at 5 minute	123
Date of delivery	123
Was this labour started as an induction Y/N	3
Was twin1 delivered vaginally	3
What was presentation of twin 2	3

Appendix 2: Participants in project

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Colophon

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